

# Safety Manual for Construction



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## Introduction

The most valuable asset your organization has is its employees. By improving safety and preventing accidents, you can protect your work force while also reducing your workers' compensation costs. And the BWC's Division of Safety and Hygiene is here to help.

This basic safety and health manual for the Ohio construction industry summarizes successful accident-prevention principles and techniques. While application of these techniques may vary according to the size and nature of your company's operations, the basic principles remain the same.

Please note, this manual is not all-encompassing, nor is it a document for compliance. It's always important to customize safety and health programs to meet the particular needs of the workplace.

However, safety isn't the only thing you can do to reduce your workers' compensation costs. You can also lower your costs by proactively managing your workers' compensation claims. This includes incident investigation, early reporting of injuries and working with your BWC employer services specialist and claims service specialist.

This manual can also provide your company's safety teams with information to meet its goals and obligations. It contains information on incident prevention, together with a complete explanation of its use, and benefits and methods of application.

Please join BWC and the Ohio construction industry in making occupational safety and health a way of life.

## Safety and health rules and regulations

### Company commitment

Safety is more than just compliance with Occupational Safety and Health Administration (OSHA) regulations and other government rules. It's a state of mind that must permeate the entire company, including of-  
fice and field personnel, management and hourly employees.

No business can expect to have good safety performance unless the president, chief executive officer or owner demonstrates through personal conduct and concrete actions that safety is expected and required of all employees.

However, because managers are confronted each day with non-safety-related problems that require immediate handling, they often are tempted to overlook safety and health activities. That's why a company must establish and enforce safety rules to communicate its commitment to safety, and ultimately, to prevent incidents and injuries.

### Company rules

Company safety rules are designed primarily as training aids to familiarize employees with potentially hazardous situations and operational errors that can result in injuries. Rules can be readily developed by observing existing conditions and reviewing previous accidents.

Rather than having top management develop and implement rules, it's better to have all parties help develop the company rules. Involvement from supervisors, safety coordinators and employees leads to cooperation and an understanding of why the rules exist and what hazards they are designed to control.



Involving all parties also helps ensure the rules are presented in terms the workers understand.

Whenever possible, rules should state what is to be done, rather than what is prohibited. Positive statements are more effective than negative declarations. Rules also should be logical, enforceable and applicable to the specific company or department operations.

Rules, such as be careful around electricity, are too general, and therefore, not enforceable. And if rules are not or cannot be enforced, it impairs the effectiveness of other rules and dilutes management's commitment.

In addition to general company rules, develop special-purpose safety rules for non-routine tasks, the operation of dangerous equipment and other hazardous jobs.

Review and revise rules on an ongoing basis and communicate them regularly to employees during new-employee orientation and at weekly toolbox talks.

### Government rules

In addition to company rules, employers must become familiar with the various government laws that define the minimum duties, actions and precautions all employers must take to ensure the safety and health of their employees. Federal rules include OSHA's regulations for construction (29 CFR 1904 and 1926) and for general industry (29 CFR 1904 and 1910).

Other safety regulations include the Ohio Administrative Code, Specific Safety Requirements of the BWC Relating to Construction and to All Workshops and Factories, as well as those of the Environmental Protection Agency and state fire and building codes.

### **Written safety and health programs**

OSHA requires all construction companies to develop and implement a written safety and health program. A program should describe the whole of the company's safety-and-health activities. Think of it as an ongoing process. Organized leadership with proper application of the program is essential to attaining good safety and health performance, which pays off through:

- Fewer accidents;
- Improved production;
- Increased employee efficiency;
- Enhanced employee morale;
- Lower workers' compensation costs;
- Decreased OSHA citations and fines.

Programs should address at least:

- Management commitment and leadership — Management's visible support is critical to the program. Issue clearly stated policies that outline the commitment and set the standard by which management will judge safety and health behavior;
- Assignment of responsibility — From top management to the front-line workers, all employees must understand what is expected of them and must be involved in the safety and health process. Specifically identify safety and health responsibilities and expectations for all company employees;
- Identification and control of hazards — Address how to identify hazards, and how to abate hazardous situations and behavior. Company audits or inspections are a crucial part of the program;

- Training and education — A training program for all supervisors and employees must be ongoing and effective. It must also include general safety and health issues with site-specific hazards and non-routine tasks;
- Record keeping and hazard analysis — Include evaluation of all incidents, including near-misses, so management can determine trends and causes, and initiate corrective action;
- First aid and medical assistance — Evaluate emergency procedures and first-aid supplies available at each job site;
- Site-specific issues — In addition to general safety and health provisions, address hazards that are unique to each individual construction site. Before performing work, conduct an inspection to determine the unique hazards. Inform all employees of how to eliminate or avoid the hazards.

Elements of a site-specific plan can include:

- Emergency procedures;
- Contact with utilities;
- Interaction with other contractors;
- Weather conditions;
- Environmental conditions;
- Unique activities known to be hazardous, such as confined space entry or demolition;
- Material-storage areas;
- Access routes;
- Specific training requirements.

## Employee safety and health education

### General training

Employee training is key to the effectiveness of a company's safety and health program, and to the prevention of injuries and illnesses.

The purpose of employee training is to provide instruction in safe work practices and rules, and to provide the skills and knowledge necessary to identify and control work-place hazards. Awareness of the physical or administrative consequences of ignoring safe practices will foster a healthy respect for company policy and procedures, as well as the hazards themselves.

Training should be an ongoing process for all employees, including office workers and field personnel. It should address general safety and health issues, as well as specific procedures for working safely.

You can conduct training in a group setting or on an individual basis. It can come in many forms, such as:

- New-employee orientation;
- Supervisor training;
- Communication of company safety rules;
- Site-specific training;
- Training for non-routine tasks;
- Equipment and machinery training;
- Hazard-communication training;
- Weekly toolbox talks.

Document all training, including meeting minutes or a synopsis of the items discussed, with the signatures or names of employees who participated in the training.

Use the following steps to conduct training:

- Explain the purpose of training and the reason why it is so important to the employee;
- Break down training into understandable parts and identify key points. Be concise and clear with the training issues;
- Conduct demonstrations to emphasize key areas or points. Remember the adage, "A picture is worth a thousand words;"
- Encourage employees to ask questions;
- Conduct testing to ensure employees understand the covered information.

### Toolbox talks

Toolbox talks are a useful tool in the maintenance of a viable safety and health education program in the construction industry. For best results, follow these guidelines:

- Schedule regular weekly meetings, and never skip a meeting;
- Limit topic discussion to about 10 to 15 minutes;
- Review the talk in advance and deliver the information in your own words;
- Encourage group participation. Receive and act upon questions, ideas and suggestions;
- Avoid holding meetings in noisy areas. Use an atmosphere conducive to learning;
- Devote meetings exclusively to health and safety matters that apply to the particular group of workers;
- Use visual aids where available or appropriate;
- Document the meeting with a synopsis and signatures of attendees;
- If the talk involves an incident, discuss it with injury factors, causes and recurrence prevention, rather than the individual involved in the accident;
- If the meeting involves work being planned, discuss potential hazards, safety equipment to be used and basic procedures to be followed.

### Competent persons

According to OSHA, a competent person is someone designated by the company who can identify potential and existing hazards, and who has the authority to correct the hazards. There is no specific class, degree or years of experience that can make someone a competent person. However training can assist in the task.

The company typically designates a job foreman, supervisor or superintendent as a competent person. Upper management relies upon this individual to address hazards and train others in safety and health **issues**.

Many rules and regulations require very specific safety training and can be referenced in the OSHA regulations and the Ohio Administrative Code (OAC).

## Supervisory safety performance evaluation



Before any organization can expect good safety performance, top management must establish goals and commit to a safe and healthful work environment. This commitment must continue in an unbroken chain to the line supervisor.

Supervisory safety performance evaluations (SSPE) provide a complete method for determining the safety capabilities of each first-line supervisor. Including the SSPE on performance appraisals will help to determine which supervisors have a good and consistent safety performance, and which ones need additional training. Make safety training available to all supervisors to ensure the company achieves its goals and objectives.

Ideally, the supervisor's immediate manager should serve as the safety auditor. Forward the completed SSPEs to the next level of management for review and comments. Continue this progression upward through the chain of command until it reaches the top-management level. Note corrective action taken on specific items on the SSPEs as they pass through management review. The first-line supervisor's immediate manager should be responsible for informing him or her of comments and corrective actions required.

Conduct these SSPEs periodically throughout the year. The supervisor and his or her immediate manager should set the goals and objectives prior to the beginning of each evaluation period.

SSPEs are not just based upon numbers alone, but also on the quality of all safety functions. These functions may require a supervisor to:

- Be accountable for the safety of employees. This includes the prompt correction of unsafe conditions or work practices, enforcement of

established safety rules, laws and procedures, and high housekeeping standards;

- Ensure each employee is provided with, wears or uses any prescribed personal protective equipment deemed necessary, according to the company safety and health program or appropriate safety regulations;
- Enforce all safety rules and regulations on a fair and equitable basis;
- Set a good example by following safety and health rules, and safe practices;
- Instruct each employee on the hazards of his or her job and how to avoid and/or control them. Take proper corrective action whenever unsafe behaviors or unsafe conditions are observed or reported;
- Ensure employees follow the preventive-maintenance program, and that any repair and replacement needs found during those activities are tracked to completion;
- Require all vendors, customers, subcontractors and visitors to comply with the company's safety and health program;
- Ensure that all employees are physically able to perform their work safely;
- Conduct regular safety inspections, and submit written reports to management upon completion. Determine what corrective action is needed when safety discrepancies are found, and establish a time frame to correct them;
- Personally investigate all accidents and incidents, determine the source of the accident and correct any unsafe practices or conditions that might cause recurrence. Promptly complete and forward all accident-report forms;
- Maintain the company's job-site medical kit as OSHA regulations require;
- Conduct regular employee safety meetings or toolbox talks;
- Maintain all postings and written safety policies and programs as required. Ensure that the HazCom Program and material safety data sheet (MSDS) book are current.

While this chapter deals solely with supervisors, it is equally important to evaluate employee safety performance.

## Fire prevention and protection

Fires require three elements to burn — fuel, oxygen and heat. A construction site contains all three elements, although their quantities and locations change constantly.

### Examples include:

- Fuel sources, such as gasoline, diesel fuel, paint thinner, piles of wood scraps, cardboard, straw, paper and other trash;
- Heat sources, such as electricity, cutting, welding, cigarettes, roofers' tar kettles and temporary heaters;
- Oxygen, present in the atmosphere and as a compressed gas.

Fuel sources are the easiest element to remove. Therefore, concentrate on cleanup by disposing of scrap before it accumulates, storing flammable liquids in approved self-closing containers, keeping all flammable and combustible material away from all heating devices or heat sources. Shut engines off to allow hot parts to cool before refueling.

Every worker on a construction site should know:

- Locations of fire extinguishers;
- How to operate fire extinguishers and the hazards involved with the beginning stage of firefighting;
- Classifications of fire extinguishers and classes of fires;
- Location of telephone and how to call the fire department;
- How to make sure that a used fire extinguisher has been recharged before it is returned to its holder;
- Who to notify that the extinguisher has been used and needs recharging.

### Fire and fire extinguisher classification

There are four types of fires — Class A, Class B, Class C and Class D.



- Class A fires occur in wood, rubber, paper, cloth and most plastics. The most effective type of extinguishing agent is water or a solution containing large concentrations of water because the quenching-cooling effect reduces the temperature of the burning material to below its ignition temperature.
  - Class B fires occur in flammable or combustible liquids, such as petroleum products and greases. A blanketing-smothering effect of an agent that excludes oxygen or inhibits the chemical chain reaction, such as carbon dioxide, dry chemical, halon or foam are most effective.
- Class C fires involve electrical equipment. Carbon dioxide, dry chemical and halon are examples of nonconductive extinguishing agents used to snuff out electrical fires.
- Class D fires involve combustible metals, such as aluminum, magnesium, zirconium and titanium. The use of water and other conventional types of extinguishing agents is ineffective and may even cause a violent reaction. Extinguish these fires with specially-prepared agents.

### Fire extinguishers

The ABC dry-chemical fire extinguisher is the most commonly used extinguisher on construction job sites. Maintain in good operating condition and periodically inspect firefighting equipment. Immediately replace defective equipment. Conduct an annual maintenance check of the fire extinguisher and record the maintenance date. Retain this date for one year after the last entry or the life of the shell, whichever is less.

Provide a fire extinguisher rated not less than 2A for each 3,000 square feet of the protected building area or major fraction thereof. Mount each fire extinguisher on the wall, and mark its location. The travel distance from any point of the protected area to the nearest fire extinguisher cannot exceed 100 feet.

Provide one or more fire extinguishers rated not less than 2A on each floor of a multistory building with at least one fire extinguisher located near a stairway. Provide a fire extinguisher, rated not less than 10B, wherever more than five gallons of flammable or combustible liquids or five pounds of flammable gas are being used on the job site.

### **General rules for fire extinguishers**

Use fire extinguishers in the upright position. Discharge the fire extinguisher about eight feet from the fire with the wind at your back, if possible. Attack the fire as you advance.

Quick work is important because most extinguishers empty in about one minute. If you are out in the open, be prepared to retreat in case of a sudden change in wind direction. In enclosed areas, you may be on your knees with your head no higher than the upright extinguisher you are using; the best air to breathe will be between knee level and the floor.

With water-type extinguishers, direct the stream at the base of the fire and move forward. When using dry-chemical extinguishers, attack the nearest edge of the fire and go forward, moving the nozzle rapidly with a side-to-side sweeping motion. When fighting flammable-liquid fires with carbon dioxide (CO<sub>2</sub>) extinguishers, use the carbon-dioxide in a sweeping formation to clear the flames off the burning surface. Begin fighting at the near edge of the fire and gradually move forward, waving the discharge slowly from side to side. When using this extinguisher in an enclosed area, be careful because carbon dioxide may produce an oxygen deficit within the area.

When two or more persons are using fire extinguishers on a flammable liquid fire, they must act as a team, working from the same side of the fire and making sure the fire does not re-ignite between them.

### **Emergency action plans**

The employer is responsible for preparing and implementing plans covering the actions that employers and employees must take to ensure employee safety in the event of fire or other emergencies, such as tornadoes, floods, or other natural or manmade disasters. The elements of this plan include:

- Emergency-escape procedures and emergency escape-route assignments;
- Procedures for employees who remain to operate critical equipment before they evacuate;
- Procedures to account for all employees after an emergency evacuation;
- Rescue and medical duties for employees who perform them;
- The preferred means of reporting fires and other emergencies;
- Names and job titles of persons who can be contacted for further information or explanation of duties under this plan.

### **Fire alarms**

In the event of a fire, means should be available for calling the fire department quickly. Post signs instructing personnel how and where to turn on an alarm, whether it is by telephone, siren or horn. Finally, always make sure firefighters have easy access to all parts of the project.

### **Training**

Prior to implementing the emergency action plan, the employer will designate and train sufficient personnel to assist in the safe and orderly evacuation of employees. The employer also will review the plan with each employee when the plan is developed and whenever an employee's duties under the plan are changed.

*For further detailed information on fire prevention and protection, consult the OSHA Construction Standards, 29 CFR Subpart F, 1926.150 and 1926.151.*

## Chapter 5

# Accident and incident investigation

Accident and incident investigation is primarily a fact-finding procedure; use the facts revealed to prevent similar accidents. Properly handled, these investigations also can increase safety and health awareness in all employees.

Obviously, you can reduce injuries and illnesses by eliminating unsafe or hazardous situations. Although you can never prevent all accidents, it is easier and more effective to make physical and cultural changes to eliminate and to reduce hazards than it is to teach employees to work around these hazards.

Reduce all hazards to the practical minimum. You can accomplish this by changing equipment, installing guards, changing work and material-handling procedures, and substituting less-hazardous processes and chemicals. When investigating accidents, identify the unsafe or hazardous conditions and other pertinent facts. Make efforts to reduce the hazards.

Once an accident does occur, the severity can be a matter of chance. Assume, for example, that two employees are working in an area where carbon monoxide is escaping into the atmosphere from a propane heater. One worker, a laborer, slumps to the floor, is removed from the area and quickly revived. The other, a carpenter, is on a ladder replacing acoustical tile. He falls to the floor, strikes his head and is killed. Both accidents had the same basic causes, but one resulted in a minor non-disabling injury and the other a fatality.

You can even use minor injuries and incidents that do not involve property damage or personal injury to reveal hazards. If corrected, you can use them to prevent serious injuries. Investigate these incidents with the same thoroughness as serious injuries and fatalities.

You may define the principal purpose of accident investigation as primarily a fact-finding procedure that attempts to identify unsafe or hazardous conditions or procedures. Once you identify these factors, take immediate action to eliminate or reduce the hazard as much as possible.

With those objectives in mind, the procedure you should follow immediately after an accident includes:

- Ensuring any injured person receives proper medical care;
  - Starting the accident investigation promptly. Maintain all of the conditions that existed at the time of the accident until the investigation is conducted. Allow no one to perform the job function that resulted in the accident or injury until the matter is cleared up;
  - Having the supervisor under whose direction the employee worked or the supervisor in whose area the accident occurred conduct the investigation. Persons involved should submit their findings in writing in an accident investigation report. Use a form similar to OSHA 's *Form 301* (Injury and Illness Incident Report) or BWC's *First Report of an Injury, Occupational Illness or Death* (FROI-1).
- Have a responsible member of management review reports and take corrective action. The organization should review accident-investigation reports. Direct reports to anyone who is directly involved in making changes. In the case of very serious accidents, you also may appoint a fact-finding committee to thoroughly investigate the accident and submit a report.
- Include photographs, sketches or other exhibits in the investigation report to help clarify the accident's facts. Include detailed statements from all witnesses to the accident as well as others who can contribute information.
- The past has shown that the largest fault in accident investigations is the lack of follow-up action to correct the conditions and/or behaviors that led to the accident. Note in the report the specific actions that you will take, the name of the management representative responsible for completing each item and the deadline for completion. Later, the responsible member of management should follow up to ensure that the action is taken. Unless this procedure is followed the entire investigation has little value.
- After you complete the investigation and take corrective action, bring the findings to the attention of all employees in the accident area and those working in similar areas. Use these findings to provide additional safety training, make operational changes based on the facts involved in the accident, and inform employees about actions taken to protect their safety and health and prevent similar occurrences.

## Job safety analysis

The technique called job safety analysis (JSA) is a simple but comprehensive means to determine the hazards involved as well as potentially unsafe procedures most likely to occur in a given task or job. Use this analysis to reduce hazards and to train workers in safe procedures. A JSA is essential to any effective safety program. It should be one of the first steps you take when there is a possibility of worker injury. The best way to efficiently and safely perform a job can be determined only by carefully studying each element involved in its performance.

When considering a JSA, first analyze the tasks with the worst accident experience or the greatest potential to cause injury to the worker and then the tasks with lesser risks. By establishing priorities, you can use the JSA as a focal point of the accident-prevention program.

A JSA serves two valuable purposes. It provides a systematic means of reviewing a workers' previous experience and knowledge to establish safe work procedures, and it promotes employee involvement in establishing safety awareness while developing safe work practices.

To accomplish these objectives management should:

- Understand the objectives and means of analyzing jobs element by element;
- Establish a plan for analyzing job elements on a regular basis;
- Analyze statistical data, accident experience, and management and employee experience to develop the sequence of job elements;
- Devise an action plan to control hazards identified with a timetable for implementing the plan;
- Have supervisors review the results of all JSAs covering job elements for which they have supervision;
- Provide supervisors with a copy of all approved safe job procedures developed as a result of a JSA;
- Train workers in accordance with the conclusions of the JSA both initially and each time the task is analyzed;

- Have supervisors regularly observe the workers and ensure they follow safe work practices;
- Give supervisors the authority and responsibility to enforce adherence to safe work habits.

In practice, the person conducting the JSA must be competent, qualified and practical in assessing each job element, and follow a management-approved breakdown of each job to be analyzed

As you conduct the JSA, it is important to search for the hazards of each element — whether produced by the environment or connected with the job procedure. When properly and thoroughly done, this will assist in making the entire job safer and more efficient.

To assist in gathering the necessary information, we have included a form at the end of this chapter, which will ensure consistent and acceptable procedures are used.

### Safety observations

The principal purpose for safety observations is to determine if employees are at risk. This section will help you determine the effectiveness of your employee training program.

Many construction injuries result from operational errors. Good safety observations can reveal and correct these deviations before they lead to accidents. The following are key elements required for good safety observations:

- Make safety observations when you can concentrate all of your attention on safety;
- Observe the work area, making mental and written notes of any potentially dangerous situations or conditions;
- Whenever possible, take immediate corrective action to prevent reoccurrence.

It is always good practice to observe the way employees perform their jobs. However, planned safety observations are much more effective because they focus your attention on the safety aspects of the job, thus pointing to those conditions requiring immediate correction. In addition,

the observations may indicate the need for more extensive training. They also provide a record of unsafe procedures or conditions for further reference.

**Non-routine tasks**

A non-routine task is one not normally performed as part of a job assignment.

Tackling a non-routine task takes preparation — the less familiar the task, the more planning required to do it safely. Prior to starting work on such a task, give each affected employee information concerning the hazards they will be exposed to. The immediate supervisor will be responsible for determining what hazards may be present and/or created. In addition, the supervisor will be responsible for communicating this information to appropriate employees. This information will include, but is not limited to:

- Specific hazardous conditions;
- Protective/safety measures the employee

- must take, including special equipment;
- Measures the company has taken to lessen the hazards.

Upon the completion of each non-routine task, document and distribute to all supervisors all information concerning the hazards encountered during the task. This will ensure that the proper information concerning this task will be properly communicated to the affected employees. Keep this documentation on file for future references.

**Sample Form**

When implemented correctly, the following sample form will assist supervisors in defining the hazards in a non-routine task.

**Non-routine task**

Name of task \_\_\_\_\_

Location where task is performed \_\_\_\_\_

Special conditions \_\_\_\_\_

Permits required

<input type="checkbox"/> Confined space entry	<input type="checkbox"/> Welding/hot/burning
<input type="checkbox"/> Pressure/chemical pipe opening	<input type="checkbox"/> Electrical only
<input type="checkbox"/> Lockout/tagout (or zero-stage energy)	

Training required \_\_\_\_\_

Job materials needed \_\_\_\_\_

Safety equipment needed (air monitors, rigging, fall protection, disposal containers, PPE, etc.) \_\_\_\_\_

Safety procedures (back-up procedures, standby help, chemical hazards, physical hazards, environmental conditions, what to watch for, etc.) \_\_\_\_\_

Completed by \_\_\_\_\_ Reviewed by \_\_\_\_\_

Issue date \_\_\_\_\_ Revised on date \_\_\_\_\_



## Hazard communication standard

The purpose of OSHA's Hazard Communication Standard (1926.59) for construction is to ensure employees are aware of and protected from hazardous substances in the workplace. It requires employers to evaluate the presence and potential hazards of chemicals and other substances employees may be exposed to in their workplaces.

Employers must pass on this information to employees through training, MSDSs, labels and other identifying means.

### Inventory

To meet the requirements of this standard, employers should compile a master list of substances used in the facility and on the job sites. At this point, do not make judgments as to whether a substance is hazardous — list everything. You must obtain information for this list from several sources:

- A complete inventory of the office, warehouse, job sites and any other areas where the company may have materials stored;
- Materials the company may use regularly that are not on hand at this time; check with other company offices, such as purchasing or receiving for information;
- Janitorial and office supplies used by company personnel.



### MSDS

Use the inventory to contact manufacturers and/or suppliers to obtain MSDSs for all the identified substances. If a manufacturer or supplier says the material is nonhazardous, ask for a letter or other documentation, and keep this on file in the office.

An MSDS form describes a single substance, such as gasoline, or a mixture of substances,

like concrete. An MSDS must give the following information:

- Substance name, both chemical and common;
- Chemical and physical characteristics, including appearance and odor;
- Physical and health hazards;
- Primary routes of entry into the body;
- Recommended and required exposure limits;
- Known control measures;
- Measures to protect workers during use or cleanup of the substance;
- First-aid measures to be used in case of accidental exposure;
- Name, address and telephone number of the responsible MSDS preparer or distributor, and the date prepared.

An MSDS for a substance containing a mixture of ingredients also must include the chemical and common name(s) of ingredients amounting to 1 percent or more when it constitutes a health hazard, or 0.1 percent if the ingredient is a carcinogen. New information about hazards or protective measures must be disseminated by the manufacturer or distributor within three months of its appearance.

Maintain copies of MSDSs in a central file and also in the area where workers use the substance. Have MSDS files easily accessible to employees at all times while they work with the substances. Use the MSDS to determine whether the substance is hazardous. Guidance for this determination is contained in OSHA Hazard Communication Standard 1926.59.

### Labeling

The Hazard Communication Standard requires that all containers be labeled with the following information:

- The substance's chemical and common names;
- Physical and health hazards, including target organs;
- Manufacturer's or distributor's name and address.

Maintain these labels in a legible manner understood by the employee. Cover this in your training program.

### **Training**

Employee training is the key to a company's successful implementation of the Hazard Communication Standard. You can divide this training into two categories, general and specific.

Give general training to all company employees, whether or not they will be exposed to hazardous substances in their work place. Any qualified trainer may conduct general training during orientation by any qualified trainer. It includes:

- Awareness of the Hazard Communication Standard and its provisions;
- Training on the company's Hazard Communication Program;
- How to read MSDSs and labels.

Specific training is given to employees who will or may be exposed to hazardous substances in their work place. A foreman or supervisor who is familiar with the hazardous substances in the work place should conduct this training. It includes:

- Identification of hazardous substances in their work place;
- Measures to take to protect themselves from the hazardous substances;
- How to read the labels in their work place;
- Location of MSDSs for hazardous substances in their area.

The employer should document all training. Retain sign-in sheets for training sessions, to include the date, subject covered and instructor's name.

### **Hazardous non-routine tasks**

Construction companies are generally not aware of the types of hazardous nonroutine tasks when writing and implementing their plan. You should include a statement that you did not know these tasks when you wrote the plan. However, when they arise you will develop a procedure to accomplish these tasks.

### **Informing outside contractors (multi-employer work sites)**

Employers in the construction industry generally share a work site with a number of other employers. The standard requires the exchange of information among employers concerning hazardous substances brought onto the work site that may pose a hazard to on-site personal other than their own employees. This exchange should include:

- Substances to be stored or used on site;
- Hazards to which other employers' workers may be exposed;
- Methods that other employers' can use to protect their workers;
- Other employers' assessibility to the appropriate MSDS for the hazardous substances.

Outline this procedure in the company's hazard-communication plan.

### **Written hazard-communication plan**

The hazard-communication standard requires employers prepare and implement a written procedure detailing how they will accomplish the standard's requirements. This plan should include company-specific means to accomplish the objectives set out by the topics included in this chapter. Once completed, this plan must be available to all employees, employees' designated representatives and OSHA's assistant secretary of labor or designated representative.

Reference:

<u>Standard Number</u>	<u>Title</u>
29 CFR 1926.59	Hazard communication

## Confined space entry



This chapter describes the procedures and responsibilities for employees to safely enter confined spaces and be able to distinguish between permit-required and non-permit-required confined spaces.

OSHA's Confined-Space Standard for General industry (29 CFR 1910.134) contains any requirements mentioned in this chapter. A separate confined-space rule has not yet been issued for construction, but the regulations in the respirator standard (29 CFR 1910.134) regarding entry into immediately dangerous to life and health (IDLH) atmospheres apply to construction.

### Responsibility

The employer will identify and evaluate all confined spaces and whether entry requires a permit. It is the employer's responsibility to take all precautionary measures necessary for safe confined-space entry and to instruct employees in the nature of hazards involved, precautions to take, the proper use of personal protective equipment (PPE) and any emergency equipment required. The entry supervisor in charge will have the responsibility of initiating the confined-space entry permit before allowing anyone into the confined space.

Employees are responsible for following the guidelines set by management.

### Definitions

Confined space means a space that:

- Is large enough and so configured that an employee can bodily enter and perform assigned work;
- Has limited or restricted means for entry or exit;
- Is not designed for continuous employee occupancy.

Permit confined space means a confined space that has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere;
- Contains a material that has the potential for engulfing an entrant;
- Has an internal configuration, such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section;
- Contains any other recognized serious safety or health hazard.

A hazardous atmosphere is an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to escape unaided from a permit space, injury or acute illness from one or more of the following causes:

- Flammable gas, vapor or mist in excess of 10 percent of its lower flammable limit (LFL);
- Airborne combustible dust at a concentration that meets or exceeds its LFL;
- Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;
- Atmospheric concentration of any substance for which a dose or a permissible exposure limit (PEL) is published in OSHA's Subpart Z and could result in employee exposure in excess of its dose;
- Any other atmospheric condition that is IDLH.

Examples of confined spaces may include, but are not limited to:

- Excavations;
- Sewers;
- Pipelines;
- Storage tanks;
- Underground utility vaults;
- Pits;
- Ventilation and exhaust ducts;
- Tunnels;
- Boilers;
- Bins;
- Vessels.

### **Hazards**

Examples of commonly encountered hazards are:

- Toxic air contaminants;
- Flammable gas;
- Insufficient oxygen;
- Electric shock from portable lights, tools or assorted electrical equipment;
- Physical hazards, such as slipping, falling and falling objects;
- Physical deficiencies causing collapse because of fatigue, low resistance to temperature extremes and general poor health;
- Mechanical equipment inadvertently activated, such as agitators and mixers;
- Inadvertent starting of pump and/or opening of valves leading in or out of tanks or vessels.

### **Training**

The employer will provide adequate training in pre-entry practices and entry practices to all affected employees. He or she will document the training has been accomplished.

## **Permit-required confined-space procedure**

### **Pre-entry**

- Specify acceptable entry conditions.
- Identify and evaluate the hazards of permit spaces before employees enter.
- You must do periodic or continuous testing must be done the entire time the confined space is occupied. When testing for atmospheric hazards, test first for oxygen, then combustible gases and vapors, and then for toxic air contaminants
- Isolate the permit space.
- Purge, inert, flush or ventilate as needed.
- Implement the measures necessary to prevent unauthorized entry.
- Provide entry permit identifying the space to be entered, purpose of entry, date(s), authorized entrants and other pertinent information.
- Provide barriers to protect entrants from external hazards.
- Provide trained attendants capable of rescuing or summoning rescuers outside the space.
- Provide the following equipment at no cost to employees, maintain that equipment properly and ensure that employees use it properly:
  - Testing and monitoring equipment;
  - Ventilating equipment;
  - Communications equipment;
  - PPE;
  - Lighting equipment;
  - Barriers and shields;
  - Equipment for safe entrance and exit;
  - Rescue and emergency equipment;
  - Any other equipment necessary for safe entry into and rescue from permit spaces.

### **Entry**

If employees detect a hazardous atmosphere during entry, each employee will leave the space immediately. You will then evaluate the space

to determine how the hazardous atmosphere developed. You must implement measures to protect employees from the hazardous atmosphere before any subsequent entry takes place. Continuous forced-air ventilation is required when alternative entry is permitted under 1910.146 (c) (5). Test the atmosphere within the space at various levels to ensure that the continuous forced-air ventilation is preventing the accumulation of a hazardous atmosphere.

**Permit-required confined space entry practices**

(Review Section (g) (3) of 1910.134 for complete requirements.)

- Station one or more attendants at the access opening at all times when employees are working inside; the attendant(s) must be in constant communication with the entrant(s).
- No one will enter a confined space under any condition without an outside attendant who is trained and capable of rescuing the entrant.
- The attendant(s) must never enter the confined space without self-contained breathing apparatus (SCBAs) or equivalent protection. (This is the cause of most confined-space entrant deaths.)
- Use only nonspark-producing tools in a potentially explosive atmosphere.
- To reduce the risk of electrical shock, consider using low-voltage (12 volts or less) electrical lighting and equipment, or portable battery lights.
- Use only approved, grounded electrical equipment.
- Consider using air-operated tools where possible.
- Do not take cylinders of oxygen and other gases, except SCBAs, into tanks or vessels;

- Standard 1910.146 requires retrieval systems or methods, such as a safety harness with lifeline, except where it creates a hazard.
- Complete and post a confined-space entry permit at the entry point.

Use the following personal protective clothing and equipment for employee protection when applicable:

- Safety harness with lifeline (except where it creates a hazard itself);
- Air-line respirator (with escape bottle in IDLH atmospheres) or SCBA equipment;
- Protective suit;
- Safety glasses, hard hat, rubber gloves or other equipment appropriate for the environment.

The procedures outlined are intended as a minimum precaution; consider carefully each entry. Entering confined spaces, whether permit required or not, may result in injury or death. Circumstances may change; a non-permit required confined space might become permit required and vice versa.

Reference:

Standard Number	Title
1910.146	Confined space (industry)
1910.134	Respiratory protection (industry)
1926.21 (b) (6) (i) (ii)	Training
1926.55	Limit values of airborne contaminants
1926.103	Respiratory protection (construction)
1926.353 (b), (c)	Ventilation
1926.651 (g), (h)	Excavation
1926.800	Underground construction
1926.956	Electric vaults/manholes

## Hearing conservation

Employers in the construction industry are required to use feasible engineering and administrative controls as the primary means of reducing excessive sound levels. Where those controls are not feasible, employers should provide their employees with ear-protective devices. Make sure employees wear the protective devices.



Noise can be more than a nuisance. It may cause you to lose your hearing — either temporarily or permanently. The severity of hearing loss depends on:

- How loud the noise is (intensity);
- How high-pitched the noise is (frequency);
- How long you are exposed to the noise — hourly, daily, weekly, monthly;
- The age of the person exposed to the noise;
- Whether the noise is continuous (impact every second or less) or intermittent;
- Individual susceptibility of the person exposed to the noise.

Permissible noise exposure is based on two factors — intensity of sound and the length of exposure. Noise-related hearing loss results when small hair cells in the inner ear are damaged by repeated exposure to noise. These hair cells bend in response to the amount and intensity of the noise. Too much noise, too often, stresses the hair cells to the point where they no longer spring back to their original position. Over time, the hearing loss becomes more noticeable.

Wearing hearing protection, even when not legally required, can prevent this irreversible loss of hearing.

Hearing protection is generally available in three styles: earmuffs, ear plugs and canal caps. Earmuffs, which consist of two acoustically insulated cups connected with a metal or plastic band, are placed over the outside of the ears.

There are three categories of ear plugs: molded plugs, custom plugs and formable plugs.

Custom-molded plugs are manufactured from silicone rubber or plastic and are usually available in small, medium and large sizes. Formable plugs are made from resilient materials, such as expandable plastic foam and wax-impregnated cotton. The plug material is compressed and inserted into the ear. After a few moments, the material expands, sealing off the ear canal. Canal caps provide protection by sealing off the opening in the outer ear. They consist of two small rubber caps connected together by a semicircular band. The band is fitted behind the neck or under the chin, and the caps are positioned over the canal openings.

Employee training in the proper selection and use of hearing protection is an important part of an effective hearing-conservation program.

The level of noise reduction afforded by a specific type of ear protector is indicated by the Environmental Protection Agency noise reduction rating (NRR). NRRs are established on the basis of laboratory tests. Attenuation levels during actual use are usually less than those achieved in the laboratory.

The OSHA Industrial Hygiene Technical Manual provides some guidance for determining the acceptability of ear protection in the field. Using OSHA's method, 7 decibels (dB) is subtracted from the published NRR to compensate for spectral uncertainty, and the result is divided by two to provide a safety factor. The ear protectors with a published NRR of 27 dB would have a field rating of 10 dB  $([27-7] \text{ divided by } 2=10)$ .

Employers should do audiometric testing annually on workers exposed to excessive noise levels.

Reference:

<u>Standard Number</u>	<u>Title</u>
1926.52	Occupational noise exposure
1926.101	Hearing protection

## Chapter 10

### Mobile equipment

The general principles for safe, productive motor-vehicle operation are applicable to all motor-vehicle operations, including vehicles that operate within an off-highway job site, not open to public traffic.

Safe, productive motor-vehicle operation requires:

- A qualified operator — a person trained and experienced in the operation of the vehicle to which he or she is assigned. This person should be in good physical condition with his or her judgment unimpaired by drugs, alcohol or fatigue;
  - An operable, well-maintained motor vehicle — a vehicle in good mechanical condition with all controls identified and fully functional;
  - A daily, pre-operation inspection system — to verify the vehicle's condition using a check list specific to the vehicle or using a general, logical system. The operator should:
    1. Check fluid levels (cooling, oil, hydraulic, fuel, etc.);
    2. Check that the emergency brake and parking brake are set and transmission is not in gear;
    3. Start engine and allow the various systems to warm up to operating temperatures;
    4. Check the vehicle to be sure that all glass, mirrors, lights and reflectors are clean and intact;
    5. Check tires to ensure that treads and sidewalls are in good condition, and that they are properly inflated (if pneumatic). Check grousers, idlers and drive sprockets of tracked vehicles;
    6. Check the vehicle's controls for their proper function, i.e., horn, windshield wipers, steering, transmission, etc. If all is in order, proceed;
- An operator's guide — to give the operator an idea of what is expected, such as smooth operation with speeds consistent with the existing job site. Always follow the established traffic patterns and haul routes for the job site;
  - A parking/shutdown procedure — to secure the vehicle. Park on as level a surface as possible and as applicable: parking brake set; wheels cramped up-slope and/or blocked; bowl, bucket or blade on the ground and with the tampering or vandalism potential minimized.



#### Reference:

<u>Standard Number</u>	<u>Title</u>
29 CFR, Subpart N, 1910.176	OSHA General Industry Standards
29 CFR, Subpart O, 1926.600	OSHA Construction Standards

## Powered industrial trucks



Powered industrial trucks (PITs), commonly referred to as forklifts, are a vehicle of necessity for many companies on construction job sites. However, they also are involved in many injuries resulting in sprains and strains, amputations, bone fractures, burns, contusions and fatalities.

Because of the recent increase in injuries, the construction industry is mandated to provide adequate, organized and documented training for all employees using PITs. Base the training on the operator's prior knowledge and skill, the type of PIT that he or she will use, the potential hazards present and the operator's demonstrated ability to operate the PIT.

Employers should require refresher training after an accident, a near-miss incident or observation of the operator using the PIT in an unsafe manner. You also should hold refresher training when there are changes in the work place, new hazards present or when the operator is assigned to a different type of PIT.

Complete an evaluation of each operator at least once every three years, and document and keep on file all initial and refresher training. A basic outline of elements you should incorporate into a training program for PITs follows:

1. A site-specific written training program;
2. Training to cover the minimum required elements, including;
  - Review of the written safety policy related to PITs;
  - Who, when and how initial and refresher training will be conducted;
  - Tests or examinations documentation;
  - Attendance records and results;
3. Written program describing the hands-on testing procedure, including;
  - Who performs the evaluations;
  - Specific training the evaluator received;
  - Hands-on driving exam representative of the actual work environment;
  - Pre-operational safety check of the equipment incorporated into the driving evaluation;
4. The type of physical examination for operators being performed and retention of the records;
5. The company issuance of authorization cards or IDs after completion of training;
6. The specific measures the company has incorporated to handle novice operators.

## Crane operations

The essence of safe, efficient crane operation is keeping the crane and its load under control at all times. Certain basics apply to every crane operation.

### Job planning

During the initial job-planning stage of the construction operation, the company should decide what its crane requirements will be. Then plan for a crane or cranes adequate to accomplish the job. When selecting a crane, consider a variety of factors other than crane capacity. These may include terrain, ground conditions, weather conditions, crane mobility and/or overhead utilities.

### The crane

The crane should be in good mechanical condition with sufficient lifting capacity to perform the work required. The crane also should have documented periodic (usually annual) inspections and documented frequent (daily to monthly) inspections. Make sure lifting charts and operator manuals are available onsite.

### The operator

A qualified operator is experienced in operating the crane; knowledgeable in methods, means and limitations of crane use; able to conduct frequent inspections of the crane; and able to read and interpret crane load charts and operator's manuals. This operator should be in good physical condition with judgment unimpaired by drugs, alcohol or fatigue.

### The signaler

The person giving signals must be familiar with the signals contained in the American National Standards Institute (ANSI) standard B30.5. You may use a telephone or radio for signaling. Whatever system you use, signals must be clearly visible or audible at all times, and the operator should make no response unless signals are clearly understood. The operator and signaler will agree upon in advance to any special signals to be used during the crane operation. Special signals should not conflict with standard signals.

### The load

To properly plan the lift, the weight of the load, including rigging, headache ball, load line, etc.,

should be known. If the weight is unknown, a knowledgeable person should calculate it. Other factors you may need to consider are center of gravity and attachment points for rigging.

### The rigging

Rigging consists of the slings, shackles and spreaders that attach the load to the crane and are designed for the load. Like the operator, the rigger should be qualified through training or experience to determine the best method and equipment to secure the load to the crane. This is one area of crane operations that is often overlooked.

### The lift

Begin the lift by ensuring that the crane is level and on a base with sufficient strength to support the load and pressures generated during the lift. Be sure the swing radius for the boom and counterweight is clear of personnel and equipment. Check for any overhead obstructions, and make sure that the clearance for electrical utilities can be maintained throughout the lift.

Perform a trial lift. This lift is one where the load is picked up only a few inches from the ground or the staging surface and held. This lets the operator and rigger observe if the choices of crane configuration, line parts, rigging and rigging equipment are correct. If the load shifts or something has been overlooked, land the load and stop the operation until adjustments are made.

Accomplish the lift in a conservative manner. This means making smooth, steady motions, not too fast, with the load under control at all times. Make no sudden changes of direction or speed. During the lift, never allow the load to swing over personnel. Use taglines to control the load.

Reference:

<u>Standard Number</u>	<u>Title</u>
29 CFR 1926.550	Cranes & Derricks
29 CFR 1926.953	Material Handling - General
OAC 4121:1-3-07	Cranes, Hoists and Derricks
ANSI/ASME B30.5	Crawler, Locomotive and Truck Cranes
	Bob's Rigging and Crane Handbook



Construction workers are considered experts in the selection and use of hand tools, yet every year workers are injured on the job as a result of hand-tool accidents. Hand tools are designed to make jobs easier and more efficient. The worker must choose the correct tool for the job being performed, ensure that the tool is in good condition and use the tool properly.

Common types of hand tools include striking tools, turning tools, metal-cutting tools, woodcutting tools, screwdrivers, pliers, knives and crowbars.

### **General requirements**

A tool-maintenance procedure is one of the most important factors in any hand-tool safety program. Extensively used hand tools require careful and frequent inspection to maintain them for safe use. When hand tools are not sharpened and dressed, inefficient cutting and glancing off material often cause injuries. Straighten bent shafts, replace broken handles and discard tools you cannot repair. Remove hand tools with defective handles from service immediately.

PPE must protect a person using hand tools who is exposed to hazards, such as falling, flying, abrasive and splashing objects, or exposed to harmful dust, fumes, mists, vapors or gases. Follow guidelines described for PPE in Chapter 20.

### **Striking tools**

Striking tools include carpenter hammers, sledgehammers, riveting hammers and rubber or rawhide mallets. To guarantee safety, follow these guidelines:

- Choose the most appropriate striking tool for the task. Use carpenter hammers for driving and drawing nails, sledge hammers for driving stakes and pins, riveting hammers for sheet metal and mallets for driving other hand tools, such as a chisel;

- Before using any kind of striking tool, make sure the face of the tool is free of oil or other material that can cause it to glance off the object being struck;
- Check wooden handles to assure they are free of cracks and splits. Replace cracked or split handles;
- Check hammer heads to make sure they are not loose or chipped.

### **Turning tools**

Turning tools, better known as wrenches, are used to exert a twisting force on bolt heads, nuts and pipes. Wrenches include open-end, box, socket, torque, lockjaw and pipe wrenches. Safety principles for use of turning tools include:

- Place the jaws on the nut and pull the wrench toward your body.  
This method will help maintain leverage;
- Use socket wrenches for hard-to-reach places and to loosen and tighten nuts and other fasteners with the aid of a ratchet apparatus;
- Box wrenches have box openings at both ends. Each opening is a different size and is used to free frozen nuts;
- Open-end wrenches, used for a variety of purposes, are made with a 15-degree opening. Never use these wrenches to free frozen nuts;
- When using wrenches, never use hammers or extension pipes to gain leverage on a wrench;
- When using a wrench, always ensure that the gripping surfaces are clean and oil free to prevent slipping;
- It is essential to use the wrench that fits the nut or pipe properly. Be careful when using adjustable wrenches, often called knuckle-busters, because this wrench can slip if not adjusted to fit the nut snugly.

### **Metal-cutting tools**

Snips and shears, bolt-cutters, hacksaws, chisels, and files are metal-cutting tools. Guidelines for the proper use of metal-cutting tools include:

- Oil and adjust snips and shears to make cutting easier and to produce surfaces that are free of burrs;
- When using bolt-cutters, make sure fingers are clear of the jaws and hinges;

- Never use cutters near live electrical circuits;
- Use hacksaws to cut metal that is too heavy for snips or bolt-cutters. Install hacksaw blades so that the teeth point away from the handle of the saw. The main danger in using hacksaws is injury to the hands if the blades break. To operate a hacksaw properly, apply pressure on the downward stroke. After the forward pressure stroke, slightly lift the saw and lightly pull it back in the cut to protect the teeth. Twisting the blade or applying too much pressure may break the blade and result in hand or arm injuries;
- In most cases, you can determine the safety of a hand tool by the condition of its cutting and striking ends, particularly in the case of sharp-edged and pointed tools, such as cold chisels. A cold chisel with a mushroomed or cracked head is a common cause of injury. When a mushroomed head is struck, chips may be knocked off the chisel. You can redress a mushroomed head to its original shape;
- Keep files sharp when not in use by wrapping them in paper or cloth to protect the teeth. A file with a tongue should have a handle attached; make sure that it fits tightly with the file.

### **Woodcutting hand tools**

Examples of woodcutting hand tools are handsaws, planes and wood chisels. Safety tips for these tools include:

- Keep handsaws sharp and free of rust to prevent them from binding or jumping and causing injuries. Always make saw cuts directly across the material, with a slow, careful downward stroke. Crowding or forcing the saw through the cut may cause the saw to buckle or fly out and result in injury to the user;
- Keep the cutting edge on wood planes sharp. Store planes in a rack designed to protect the cutting edges from damage and workers from injury. Hold material being planed securely in a vise, clamp, or other holding device;
- When using a chisel, never cut toward yourself. Always keep the cutting edge sharp.

### **Screwdrivers**

Screwdrivers are designed to drive and remove screws. Never use screwdrivers as pry bars, scrapers or punches. Guidelines for the safe use of screwdrivers include:

- Use the proper size screwdriver so the blade fits the screw properly. This prevents the screw slot from burring, which can cause injury;
- Keep screwdriver tips away from live electrical circuits, and never put any part of your body in front of the screwdriver blade tips while working.

### **Pliers**

Pliers are used for cutting as well as holding and gripping small articles. Guidelines for safe use of pliers include:

- Do not use pliers to cut hard wire unless they are specifically manufactured for this purpose;
- When using pliers, always cut at a right angle;
- Never use pliers as hammers or to remove nuts and bolts.

### **Knives**

Safely use knives by following these guidelines:

- Cut away from the body, or keep the body clear and wear protective clothing. Avoid jerky motions, sudden strains or other movements that might cause loss of balance;
- Keep a knife in a sheath or holder when carrying it on the job. Never leave knives lying on benches or shelves;
- Keep knives sufficiently sharp to do the work for which they are intended.

### **Crowbars/prybars**

Maximize the safe use of crowbars by following these guidelines:

- It is essential to use the correct size crowbar for each job;
- Do not use makeshift tools (cheaters), such as pipe lengths, iron bars or extensions for leverage. To prevent slips, place a block of wood under the head of the crowbar;
- When using spud bars, ensure a firm grip on the handle and stand at the side of the bar to prevent injury caused by recoil.

## Power tools

Portable power tools present greater hazards than hand tools. Nearly all power-tool accidents are caused by improper handling and poor maintenance. Use power tools only after becoming thoroughly familiar with their controls, safety requirements and operating procedures. The categories that most power tools fall under are electric power tools, fuel-powered hand tools, fuel-cell tools, pneumatic power tools and hydraulic power tools.

### General safety precautions

Employers must provide employees who use hand and power tools, and who are exposed to the hazards of falling, flying, abrasive and splashing objects, or exposed to harmful dusts, fumes, mists, vapors, or gases with the proper personal protective equipment (See Chapter 20).

You can prevent hazards involved in the use of power tools by following five basic safety rules:

- Keep all tools in good condition with regular maintenance;
- Use the right tool for the job;
- Examine each tool for damage before use;
- Operate according to the manufacturer's instructions;
- Provide and use the proper protective equipment.

Employees and employers have a responsibility to work together to establish safe working procedures. If a hazardous situation is encountered, correct it immediately.

### Guards

You need to safeguard the hazardous moving parts of a power tool. For example, you must guard belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating or moving parts of equipment if such parts are exposed to contact by employees.

Provide guards, as necessary, to protect the operator and others from the following:

- Point of operation;
- In-running nip points;
- Rotating parts;
- Flying chips and sparks.

Never remove safety guards when using a tool. For example, you must equip portable circular saws with guards. An upper guard must cover the entire blade of the saw. A retractable lower guard must cover the teeth of the saw, except when it makes contact with the work material. The lower guard must automatically return to the covering position when the tool is withdrawn from the work.

### Safety switches

Equip the following hand-held powered tools with a momentary contact on-off control switch: drills, tappers, fastener drivers, horizontal, vertical and angle grinders with wheels larger than two inches in diameter, disc and belt sanders, reciprocating saws, saber saws, and other similar tools. You also may equip these tools with a lock-on control provided that turn-off can be accomplished by a single motion of the same finger or fingers that turn it on.

### Electric tools

Employees using electric tools must be aware of several dangers; the most serious is the possibility of electrocution. Examples of electric power tools are portable drills, grinders and saws.

Among the chief hazards of electric-powered tools are burns and shocks that can lead to injuries or even heart failure. Under certain conditions, even a small amount of current can result in fibrillation of the heart and eventual death. A shock also can cause the user to fall off a ladder or other elevated work surface. To protect the user from shock, tools must either have a three-wire cord with ground and be grounded, or be double insulated.

Follow these general practices when using electric tools:

- Protect tools with a ground fault circuit interrupter (GFCI);
- Operate electric tools within their design limitations;
- Wear gloves and safety footwear when using electric tools;
- When not in use, store tools in a dry place;
- Do not use electric tools in damp locations;
- Work areas should be well lighted;
- Never remove the third prong from the plug.

### **Fuel-cell powered tools**

Cut-off saws and chain saws are examples of fuel-powered tools. Guidelines for the safe use of these tools include:

- Ensuring that the tool has stopped and is cool before refueling, servicing or adjusting;
- Using caution when handling fuel by moving the fuel at least 10 feet from the cutting machine before starting the engine;
- Keeping the handles dry, clean and free of oil or fuel;
- Making sure all guards are on and in good working order;
- Operating the machines only in well-ventilated areas; failure to work in a well-ventilated area can lead to serious injury or death.

### **Powder-actuated tools**

Exercise caution when using powder-actuated tools. Proper use of powder-actuated tools includes:

- Ensuring employees are trained for the specific tool they will use;
- Inspecting and testing each powder-actuated tool in accordance with its manufacturer's recommended procedure before every work shift to ensure that no defects exist and that all safety devices are in proper working order;
- Loading the powder-actuated tool with the correct charge just prior to firing; insert the fastener before inserting the cartridge;
- Never storing a loaded tool and never leaving a loaded tool unattended;
- Treating the powder-actuated tool as a firearm; keep hands and other body parts away from the open barrel end and the tool, whether loaded or unloaded, and never aim at anyone;
- Following the manufacturer's recommended procedures in the event the load fails to ignite;
- Never attempting to fasten at an angle to the work surface or fasten through a pre-drilled hole unless adequate guidance is provided;
- Not fastening into a spalled area on concrete;
- Never using the tool in an explosive or flammable atmosphere;

- Not attempting to fasten into very hard or brittle material, such as cast iron, glazed tile, surface-hardened or high-tensile-strength steel, glass block, rock, face brick or hollow tile;
- Inspecting the area before using the tool;
- Wearing appropriate personal protective equipment in accordance with manufacturer's recommendations.

### **Pneumatic power tools**

These guidelines apply to the safe use of pneumatic power tools:

- Ensure the supply pressure meets rated pressure; if not, use pressure regulators;
- Relieve air hoses and lines of compressed air before being disconnected or disjointed;
- Do not use synthetic lubricants, which can cause deterioration of elastomer seals, in air systems for tools;
- Secure pneumatic power tools to the hose by a positive locking clamp or other means;
- Install safety clips or retainers on pneumatic impact tools to prevent attachments from being forced out;
- Ensure all pneumatically driven nailers, staplers and other tools, which operate at more than 100 psi of pressure, have a muzzle device to prevent the tool from ejecting fasteners, unless the muzzle is in contact with the work surface;
- Inspect, lubricate and maintain the equipment in accordance with manufacturer's recommendations.

### **Hydraulic power tools**

The fluid used in hydraulic-powered tools must be fire-resistant fluid and retained in the tool. The operating characteristics of the hydraulic-powered tool must withstand the most extreme temperatures at which the tool will be exposed. Follow the manufacturer's directions, especially to ensure that safe operating pressures of hoses, valves, pipes, filters and other fittings are not exceeded.

## Chapter 15

# Ladders



The frequent use of ladders at home and on construction sites tends to dull awareness of the dangers involved in their use. Although there are varieties of ladders, many of the same requirements and safe work practices apply.

The following information applies to all portable ladders used in construction, alteration, repair (including painting and decorating), and demolition of work sites covered by OSHA's construction safety and health standards. When using ladders for such use, make sure they are a minimum Type I (250 lb. rating) or greater.

The following general requirements apply to all portable ladders and job-made ladders:

- You must provide a double-cleated ladder or two or more ladders when ladders are the only way to enter or exit a work area for 25 or more employees, or when a ladder serves simultaneous two-way traffic;
- Ladder rungs, cleats and steps must be parallel, level and uniformly spaced when the ladder is in position for use;
- Space rungs, cleats and steps of portable ladders not less than 10 inches apart, nor more than 14 inches apart, along the side rails;
- Provide a metal spreader or locking device on each stepladder to hold the front and back sections in an open position when the ladder is being used;
- Ladder components must be surfaced to prevent injury from punctures or lacerations, and prevent snagging of clothing;
- Do not coat ladders with an opaque covering (such as paint) except for identification or warning labels, which you may place only on one face of a side rail;
- Do not tie or fasten ladders together to create longer sections unless they are specifically designed for such use;
- Prior to each use, inspect the ladder for:
  - Cracks, splits or deterioration of the side rails;
  - Broken or missing rungs, cleats, or steps;
  - Loose rivets, screws, bolts or hardware;
  - Corroded components;
  - Damaged or non-functioning safety shoes;
  - Oil, grease or other slipping hazards;
  - Other faulty or defective components.

If you note defects, immediately mark or tag the ladder with "Do Not Use" or similar language and withdraw the ladder from service until repaired. When repairing a ladder, you must restore it to a condition meeting its original design criteria. If you cannot repair a ladder, destroy it before discarding it.

The following are suggested safe work practices when using portable ladders:

- When using portable ladders to access an upper landing surface, the side rails must extend at least three feet above the upper landing surface. If this is not possible, you must place a grabrail to assist mounting and dismounting the ladder;

- Keep ladders free of oil, grease and other slipping hazards;
- Use ladders only for the purpose for which they were designed;
- Do not load ladders beyond the maximum intended load for which they were built;
- Use straight ladders at an angle where the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder;
- Use ladders only on stable and level surfaces unless secured to prevent accidental movement;
- Never use ladders on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental movement;
- Secure or barricade ladders when using them in passageways, doorways or driveways where they can be displaced by work-place activities or traffic;
- Keep the area around the top and bottom of the ladder clear;
- Do not move, shift or extend ladders while occupied;
- Do not use the top or top step of a stepladder as a step;
- Do not climb the cross bracing on the rear section of stepladders unless the ladder is designed and provided with steps for climbing on both sections;
- When ascending or descending a ladder, face the ladder;
- Use at least one hand to grasp the ladder when moving up or down it;
- A worker on the ladder must not carry any object or load that could cause him or her to lose balance and fall;

- Ladders must have nonconductive side rails if they are used where they could contact exposed energized electrical conductors or equipment;
- Support, protect from damage and keep out of traffic areas ladders that are in storage. Store fiberglass ladders out of direct sunlight when possible.

### Training

Train each employee to recognize hazards in the use of ladders, such as:

- Fall hazards in the work area;
- The procedures for erecting, maintaining and disassembling fall-protection systems;
- Their proper use and placement;
- Their maximum intended loads;
- Any appropriate standards, OSHA standards or Ohio administrative codes.

Retrain employees as necessary to maintain their understanding and knowledge of safe ladder use.

Reference:

Standard Number	Title
1926.951(c)	Tools and protective equipment
1926.1053	Ladders
OAC 4121:1-3-11	Ladders
ANSI A14.3	Ladders-fixed, safety requirements
ANSI A14.2	Ladders-portable metal, safety requirements
ANSI A14.5	Ladders-portable reinforced plastic, safety requirements
ANSI A14.1	Ladders-portable wood, safety requirements
ANSI A14.4	Ladders-job-made, safety requirements

## Chapter 16

### Slings



To ensure safety when using slings made with wire rope (chokers), alloy steel chain and synthetic web, in conjunction with other material handling equipment, such as cranes and hoists, follow these tips:

- Use only slings that are not damaged or defective;
- Never shorten slings with knots, bolts or other make-shift devices;
- Never load slings in excess of their rated capacities;
- Always pad or protect the slings from the sharp edges of their load;
- Always keep suspended loads clear of all obstructions;
- Always keep employees clear of loads to be lifted and suspended loads;
- Always keep hands and fingers clear of the load while tightening the sling around the load;
- Never pull a sling from under a load that is resting on the sling.

#### Inspection procedures for wire rope slings

Remove slings from service if any of the following conditions are present:

- 10 randomly distributed broken wires in one lay or five broken wires in one strand in one lay;
- Kinking, crushing, bird caging or any other damage;
- Evidence of heat damage;
- Cracked, deformed or worn end attachments;
- Stretched or twisted hooks.

#### Inspection procedures for alloy steel chain slings

Remove slings from service if any of the following conditions are present:

- Defective welds;
- Bending or elongation of chain links;
- Cracked or deformed master and coupling links;
- Removal of the identification tag.

#### Inspection procedures for synthetic web slings

Remove slings from service if any of the following conditions are present:

- Acid or caustic burns;
- Melted or charred sling surface;
- Broken stitches;
- Snags, tears or cuts to the point of exposure of the colored threads;
- Removal of the identification tag.

#### Sling storage

- Store slings in a dry environment out of the sun, off the floor or ground to prevent damage due to corrosion.
- Hang slings from hooks to prevent tangling and allow for easy access when needed.
- A good sling inspection program is not only required, it is cost effective; this prevents sling deterioration and serious accidents caused by sling failure.

#### Rigging

Improper rigging can lead to accidents involving personal injury or damage to equipment or material. Slings are like any other tool and only trained workers should be allowed to rig loads. The employer should designate who is qualified to use slings to rig loads.

## Scaffolds

Scaffolds vary in design and are used for a variety of purposes in the construction industry. You can obtain further information from the OAC 4121:1-3-10 or OSHA 1926, Subpart L.

### Scaffold erection

While scaffolding varies greatly in design and construction, there are many similarities regarding requirements for erection and dismantling. Erection and dismantling of scaffolding must be done under the direct supervision of a competent person. Specific requirements for differing scaffolds are addressed later in the chapter. The following items are required of all scaffolding:

All components must be free of damage;

- Planking must be scaffold grade;
- Unless planking is secured, it must extend a minimum of 6 inches over bearer but not exceed 12 inches;
- You must provide safe access;
- Keep scaffold free of debris or slippery substances;
- All x-braces must be in place;
- An 18-inch minimum platform width is recommended;
- Erect scaffold away from energized or unguarded power lines;
- If erected over walkways or traffic areas, place 18-gauge screen or equivalent in place to prevent items from falling off;
- All scaffold components, including casters, must be capable of supporting, without failure, their own weight and at least four times the maximum intended load.

### Supported scaffolds

When erecting a scaffold from the ground up, give special attention to footing. It must be solid and stable; mudsills are suggested, but you should not use block, brick and similar items. The scaffold must be erected plumb and level. The installation of all x-braces will assist in this goal.



Fall protection, such as guardrails and toeboards, is not required at a height of 10 feet. Lockpins should be in place to prevent frame separation. Secure the scaffold to the building or structure if it will exceed 26 feet in height or a horizontal length greater than 30 feet.

### Manually propelled mobile scaffolds

Do not build manually propelled mobile scaffolds higher than three times their minimum base dimension. Use horizontal or diagonal bracing to prevent racking. The supporting casters are required to have operating locks on them and to be engaged while the scaffold is occupied. Fully plank mobile scaffold work platforms. Take special care to avoid striking piping, electric lines or other obstructions when moving scaffolds. Secure or remove tools, materials and equipment from the platform prior to relocation. Do not allow employees to ride a moving scaffold. Guardrailing is the same as for stationary scaffolds.

### Suspended scaffolds

Suspended scaffold support devices must be capable of sustaining four times the intended workload. The suspension ropes (wire, synthetic or fiber) must be capable of sustaining six times the intended workload. Protect employees through the use of a body harness attached to their individual lifelines. To prevent the platform from swinging, secure to the building or structure.

### Ladder jack scaffolds

Limit ladder jack scaffolds to light-duty use. Their height should not exceed 20 feet. Use heavy-duty ladders (Type 1A) to support the platform and workload. If bearing on the rungs only, the bearing area should include at least 10 inches of bearing on the rung. The platform should be a minimum of 12 inches wide. If you use wood planks, provide support every 8 feet.

### **Metal-bracket and form scaffolds**

Secure metal-bracket and form scaffolds in place by either welding or bolting in place. Use clip-on or hook-over brackets if the form walers are secured in place. The maximum permissible span is 8 feet; standard guardrailing and toeboards are required.

### **Stilts**

Equip stilts with skid-resistant feet and use them in accordance with manufacturer's recommendations.

### **Training**

Selecting the type of scaffold to use is as important as tool selection. An ongoing program that trains personnel in selection and use of scaffolding is imperative to reducing accidents in the work place. If you need more detailed information, consult the references and manufacturer's recommendations.

### **Definitions**

- **Competent person** — One who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous or dangerous to employees. He or she also has authorization to take prompt corrective measures to eliminate them.
- **Brace** — A brace is a rigid connection that holds one scaffold member in a fixed position with respect to another member, or to a building or structure.
- **Heavy-duty scaffold** — The type of scaffold designed and constructed to carry a working load not to exceed 75 lbs. per square foot.
- **Ladder jack scaffold** — A light-duty scaffold consisting of a platform resting on brackets attached to ladders.
- **Lean-to or shore scaffold (use prohibited)** — The type of scaffold kept erect by tilting it toward and resting it against a building or structure.
- **Light-duty scaffold** — A scaffold designed and constructed to carry a working load not to exceed 25 lbs. per square foot.
- **Mobile scaffold** — A powered or unpowered, portable caster or wheel-mounted supported scaffold.

- **Medium-duty scaffold** — The type of scaffold designed and constructed to carry a working load not to exceed 50 lbs. per square foot.
- **Qualified person** — A person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his or her ability to solve or resolve problems related to the subject matter, the work, or the project.
- **Scaffold** — A scaffold is any temporary elevated platform (supported or suspended) and its supporting structure (including points of anchorage) used for supporting employees, materials or equipment.
- **Standard guardrail** — Rails secured to uprights and erected along the exposed sides and ends of platforms, top rail being at 42 inches, midrail at 21 inches.
- **Suspended scaffold** — The type of scaffold supported from above; it can be manually or power operated; it can be single- or two-point suspended.
- **Toeboard** — A barrier secured along the sides and ends of a platform to guard against the falling of materials (3.5-inch minimum height).
- **Working load** — The load on the scaffold imposed by employees, material and equipment.

### **Reference:**

<u>Standard Number</u>	<u>Title</u>
1926.451	Scaffolding, General Requirements
1926.450	Definitions for scaffolding
1926.452	Additional requirements
1926.453	Aerial lifts
1926.454	Training
4121:1-3-10	OCA Scaffolding
ANSI A10.8	Scaffolding safety requirements
ANSI/SIA A92.5	Boom-supported elevating work platforms
ANSI/SIA A92.3	Manually propelled elevating work platforms
ANSI A14.7	Mobile ladder stands & mobile platforms
ANSI A120.1	Powered platforms for building maintenance
ANSI A92.2	Vehicle-mounted elevating and rotating aerial devices



There are varieties of aerial lifts included within the OSHA Subpart L-scaffold standard, including extensible boom platforms, aerial ladders, articulating boom platforms, vertical towers or a combination of any of these devices. This chapter's information applies to company-owned, leased and borrowed equipment.

### **Manufacturers' information**

Manufacturers of aerial lifts provide important information about the lift that the end user must be familiar with, including:

- Warnings, cautions or restrictions for safe operation and maintenance;
- Make, model, serial number and manufacturer's name and address;
- Rated work load, including number of occupants;
- Maximum travel height;
- Nominal voltage rating of batteries;
- Notice to study the operator's manual;
- Notice of required inspections;
- Alternative configuration use statement such as: outriggers, platform extension and attachments and extendible axles;
- Notice if platform or other parts are electrically insulated;
- Warning on key-part replacement.

### **User responsibilities**

To ensure safe usage of aerial lifts, users must:

- Maintain copies of operating/maintenance manuals;
- Inspect and maintain to manufacturer's specifications;
- Provide operator training;
- Instruct operator on intended purpose and function of each control;
- Read and understand manufacturer's operat-

ing instructions and user's safety rules;

- Understand all instruction, warnings and decals displayed on lift;
- Demonstrate proficiency and knowledge on the same model type.

The operating/maintenance manual provides the user with critical information that describes the type of lift and ratings of the aerial platform, maximum voltage of the electrical systems and maximum hydraulic and pneumatic operating pressure. It also includes instructions, operational safety rules, operating maintenance and intended use.

### **Inspections**

Base inspection procedures for aerial lifts on information provided by the manufacturer. Manufacturers provide various inspection intervals due to component function and wear, and deterioration that could affect component life. Frequent inspection items should include:

- All functions and their controls for speed(s), smoothness and limits of motion;
- Lower controls, including provisions for overriding the upper controls;
- All chain and cable mechanisms for adjustment and worn or damaged parts;
- All emergency and safety devices;
- Lubrication of all moving parts, inspection of filter elements, hydraulic oil, engine oil and coolant;
- Visual inspection of structural components and critical components;
- Placards, warnings and control markings;
- Any additional items specified by the manufacturer.

There also are daily prestart inspection procedures that should include quick visual checks and proper function of the following items:

- Operating and emergency controls;
- Safety devices;
- Personal protective devices;
- Air, hydraulic and fluid leaks;
- Cables and wiring harnesses;
- Loose or missing parts;
- Tires and wheels;
- Placards, warnings, control marking and operating manuals;

- Outriggers, stabilizers and extendible axles;
- Guardrail system and access gates and openings;
- Load and its distribution on platform and any platform extensions;
- Any other items specified within the manufacturer's operating manual.

### Operating procedures

Before any work is started and while work is being performed from an aerial lift, you must address various site inspection and operating procedures, including:

- Avoiding drop-offs, holes or bumps;
- Checking for floor obstructions and debris;
- Avoiding grades, slopes and ramps;
- Watching for overhead obstructions/high voltage conductors;
- Being aware of wind or weather conditions;
- Providing adequate surface support;
- Looking out for hazardous locations;
- Operating the platform on a surface within limits specified by the manufacturer;
- Using stability enhancing means as manufacturer requires;
- Closing guardrails, access gate or openings per manufacturer's instructions;
- Making sure the load and its distribution are within manufacturer's rated capacity;
- Ensuring adequate clearance from overhead obstructions;
- Having personnel wear required safety gear;
- Maintaining maximum safe approach distance to energized lines and parts;
- Determining hazardous locations;
- Maintaining a firm footing on the platform floor;
- Taking precautions for any other moving equipment operating in the same area;
- Preventing ropes, electric cords, hoses etc. from entangling with the platform;
- Following rated capacities;
- Clearing personnel and equipment from surrounding areas before lowering the platform;

- Shutting down the engine while fueling;
- Charging batteries in well-ventilated areas free of flames, sparks or other hazards that could cause a fire;
- Not using other objects to steady the platform;
- Not using aerial lifts as cranes;
- Limiting travel speed to travel conditions;
- Limiting platform travel height to no more than twice the base width;
- Avoiding stunt driving and horseplay;
- Not altering safety devices or interlocks;
- Driving on grades, slopes or ramps only within the manufacturer's ratings;
- Ceasing operation if any suspected malfunction occurs;
- Permitting only manufacturer's authorized alterations to be made;
- Reporting problems or malfunctions immediately to the supervisor;
- Reporting potential hazardous locations immediately to the supervisor.

### Fall protection

Operators of extensible and articulating boom lifts must wear a body harness with a lanyard attached to the boom or basket when working from an aerial lift. Also, operators of ladder trucks and tower trucks must wear a body harness with attached lanyard. The manufacturer's information provided with the lift device includes the proper attachment points and procedures. There are no requirements for the wearing of a body harness and lanyard while working from a scissors-type lift. If it is a policy of your company to wear a body harness with an attached lanyard in a scissors lift, contact the manufacturer to obtain information about suitable anchorage points and proper tie-off procedures.

Reference:

<u>Standard Number</u>	<u>Title</u>
1926.453	Aerial lifts
ANSI/SIA A92.2-1990	Vehicle-mounted elevating and rotating aerial devices
ANSI/SIA A92.6-1990	Self-propelled elevating work platforms

## Respiratory protection



Not only is it a good idea to have a written respiratory protection program, it is an OSHA requirement. As with other PPE, respirators are used only when administrative and/or engineering controls are inadequate.

You can choose the correct respiratory protection from the following respirator classifications and definitions:

- Air purifying-particulate filter respirators are generally called dust, mist or fume respirators. They filter particulates before they are inhaled. This type of respirator does not provide oxygen and must not be worn in an oxygen-deficient atmosphere (an atmosphere where the percentage of oxygen by volume is less than 19.5 percent). Additionally, it does not protect against toxic gases and vapors;
- Air purifying-chemical cartridge/canister respirators remove the gas or vapor by absorbing

specific gas or vapor on a sorbent material before the air is breathed. The cartridge or canister protects against a single chemical or class of chemicals. Read the label on the cartridge or canister to ascertain the agent against which it will protect, maximum concentration and, in some instances, the service life of the element. Air purifying-chemical cartridge/canister respirators do not supply oxygen. You cannot use them in an oxygen-deficient atmosphere. You must not use them in an atmosphere IDLH or where warning properties of the contaminant are poor, and therefore would not signify that the filter is consumed;

- Self-contained breathing apparatus (SCBA) type-C supplied-air respirators allow the user to work independent of the air quality of the work site. You will generally use SCBA as an emergency rescue respirator or for cleaning up chemical spills;
- Supplied-air respirators provide the user with grade D certified breathing air from a central source via an air supply line or hose. Supplied-air respirators are available in either half-mask or full-face mask. The air-line respirator allows the user to work for extended periods of time in a contaminated atmosphere. This type of respirator is not allowed in an atmosphere classified as IDLH unless it includes a small self-contained source of breathing air for escape purposes and is approved for such use.

Respirator need and selection (sample procedure)  
To determine the need for respirator protection in each situation:

- a) Assess whether potential exposures exist and to what extent;

- b) Review all available industrial hygiene data to establish need and assist in selecting the correct respiratory protection. Conduct additional industrial hygiene surveys as necessary;
- c) Assess current engineering and/or administrative controls used to prevent exposure;
- d) Assess the feasibility of engineering;
- e) Review in-depth any current work requirements and conditions that may impair an employee's ability to wear respiratory protection;
- f) Assess the characteristics and limitations of available respiratory protection;
- g) Select and use only National Institute for Occupational Safety and Health (NIOSH) or Mine Safety and Health Administration (MSHA)-approved respirators.

Medical evaluation (sample procedure)

- a) Examine employees to evaluate their medical status as it relates to respiratory protection, and to ensure they are physically able to perform the work while wearing a respirator.
- b) Medical examination will consist of:
  - Completion of respiratory questionnaire;
  - Pulmonary function test;
  - Physical examination.
- c) Review annually the medical status of all employees who use respiratory protection.

Training (sample procedure)

- a) Only medically approved employees will receive training in respiratory protection.
- b) The training program will include:
  - Purpose of respiratory protection;
  - Types of protection available and the limitation of each type;
  - How to properly don the equipment and check the face-piece fit;
  - How to properly clean, inspect and store the equipment;
  - Discussion of the company's written respiratory protection program.
- c) Provide all employees the opportunity to wear the respirator of their choice for 15 minutes before the face fit-testing procedure.

**Program surveillance**

Periodically, management will survey the work area(s) to ascertain the effectiveness of the program and modify it as necessary.

## Personal protective equipment

When a hazard is identified on a construction site, make every possible effort to eliminate it so no one is harmed. When exposures to hazards cannot be engineered completely out of normal operations, use protective clothing or equipment. PPE covers:

- Face and eye protection — safety glasses, goggles, face shields, welding and laser protection;
- Head protection — hard hats capable of protection against impact and electrical shocks and burns;
- Hearing protection — ear muffs, and molded and formable ear plugs;
- Protective footwear — steel-toed (safety) shoes, rubber boots, metatarsal guards and slip-resistant soles;
- Respiratory protection — filter respirators, cartridge respirators, supplied-air respirator, and self-contained breathing apparatus;
- Body harness, lanyards and lifelines;
- Special clothing — chemical protective clothing (CPC), hot/cold environment clothes and high-visibility clothing (traffic vests).

### Hazards of PPE

While PPE is considered to be part of the job in the construction industry as a rule, it is considered a last-resort, temporary type of protection. For normal operations, always try to eliminate the hazard in the environment before using PPE (unless the law requires the use of PPE).

No single combination of protective equipment and clothing is capable of protecting against all hazards. Thus, you should use PPE in conjunction with other protective methods. PPE use can itself create significant worker hazards, such as heat stress, physical and psychological stress, and impaired vision, hearing, mobility and communication.

In general, the greater the level of PPE protection, the greater the level of associated risks. For any given situation, select equipment and clothing that provide an adequate level of protection.

### Developing a PPE program

Develop a formalized, written program once you

decide employees will use PPE. This program should at least include the following elements:

- A communicated policy on usage of PPE to employees and visitors;
- Responsibility for the selection of equipment;
- The requirements of a PPE training program;
- Instructions on the correct use and maintenance of the equipment;
- Corrective action for policy violations;
- Employee involvement and recognition for safe behavior.

For the safe use of any personal protective device, it is essential that you properly instruct employees in its selection, use and maintenance. Additionally, competent persons in the use of PPE should instruct both supervisors and employees. It also is critical that contractors purchase safety equipment that fits properly and provides protection. It may be necessary to purchase more than one style of personal protective devices. Make routine and planned inspections to determine if employees properly issue, use and maintain PPE.

### Legal requirements

OSHA Standards for the Construction Industry (29 CFR Part 1926) addresses PPE as follows:

1926.28	Personal protective equipment.
1926.57	Ventilation.

Design. All personal protective equipment shall be of safe design and construction for the work to be performed.

#### Subpart E - Personal Protective and Life Saving

Section	
1926.95	Criteria for personal protective equipment
1926.96	Foot protection
1926.100	Head protection
1926.101	Hearing protection
1926.102	Eye and face protection
1926.103	Respiratory protection
1926.104	Safety belts, lifelines and lanyards
1926.105	Safety nets
1926.106	Working over and near water
1926.107	Definitions

## Fall protection

Falls are complex events involving a variety of factors. Consequently, the standard for fall protection deals with both the human and equipment-related issues in protecting workers from fall hazards. The fall-protection rule identifies areas or activities where fall protection is needed. It also clarifies what employers can do to provide fall protection for employees, such as identifying and evaluating fall hazards and providing specific training.



The fall-protection rule sets a uniform threshold height of 6 feet. This means employees must be protected from fall hazards and falling objects whenever an employee is on a walking/working surface 6 feet or more above a lower level. The rule covers most construction workers except those inspecting, investigating or assessing work-place conditions prior to the actual start of work, or after the completion of all work.

Other OSHA regulations cover fall-protection requirements for workers on scaffolds, cranes and derricks, steel erection, equipment used in tunneling, electrical transmission and distribution lines, and stairways and ladders.

### Definitions

**Competent person** — An individual capable of identifying existing and predictable hazards in the surroundings or working conditions that may be unsanitary, hazardous or dangerous to employees. He or she who has authorization to take prompt corrective measures to eliminate them.

**Controlled access zone (CAZ)** — An area in which certain work (e.g., overhand bricklaying) may take place without the use of guardrail systems, personal fall arrest systems or safety net systems, and access to the zone is controlled.

**Conventional fall protection system** — A guardrail system, personal fall arrest system or safety net system.

**Infeasible** — It is impossible to perform the construction work using a conventional fall protection system, or it is technologically impossible to use any one of these systems to provide fall protection.

**Low-slope roof** — A roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

**Qualified person** — A person, by possession of a recognized degree, certificate or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated their ability to solve or resolve problems relating to the subject matter, the work or the project.

**Roofing work** — The hoisting, storage, application and removal of roofing materials and equipment, including related insulation, sheet metal and vapor barrier work but not including the construction of the roof deck.

**Steep roof** — A roof having a slope greater than 4 in 12 (vertical to horizontal).

### Duty to have fall protection

Employers are required to assess the workplace to determine if the walking/working surfaces on which employees are to work have the strength and structural integrity to safely support workers. Once employers have determined the surface is safe to work on, they must select a fall-protection system for the work operation if a fall hazard is present.

### Protection from falling objects

Recommendations for protection against falling objects include all affected workers wearing hard hats and at least one of the following measures:

- Install toeboards, screens or guardrail systems to prevent objects from falling from higher levels;
- Erect canopy structures and keep potential falling objects far enough from the edge to prevent accidental displacement;
- Provide barricades around areas where objects could fall, and prohibit employees from entering those areas.

### Systems criteria and practices

Guardrail systems should comply with the following provisions:

- The top edge height of top rails should be 42 inches (plus or minus three inches) above the walking /working level;
- Install midrails or equivalent intermediate members at a height midway between the top edge of the guardrail system and the walking/working level;
- Guardrail systems should be capable of withstanding a force of at least 200 pounds applied within two inches of the top edge, in any outward or downward direction;
- Guardrail systems should be surfaced to prevent injury to an employee from punctures or lacerations and to prevent snagging of clothing;
- Top rails and midrails must be at least one-quarter inch nominal diameter or thickness to prevent cuts and lacerations. If wire rope is used for top rails, flag it at not more than six-foot intervals with high-visibility material;

- Inspect manila, plastic or synthetic ropes used for top or midrails as frequently as necessary to ensure they meet the strength requirements.

Safety net systems should comply with the following provisions:

- Install safety nets as close as practicable under the walking/working surface on which employees are working but in no case more than 30 feet below;
- Ensure safety nets extend outward from the outermost projection of the work surface as stated below.
- Safety nets need sufficient clearance to prevent contact with objects below.
- Install nets capable of absorbing the impact force of a drop test, which you should perform and document at the job site. The drop test consists of a 400-pound bag of sand, 30 inches, (plus or minus 2 inches) in diameter, dropped from the highest walking/working surface where employees are exposed to fall hazards, but not from less than 42 inches above that level.
- If the employer can demonstrate that a drop test is unreasonable, a competent person can prepare a certification record that the net can withstand the impact force equal to the drop test.
- Inspect the nets at least weekly; look for wear, damage and other deterioration. Remove defective nets from service. Clear material, scrap and equipment caught in the safety net as soon as possible and at least before the next work shift.

**Vertical distance from**  
working level to horizontal  
plane of net  
Up to 5 feet  
More than five feet up to 10 feet  
More than 10 feet

**Minimum required horizontal**  
distance of outer edge of the  
net from the working surface  
8 feet  
10 feet  
13 feet

- The maximum opening of the safety net should not exceed 36 square inches and be no longer than 6 inches on any side. When measuring center to center, the rope or webbing should not exceed 6 inches;
- The breaking strength of border rope should be a minimum of 5,000 pounds. Connectors need to be as strong as the integral net and spaced no more than 6 inches apart.

Personal fall-arrest systems should comply with the following provisions:

- Body belts are not acceptable as part of a personal fall arrest system. The use of a body belt in a positioning device system is acceptable;
- Only locking-type snaphooks are permitted for use;
- On suspended scaffolds or similar work platforms with horizontal lifelines, which may become vertical lifelines, the devices used to connect to a horizontal lifeline must be capable of locking in both directions;
- Lanyards and vertical lifelines must have a minimum breaking strength of 5,000 pounds. They also must be protected against being cut or abraded;
- Self-retracting lifelines and lanyards which limit free fall distance to 2 feet or less must be capable of sustaining a minimum tensile load of 3,000 pounds applied to the device with the lifeline or lanyard in the fully extended position;
- Anchorages used for attachment of personal fall arrest equipment must be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 5,000 pounds per employee attached, or be designed, installed and used as follows:
  1. As part of a complete fall-arrest system which maintains a safety factor of at least two;
  2. Under the supervision of a qualified person.

When stopping a fall, personal fall-arrest systems must:

1. Limit arresting force on the body to 1,800 pounds when used with a body harness;
  2. Be rigged so that an employee can free fall no more than 6 feet;
  3. Bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet;
  4. Have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet, or the free fall distance permitted by the system, whichever is less.
- When personal fall-arrest systems and components are subjected to impact loading, immediately remove from service;
  - Inspect personal fall-arrest systems and components prior to each use for wear, damage and other deterioration. Remove defective components from service;
  - Never attach personal fall-arrest systems to guardrail systems.

Positioning device systems should comply with the following provisions:

- Ensure that positioning devices are secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds, whichever is greater;
- Requirements for all hardware and components must meet the same criteria as those for personal fall arrest systems.

Warning line systems should comply with the following provisions:

- Erect warning lines around all sides of the roof work area;
- When not using mechanical equipment, erect the warning line no less than 6 feet from the roof edge;
- Warning lines may consist of ropes, wires or chains and supporting stanchions erected as follows:
  1. Flag the line at not less than 6-foot intervals with high-visibility material;

2. Rig the line and support it so that its lowest point is no less than 34 inches from the surface and its highest point no more than 39 inches;
  3. After being erected with the line attached, stanchions must be capable of resisting without tipping a force of at least 16 pounds applied horizontally against the stanchion, 30 inches above the surface;
  4. The line must have a minimum tensile strength of 500 pounds.
- Attach the line at each stanchion in such a way that pulling on one section between stanchions will not result in slack being taken up in adjacent sections before the stanchion tips;
  - Employees are not permitted in the area between a roof edge and warning lines unless they are performing roofing work in that area.

Controlled access zones should conform to the following provisions:

- When used to control access to areas where leading edge and other operations are taking place, define the zone by a control line or other means that restrict access;
- When control lines are used, erect them no less than 6 feet nor more than 25 feet from the unprotected or leading ledge, except when erecting precast members;
- When erecting precast members, erect them no less than 6 feet nor more than 60 feet or half the length of the member being erected, whichever is less, from the leading edge;
- Extend the line along the entire length of the unprotected or leading edge, and ensure it is parallel to the unprotected or leading edge;
- Connect the line on each side to a guardrail system or wall;
- When used to control access to areas where overhand bricklaying and related work are taking place:
  1. Define the zone by a control line erected not less than 10 feet or more than 15 feet from the working edge;

2. Extend the line for a distance sufficient for the zone to enclose all employees performing overhand bricklaying and related work at the working edge and be approximately parallel to the working edge;
  3. Erect additional control lines at each end to enclose the zone;
  4. Permit only employees engaged in overhand bricklaying or related work in the zone.
- Control lines can consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions as follows:
    1. Flag or clearly mark each line at not more than 6-foot intervals with high-visibility material;
    2. Rig each line so that its lowest point is not less than 39 inches from the surface and its highest point not more than 45 inches;
    3. Each line must have a minimum breaking strength of 200 pounds.

Safety monitoring systems should comply with the provisions listed below.

- The employer must designate a competent person to monitor the safety of other employees, and ensure the monitor complies with the following requirements:
  1. Be competent to recognize fall hazards;
  2. Warn affected employee when it appears that he or she is unaware of a fall hazard or is acting in an unsafe manner;
  3. Be on the same surface and within visual sighting distance of the employee being monitored;
  4. Be close enough to communicate orally with the employee;
  5. Must not have other responsibilities which could take his or her attention from the monitoring function.
- Do not use or store mechanical equipment in areas where safety-monitoring systems are being used to monitor employees engaged in roofing operations on low-sloped roofs.
- No employee, other than an employee engaged in roofing work (on low-sloped roofs) or an employee covered by a fall-protection plan, is allowed in an area where a safety monitoring system is protecting an employee.

Covers for holes in floors, roofs and other walking/working surfaces should meet the following requirements:

- Covers located in roadways and vehicular aisles must be capable of supporting at least twice the maximum axle load of the largest vehicle;
- All other covers must be capable of supporting at least twice the weight of employees, equipment and materials that may be imposed on the cover at any one time;
- Secure all covers when installed so as to prevent accidental displacement;
- Color-code or mark all covers with "HOLE" or "COVER" to provide warning of the hazard.

Falling object protection should comply with the following provisions:

- Erect toeboards along the edge of the overhead surface for a distance sufficient to protect employees below;
- Ensure toeboards are capable of withstanding a force of at least 50 pounds in any downward or outward direction;
- Toeboards must be a minimum of 3.5 inches in vertical height from their top edge to the level of the surface and have no more than one-fourth inch clearance above the surface;
- Where tools, equipment, or materials are piled higher than the top edge of a toeboard, you must erect paneling or screening from the surface or toeboard to the top of a guardrail system or to a midrail, for a distance sufficient to protect employees below;
- When using guardrail systems as falling object protection, ensure all openings are small enough to prevent passage of potential objects.
- During the performance of overhand bricklaying and related work:
  1. Do not store materials or equipment except masonry and mortar within 4 feet of the working edge;
  2. Ensure excess mortar, broken or scattered masonry units, and all other materials and debris are kept clear from the work area by removal at regular intervals.

- During the performance of roofing work:
  1. Do not store materials and equipment within 6 feet of a roof edge unless guardrails are erected at the edge;
  2. Ensure that materials piled, grouped or stacked near a roof edge are stable and self-supporting.
- Secure any objects that may fall onto the canopy.

### **Training**

Design employee training programs so employees who are exposed to fall hazards can recognize and minimize the hazards. A competent person qualified in the following areas must train employees:

- Nature of fall hazards;
- Erecting, maintaining, disassembling and inspecting of the fall protection system;
- Use and operation of fall-protection systems;
- Role of employees in safety monitoring systems;
- Use of mechanical equipment during low-sloped roofing work;
- Handling and storage of equipment and material, and erection of overhead protection;
- Role of employees in fall-protection plans;
- Standards contained in subpart M.

The employer must verify training was conducted by preparing a written certification record. The record should include names or other identities of employees trained, date and signature of the person or the company conducting the training. If another employer conducted training, the record should indicate the date prior training was determined adequate rather than the date of actual training. Maintain and keep current all training records.

Employees may receive more training when an employer believes that previously trained employees do not understand or have the skills needed to recognize and minimize these hazards. Retraining also may be in order when changes in the work place or changes in the fall protection equipment render previous training obsolete.

## Chapter 22

# Welding and cutting

Safe procedures for safe welding and cutting are extensive because the many hazards involved. Common hazards include handling compressed gases and exposure to electricity, fumes, gases, noise, radiation, fire and explosions. Thorough and effective training of workers involved in welding and cutting is critical to ensure the safe use of equipment and processes, along with procedures used to control hazardous conditions. General housekeeping also is important in preventing fires and avoiding injuries, such as a welder tripping over debris or gas hoses due to restricted vision while wearing eye protection.

### Compressed gases

The most frequent OSHA citations related to welding involve the misuse, careless handling and improper storage of compressed gas cylinders. Compressed gas cylinders are difficult to handle because of their size and weight, and the additional hazards due to the exposed valves and gas contents under pressure. If moving cylinders a short distance, you can tip them and roll them on the bottom edge. Do not drag the cylinders along the floor. Cylinders are best moved with a suitable hand truck. Hoist cylinders by securing a cradle slingboard, pallet or special carrier included for this purpose.

Do not hoist cylinders by use of an electromagnet or choker sling. Always store and use cylinders in the upright position and secure them against falling. If the cylinders are not labeled, do not use the contents and return them to the supplier. Valve protection caps are used to protect the cylinder valves and the safety devices. Caps should always be in place except when the cylinders are in use. Separate stored oxygen cylinders from fuel-gas cylinders or combustible materials by a minimum distance of 20 feet or by a non-combustible barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.

Always use a pressure-reducing device when withdrawing gas from gas cylinders used for welding and cutting operations. Inspect connection nuts and fittings before each use to detect



faulty seats. Faulty seats may allow leakage once the regulator is attached to the cylinder valves or hoses. Before connecting a regulator to a cylinder valve, wipe the valve outlet with a clean cloth free of oil or lint. Then crack the valve by opening the valve momentarily and closing immediately.

This clears the valve of dust or dirt that might otherwise enter the regulator. Mark USE NO OIL on gauges used for oxygen service and drain oxygen before attaching to the cylinder. Always open oxygen cylinder valves slowly. Do not use acetylene at a pressure in excess of 15 psig. At about 25 psig acetylene becomes unstable and doesn't need a spark or flame to explode.

Distinguish fuel gas and oxygen hoses from each other. In the United States, the generally recognized colors are red for fuel gas hose, green for oxygen hose and black for inert gas and air hose. Do not interchange the oxygen and fuel gas hoses. You can tape together parallel lengths of oxygen and fuel gas hose for convenience and to prevent tangling, but not more than 4 inches in each 12 inches shall be covered with tape. Repair or replace hoses showing leaks, burns, worn places or other defect.

Clean torch tip openings that become clogged with suitable cleaning wires, drills or other devices designed for such purpose. Inspect torches prior to their use for leaking shutoff valves, hose couplings and tip connections. Use friction lighters or other approved devices to light torches, and not matches or hot work.

## **PPE**

Welding produces molten metal, sparks, slag and hot work surfaces. Workers should wear protective clothing made of suitable materials, which provides sufficient coverage to minimize skin burns caused by sparks, spatter or radiation. Keep sleeves and collars buttoned, and eliminate pockets from the front of clothing to prevent sparks from lodging in rolled-up sleeves, pockets or cuffs of overalls or pants. All welders and cutters must wear protective flame-resistant gloves. Use gloves with insulated linings to protect from exposure to high radiant energy. Employees can use leather or flame-resistant aprons to protect the front of the body against sparks and radiant energy. Flame-resistant leggings are available to provide additional protection to the legs.

When welding or cutting overhead, wear cape sleeves or shoulder covers with bibs made of leather or other flame-resistant clothing.

Keep clothing free of grease and oil, and don't carry combustible materials in pockets. The equipment and the processes used in welding and cutting generate noise. Engine-driven generators can emit high noise levels, as do some high-frequency and induction welding processes, such as air carbon arc and plasma arc cutting. If at all possible, control the noise at the source. If this is not possible, use personal protective devices, such as earmuffs or earplugs.

You must provide adequate ventilation for all welding, cutting and brazing operations. The ventilation must be capable of keeping exposures to hazardous concentrations of airborne contaminants maintained below levels specified by OSHA or the American Conference of Governmental Industrial Hygienists (ACGIH). If the airborne contaminants cannot be effectively controlled through natural or mechanical ventilation, workers must wear respirators. Whenever the use of respirators is necessary, implement a program

to establish the proper selection, fit and use of respirators. Train welders and cutters to avoid breathing the fume plume directly. You can do this by work positioning the head or by ventilation, which directs the plume away from the face.

Another significant hazard of welding and cutting operations is the possibility of eye injuries. Ultraviolet radiation is generated during these operations. When the eyes are exposed to excessive ultraviolet radiation, they may develop sharp pains and become red and irritated.

Employees will wear proper eye and face protection that complies with ANSI standard Z87.1, Practice for Occupational and Educational Eye and Face Protection. Employees will wear welding helmets with filter lense, which protect the face, forehead, neck and ears from radiant energy from the arc and from weld spatter. Select the filter lens based on the type of welding process being performed, electrode size and arc current. Wear safety glasses or goggles to protect against slag chips, grinding fragments, wire wheel bristles and similar hazards. Welding helmets will not provide adequate protection against severe impact, such as fragmenting grinding wheels or abrasive discs.

## **Electricity**

The welder can avoid electrical shock. Therefore, it is essential that you thoroughly train him or her on how to avoid it. Severity of shock is determined by the path, duration and amount of current flowing through the body, which is dependent upon voltage and contact resistance of the area of skin involved.

Faulty installations, improper grounding and incorrect operation and maintenance of equipment are all sources of danger. Ground all electrical equipment and the work piece.

The work lead is not a ground lead and is used only to complete the welding circuit. Use the correct cable size because overloading will cause cable failure and result in possible shock or fire hazard. When electrode holders are left unattended, remove the electrodes and the holders placed or protected so they cannot make electrical contact with workers or conducting objects. Do not dip hot electrode holders in water because this may expose the welder or cutter to electric shock.

Disconnect or de-energize a welding circuit while charging or adjusting the electrode, torch or gun or to avoid electrical shock. Inspect welding cable regularly since welding cable is subject to severe abuse as it is dragged over work under construction and across sharp corners.

Replace or repair cable with damaged insulation or connectors to achieve mechanical strength, insulating quality, electrical conductivity and water tightness of the original cable.

### **Fire protection**

Welding and cutting should preferably be done in specially designated areas designed and constructed to minimize fire risk. Sparks start many fires, which can travel horizontally up to 35 feet from their source and fall much greater distances. Sparks can pass through or lodge in cracks, holes and other small openings in floors and walls.

Material most commonly ignited are combustible floors, roofs, partitions and building contents. This includes trash, wood, paper, textiles, plastics, chemicals, and flammable liquids and gases. Outdoors, the most common combustibles are dry grass and brush.

When you cannot move work to a designated safe location, remove all movable nearby fire hazards. If the work and fire hazards are immovable, use guards to protect the immovable fire hazards and nearby personnel from the heat, sparks and slag. Have sufficient fire-extinguishing equipment ready for use when welding and cutting. When welding or cutting in areas not normally designed for such operations, use a hot work permit system. The hot work permit system includes a check list of safety precautions and also alerts other workers to an extraordinary danger of fire that will exist at a particular time.

### Reference

<u>Standard Number</u>	<u>Title</u>
1926 Subpart J NIOSH Publication 88-110	Welding and Cutting Welding, Brazing and Thermal Cutting
ANSI/AWC Z49.1	Safety in Welding and Cutting
ANS F3. 2M/F3.2	Ventilation Guide for Weld Fume

## Electrical safety

There are two types of electrical current used in construction — alternating current (AC) and direct current (DC). AC alternates or changes its direction of travel many times a second whereas DC flows in only one direction.

AC is the type of electricity used at most construction sites and in homes because it can be transformed to higher voltages and transported long distances without losing much power.

### How electricity travels in a circuit

For electrical current to get from one place to another it must have a path to follow. The path that current follows is provided by material known as a conductor. A conductor is simply anything that allows electrons to flow through it. Metals make good conductors as does water. The human body is a conductor because it consists mostly of salt water. Any conductor can end up providing a path for current, which creates a real hazard to those working on or around electrical current on the construction site. Current is especially dangerous because it can show up on any conductor that is in contact with a fault, such as water, wire rope, metal studs or the frame on equipment.

Not everything conducts electricity. A material that does not allow electrical current to flow through it is called an insulator. Insulators protect you from electrical shock. Metal wires and cables are often coated with plastic, a great insulator.

This is why electricians should wear approved, protective rubber gloves and rubber boots when they perform hot electrical work. Other insulators include wood, ceramic, fiberglass and glass.

### What is an electrical ground?

To make a complete electrical circuit, current must flow in a circular path, beginning and ending at the source, such as a tool or piece of equipment.

Electricity will take the path of least resistance, including you if you happen to become part of the circuit. The path of least resistance may be any path that allows electricity to flow through it more easily than another as it travels back to the source. If there is more than one conducting path for the current, it will flow through all the conduc-

tors. More current will flow through the better conductors and less current will flow through the poorer conductors.

### Effects of electricity

What you feel when current passes through your body is called electrical shock. Most of us are familiar with the mildest form of shock, the slight tingling sensation felt when you touch a defective appliance or energized equipment. This situation may not be dangerous or even painful. However, circumstances need be only slightly different to change a mild dose of current into a killing jolt.

The degree of injury to the body varies from mild shock, burns to death. Three things determine the degree of injury: amount of current, path through the body and the amount of time in contact with the electricity. Even mild shock can cause you to drop what you are holding. This can cause injury to someone else, or it can cause you to fall and sustain a more serious injury.

It doesn't take a lot of electricity to kill you. The amount of current needed to light an ordinary 60-watt light bulb is five times what can kill a person. Thus, all electrical equipment on construction sites is potentially deadly.

### Electric inspection on construction sites

Electrical extension cords are numerous on construction sites. They become damaged because of the rough conditions they are used in.

Inspect to ensure:

- All extension cords are three-wire cords;
- Ground pin is on male plug;
- Unbroken insulation on cord;
- End appliances (plug and receptacle) are gripped to insulation;
- All wires are continuous and unbroken;
- All cords are protected from damage, likely to occur when passing through a door or window;
- Metal boxes with knockouts are not used on extension cords;
- Plugs are dead-front (molded or screwed in place);
- Romex (non-metallic sheathed cable) is not used as flexible cord;

- Cords are not stapled or hung from nails;
- Bushing is passing through holes in covers or outlet boxes.

Also check these items:

- Temporary lights not supported by their cords;
- Bulb guards on temporary lights;
- Electrical power tools with non-deadman switches have magnetic restart (when injury to the operator might result if motors were to restart following power failures);
- Provisions to prevent machines from automatically restarting upon restoration of power in place;
- Outlets do not have reversed polarity;
- Power tools are double-insulated or have a ground pin;
- All exposed electric more than 50 volts guarded so no one can come in contact (receptacles, lightbulb sockets, bare wires, load center, switches); can be guarded by:
  - Approved enclosures;
  - Location in a room, vault or similar enclosure accessible only to qualified persons;
  - Suitable permanent, substantial partitions or screens arranged so only qualified persons have access to the space within reach of live parts;
  - Location on a suitable balcony or platform elevated and arranged to exclude unqualified persons;
  - Elevation of 8 feet or more above the working surface.

### **GFCI (ground-fault circuit interrupters)**

All 125-volt, single-phase, 15- and 20-ampere receptacle outlets that are not a part of the permanent wiring of the building or structure and that are in use by personnel will have GFCI protection for personnel. You will provide GFCIs protection for personnel if a receptacle or receptacles are installed as part of the permanent wiring of the building or structure and used for temporary electric power. On construction sites, you must take precautions to aid the effective operation of GFCIs. Most laboratory-tested appliances have 0.5 mA leakage or less under normal operating conditions. However, moisture and improper maintenance on portable hand-held power tools

common at construction sites can create conditions in which you can expect GFCIs to trip.

You can expect portable cords with standard cap and connector connections, when dropped in water, to cause leakage currents (100 to 300 mA or greater) far in excess of GFCI trip currents. Motors with dirty brushes, carbon-tracking on commutators, or moisture in the windings contribute to leakage current.

A common-sense approach to installing, using, and maintaining GFCI circuits will do much to eliminate nuisance tripping at construction sites. Actually, tripping under any of the conditions mentioned previously is not nuisance tripping, but merely a device performing its intended function.

Moisture is the major culprit in current leakage on wiring and equipment.

Do not subject panel boards, receptacles, and cord caps and connectors intended for dry locations to moist conditions. Centrally locate construction receptacles so employees can use cords of 150 feet or less, with a sufficient number of circuits used to keep the number of tools on a circuit to a minimum. Do not have receptacles on the same circuit as lighting or other uses. Perform periodic maintenance of all motors used on construction sites.

### **Portable generators**

Under the following conditions, you need not ground the frame of a portable generator, which can serve as the grounding electrode for a system supplied by the generator:

- The generator supplies only equipment mounted on the generator or cord- and plug-connected equipment through receptacles mounted on the generator or both;
- The noncurrent-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are bonded to the generator frame.

You need not protect with GFCIs receptacles on a two-wire, single-phase portable or vehicle-mounted generator rated at not more than 5kW (kilowatts), where the circuit conductors of the generator are insulated from the generator frame and all other grounded surfaces.

## Lockout/tagout procedures

This procedure provides the fundamental components necessary for the deactivation of the mechanical/electrical energy sources through a lockout/block-out/tagout system.

### General

Employees are exposed to a variety of energy sources when performing daily repairs, modifications and adjustments to their operating equipment. To eliminate the hazards associated with these activities, employers will instruct employees in the correct methods to employ when performing these operations.

### Definitions

- Hazardous energy sources — Classify a hazardous energy source as mechanical, electrical, pneumatic, hydraulic, chemical, thermal or gravity.
- Lockout device — A device (a padlock or a combination of padlock and multiple-lock hasp hardware) you can use to prevent a hazardous energy source from being re-energized.
- Tagout device — A warning tag that an employee attaches to critical areas to communicate why you should not re-energize an energy source. The tag contains the name of the employee, the date and time the employee initiated the tag and a brief description of work to be performed.
- Authorized employee — A person who locks out or tags out to perform the maintenance or service task.
- Affected employee — A person who is exposed to lockout/tagout procedures.



### Program elements

Follow these steps prior to initiating any repairs, modifications and/or adjustments to operating equipment:

1. Notify an affected person with jurisdiction over the equipment to deactivate energy sources;
2. The authorized person, who will work on the equipment, will identify all sources of power that he/she must lock out, block or release;
3. To ensure employees cannot re-energize the equipment while maintenance activities are performed, the employee will lock out/blank out all potential energy sources. Assign employees padlocks with their names or identification numbers affixed to the locks. Individually key the locks to prevent another employee from removing the lock inadvertently. If more than one employee is assigned to work on the equipment, use a multi-lockout hasp so that all employees working on the equipment will apply their locks and ensure their safety;

4. Affix a tagout device to all components or systems de-energized to indicate that a lockout procedure has been performed;
5. Prior to performing any work activities, the authorized person will test the systems to ensure he or she properly deactivated the equipment;
6. Upon completion of the work, the authorized person and the supervisor will verify the equipment on the system is safe to operate. Give special consideration to the installation of guards and covers for electrical wiring, and to ensure all piping systems have been properly reconnected. Also notify the affected worker when the machine is OK to use.

#### **Special conditions**

During certain operations, it may be necessary to energize the equipment for a short period of time. Notify and direct employees in the immediate area to stay clear of the equipment. If you plan to deactivate the operation again, have the authorized person repeat the third, fourth and fifth steps in the preceding paragraph before work resumes.

In some instances work will carry over to another shift. A designated person must affix a department lock to the equipment to ensure it is not energized during the transition. When the next shift employee comes to work on the piece of equipment, he or she will repeat the second through the fifth preceding steps before work resumes on the equipment.

If the work is completed and a lock remains on the equipment, nobody will remove it until the employee responsible for the lock is found or the supervisor of the employee investigates and ascertains that the equipment is safe to operate. Unauthorized removal of a lock will subject the employee to disciplinary action.

#### **Electrical work**

Prior to doing any electrical work, a qualified person must:

- Lock out the system;
- Open the disconnect;
- Make a visible inspection of the electrical panel to ensure that all blades on knife switches are open or that the circuit is open;
- Check the voltage tester on a known energized voltage source;
- Check the voltage on the load side of the circuit to make sure it is de-energized;
- After performing the voltage test, re-check the tester on a known source to ensure that it was operating correctly;
- Remove any fuses that are in the motor disconnect box;
- Close the box and place a tag and his or her lock on the disconnect switch prior to doing any other work;
- Prior to working any capacitors, discharge and ground them, and then check with the voltage tester.

## Excavation



Trench collapses can occur without warning, regardless of the depth. The vast majority of trenching fatalities occurs in trenches 5 to 15 feet deep. These depths invite taking chances, and it is the good, safe-looking material that is the unsuspected killer.

But trench cave-ins don't have to happen. The following information will provide help in avoiding these potentially deadly accidents.

### General requirements

- Establish the locations of underground and overhead utilities and services before beginning excavation. Contact utility companies and advise them prior to the start of excavation.
- Remove or support all surface encumbrances, as necessary, to safeguard employees.
- Employees working in trenches 4 feet deep or more will have an adequate and safe means of exit, such as ladders, steps or ramps available at no more than 25 feet of lateral travel.
- Employees exposed to public vehicular traffic must wear suitable garments marked with or made of reflectorized or high-visibility material.
- Permit no employees underneath loads by lifting or digging equipment.
- When hazardous atmospheric conditions exist or you can reasonably expect them to exist, testing and control to prevent exposure to harmful levels is required.
- Removable type steel casings, and individually manned lifelines and harnesses will protect employees in bell-bottom pier holes. Follow confined-space entry procedures.
- Employees must not work in excavations in which there is accumulated water without necessary safety precautions.
- Additional underpinning, shoring or bracing may be required when adjoining utility lines, foundations, walks and footings are endangered.
- Store spoil, equipment and other materials that can pose a hazard by falling or rolling into excavations at least 2 feet away, or use effective retaining devices.
- Superimposed loads, like mobile equipment working close to excavation edges, require extra sheet piling, shoring or bracing. The use of mobile equipment near excavations also requires substantial barricades or stop logs.
- Have a competent person capable of identifying existing and predictable hazards, and with the authority to take prompt corrective action to eliminate them on the site.
- A competent person should be able to identify soil classifications and the protective systems to use in accordance with the OSHA Excavation standard, Subpart P.
- A competent person must make ongoing daily inspections of excavations, the adjacent areas and protective systems, including after every rainfall or other hazard-producing occurrence.
- Walkways are required to cross over excavations. Walkways or bridges over excavations greater than 4 feet in depth require standard guardrails.
- Erect standard guardrail or solid sheeting no less than 42 inches above ground level around all tunnel shafts and bore pits.
- Barricade or cover all wells, pits or shafts. Back fill excavations upon completion.

### Requirements for protective systems

- When employees work in trenches more than 5-feet deep, the employer must protect them from cave-ins by an adequate protective system. In hazardous soil, employers must provide an adequate protective system in trenches under 5-feet deep.
- Determine maximum allowable slopes for soil or rock deposits in accordance with Table B-1, Appendix A of the OSHA standard.
- Have a registered professional engineer design sloping or benching for excavations greater than 20-feet deep.
- Qualified personnel will design and install piling, sheeting, shoring, shields and support systems. The shoring system will withstand all loads imposed upon it.
- Make sure material and equipment used for sheeting, sheet piling, bracing, shoring and underpinning is in good serviceable condition. Use timbers that are sound and free of defects.
- Place members of support systems in true horizontal position, spaced vertically and secured to prevent sliding, falling or kickouts.
- Progress from the bottom of the trench when removing support system members. Release jacks and supports slowly.
- Remove support systems as you backfill the trench.
- Extend trench boxes and shields to the bottom of the trench and no less than 18 inches above the vertical part of the trench face, except in certain cases.
- Do not allow employees in shields during their installation, removal or relocation.
- When portable trench boxes are stacked, provide attaching means to prevent them from separating.
- Do not work outside of trench shields or shoring protection in unprotected trenches.

#### Reference:

<u>Standard Number</u>	<u>Title</u>
OSHA 1926 Subpart P 29 CFR 1926.650	Excavations Scope, application and definitions
1926.651	Specific excavation requirements
1926.652	Requirements for protective systems

## Ergonomics in construction

The least recognized aspect of ergonomics on the construction site is the fact that ergonomics, and safety and health, is profitable. Back injuries cost an average of \$30,000 per case. The high incidence of these injuries in construction makes workers' compensation a very costly part of staying in business. The aggressive prevention of these losses makes construction a much more profitable endeavor.



Injuries and illnesses are the second largest cost in construction today. One-half of workers' compensation costs in construction are musculoskeletal disorders. The frequency rate of back injuries for construction work is more than twice that of general industry.

That means a substantial number of work-site injuries are a result of wear and tear on the body where the capabilities/limitations of the human body are exceeded or overexerted. Construction work requires and attracts workers with great strength, skill and agility. However, while muscles can adapt and even grow, the joints, tendons and ligaments cannot. Recovery for the muscles is rather quick and uncomplicated. However, you can subject the the joints and connecting tissues to permanent damage. These types of injuries too often disable and drastically shorten careers. This is a tragic result for the construction workers who rely heavily upon their hands and back to perform their task.

### Cumulative trauma disorders

Cumulative trauma is a term referring to the wear and tear on the musculoskeletal system. Cumulative means that physical stresses add up gradually over a period of time and injury results

from repeated stresses on a particular body part. Trauma means a bodily injury or insult. Disorder means a physical ailment or abnormal condition. Therefore, the term cumulative trauma disorders (CTDs). Common CTDs include carpal tunnel syndrome in the wrist, tendinitis in the wrist, elbow, shoulder and other major joints, and even many back injuries.

### Risk factors

Risk factors are an element of a job or a task that we know increase the probability of developing a CTD. The broad categories of occupational risk factors include:

- Repetitive motions;
- Awkward posture (positions);
- Forceful exertions;
- Mechanical pressures on soft tissues;
- Inadequate rest.

Other contributing factors include adverse environmental conditions, such as cold, vibration and personal characteristics. Exposure to risk factors does not always result in CTDs. It is important to note we also are exposed to such risk factors off the job. The ability to recognize and evaluate these factors on the work site is important in avoiding and controlling them.

### Ergonomics

Ergonomics is a safety science focused on preventing the overexertion and overuse of injuries that are a result of cumulative trauma to the musculoskeletal system. Ergonomics attempts to achieve this by better fitting the task to the worker rather than forcing the worker to adapt to the work. A good ergonomics program systematically identifies and controls the risk factors that we know contribute to cumulative trauma and overexertion. Ergonomics principles apply to hand tool use and selection, materials handling, workplace and workspace design, display of dials and gauges, placement of controls, handles and knobs, shift work and more.

Ergonomics has not had much influence in the construction industry to date. The arguments about changing workers, changing environment, location, workstation and other factors has kept

ergonomics out of construction for far too long. The fundamental principles of ergonomics apply to any and every work situation imaginable.

Technology that can reduce if not eliminate many risk factors on the job site is now available and advancing every day. We have the technology and the knowledge to fully use ergonomics in construction to gain the same benefits realized by general industry.

So what is the missing ingredient? A contemporary safety management process that influences the organizational culture to value safety and health. In short, a safety culture.

The introduction mentions the elements for the effective safety culture. Employment of ergonomic principles and necessary training can be optimally successful with a safety culture in place.

### **Ergonomics principles**

The most effective means of controlling CTDs is to reduce, if not completely eliminate, a worker's exposure to the known risk factors. Employers can accomplish this through engineering controls. Engineering controls attempt to design the work, work piece and/or work tool to minimize motions, postures and forces that can damage and prematurely fatigue. Administrative controls, such as reducing a worker's exposure to the risk factors, can complement engineering controls. General ergonomic principles include:

- Use stools and workbenches as work surface rather, than the ground, when possible;
- Keep frequently used tools within reach or in garment pockets;
- Adjust working heights and reaches that allow the worker to keep the elbows as close to the side of the body as possible;
- Extend reach with tool extensions, according to manufacturer's recommendations, or minimize reach distances with proper placement of work surfaces like ladders, scaffolds and platforms;
- Use jigs or fixtures to hold work pieces, parts or tools — this allows both hands to operate

the tool (more strength and control) and relieves the free hand from serving as a clamp;

- If gloves are necessary for comfort, protection or cleanliness, select the proper size, material and style.

### **Tools**

Tools are often the machine part of the man-machine interface. Pay particular attention to the design, selection, condition and proper use of manual and powered tools. Principles for hand tools and general tool use include:

- Ensure the availability and accessibility of the right tools and in working condition to do the job;
- Establish systematic preventive maintenance for all tools and equipment;
- Repair or replace defective tools;
- Bend the tool not the wrist — use ergonomically designed tools;
- Look for anti-vibration technology in air hammers and chisels;
- Use mobile equipment for material breaking or cutting rather than hand-held equipment;
- Use powered instead of manual tools or equipment when work requires high forces or repetition;
- Choose tools with the torque and speed to match the task — avoid overkill;
- Handle length should span the full width of the hand (gloved hand) or 4-inch minimum;
- Hand grips should be non-conductive, textured to avoid slip or twist, and without contour or finger grooves.

### **Materials handling**

It is important to recognize that materials handling is often one of the largest cost components of a product or operation. Unnecessary handling of materials costs time and money. More importantly, unnecessary handling exposes workers to risk factors. General principles for materials handling include:

- Storing supplies and materials between knee and shoulder height to avoid excessive reaching and bending;
- Using the lifting equipment available on-site to hold and position loads for work;

- Improving housekeeping to avoid complicating materials handling, thus making daily cleanup part of the job;
- Scheduling and laying out materials for ease of use rather than ease of delivery to reduce repetition and duration of exposure to risk factors;
- Deliberate pre-planning for materials (Just-In-Time);
- Planning deliveries, including the size of load, its position, location and timing;
- Training workers in identification of ergonomic hazards and material-handling strategies.

### General advice

Safety and health professionals recognize it is crucial to manage safety and health just like any other priority on the job site. Owners, contractors and work leaders have a responsibility to communicate expectations and enforce safe work practices. The following tips should help:

- Never overlook employee participation in problem solving;
- Back problems are not just lifting and postural problems — pay attention to slip, trip and fall hazards;
- Educate supervisors and foremen about where losses occur; painters think ladders are relatively safe, while that is the greatest injury agent for their industry;
- Noise, vibration and impact affect equilibrium; therefore, falls also are ergonomic concerns.

Owners can require construction safety planning to establish an operational philosophy. Owners need to:

- Add safety performance into bid criteria for awarding contracts;
- Develop site-specific safety plans, including job safety analysis and phased safety programs;
- Encourage safety networking with contractors and labor, including a complaint log;
- Maintain safety statistics — when a spike occurs in frequency, then a recovery plan is required;
- Push for worker training and certification in apprenticeship programs;

- Pay serious attention to proper medical management of an injury;
- Promote joint labor/management safety committee on large jobs.

### New technological trends

Many specific technological advances have been made in ergonomics for construction, but there is still no magic bullet. The key remains to build in safety and health technologies, and strategies, not add them as an afterthought. Here are recent innovations used here and abroad:

- A pogo-stick looking device ties re-bar in concrete work without bending, cutting or twisting wire;
- Machinery that lays heavy block in Sweden;
- Battery powered screwdrivers that replace manual and electric versions;
- Torque screw heads that require 40-percent less push force than Philips;
- Garments that include knee pad pockets, tool holsters, neck air cushions, integrated fall arrest harness;
- A disk attachment to handles for extension poles while working overhead to reduce grip forces;
- Eyewear with a bifocal feature on the top of the lens for overhead work;
- An extension handle for a floor-spreading trowel that improves posture and productivity;
- Auto feed screws for power drills;
- A handle extension for power drills to allow worker to stand while fastening floors;
- A block with a hand hold in the center designed to fit the hand;
- A redesign of packaging (50 versus 90 pound bags of concrete) for the convenience of the user rather than the manufacturer;
- Improved cab design for better vision, operation and comfort;
- Truck design for tool storage and accessibility versus pickup truck method;
- Vehicle seats designed to reduce whole body vibration;
- Easier erecting scaffolds with sprockets that don't weld to the frames.

## Chapter 27

### Lead

Lead is a metal found in construction materials and on a variety of job sites. Construction materials commonly containing lead include paints, alloyed metals, mortars, electric wire and its insulation, lead sheeting, solder and drywall used in medical facilities. Renovation and reparation projects also can uncover lead in piping, caulking, certain types of cable, flashings, metal coatings, paint in houses built before 1978, and certain glazing materials. Grinding and abrasive blasting can result in exposures to lead dust. Cutting and welding can result in exposure to lead fumes.

Typically, exposures to lead occur by inhalation or ingestion. However, the body can absorb organic lead vapor through the skin. Lead is stored in the body's fatty tissues. It also can attack the central nervous system and other internal organs. Lead poisoning symptoms include male impotence, irritability, muscle pain, cramps, fatigue, trouble concentrating and confusion. Clothing can become contaminated with lead dust, resulting in its spread to other parts of the job, a vehicle or your home. This increases the potential for others to be exposed.

If you believe you may be dealing with lead on the job, it is important to determine the following:

- Where is the lead located? Review job specifications and material safety data sheets if they are available.
- Is there a potential for exposure to lead due to the work process?
- Do you need to perform air sampling?
- Is there a potential for employee overexposure?
- Do you need to perform an employee exposure assessment? Will employees be exposed to lead at or above the action level at any time?

If lead is present and will be cut, burned, ground, sanded or otherwise disturbed, you will need to conduct an exposure assessment to determine airborne lead levels. Do this by conducting day-long air monitoring, which must cover a representative number of employees who may be



exposed to the highest levels of lead. Compare these results to OSHA's Action Level for lead, which is the limit at which OSHA first requires employers to take certain precautions. Continuous air monitoring is required for exposures at or over the Action Level, even if employees use respirators.

OSHA also has set a PEL, which is higher than the Action Level. The current limit for lead is 50 micrograms per cubic meter of air (50mg/m<sup>3</sup>) averaged over an eight-hour workday. Since it is an eight-hour average, it does allow for short-term exposure above the PEL as long as the average does not exceed the PEL.

If exposures exceed the PEL, the standard requires additional protective measures. If engineering or administrative controls are not feasible, employees must use respirators. In addition, the employer must include a written respiratory program explaining the proper selection, use, and procedures for cleaning, storing and maintaining respirators. Other precautions required in the standard are the use of protective clothing, laundering practices for work clothes, medical testing of employees, the availability of change rooms and shower facilities, housekeeping and filtered-air lunchrooms.

Reference:

<u>Standard Number</u>	<u>Title</u>
29 CFR 1926.62.	OSHA Lead Standard

## Silica



Construction workers' risk of developing silicosis, an occupational disease caused by exposure to silica, a naturally occurring mineral, is higher than general industry.

OSHA exposure limits established for dust containing silica vary according to the percentage of silica in the dust. Dust with high silica content will have very low allowable exposure concentrations.

The ACGIH sets a limit for a common form of crystalline silica at 0.1 milligrams per cubic meter of air.

Workers become ill by inhaling dust containing crystalline silica. Typical tasks where workers often inhale dust-containing silica include cut-

ting concrete, sandblasting and demolition work. Silica also may be contained in materials brought to a job site. Over a period of time, silica dust can accumulate in the lungs, where fibrous structures and scar tissue develop around the trapped silica particles. As this disease progresses, breathing may become difficult and in some cases results in death. There is no cure for silicosis; prevention is the only control method.

The best way to protect yourself from silica is to limit exposure. Substitute less hazardous materials for silica sand. This practice is commonly used in sandblasting operations.

Other operations use water to control dust in the air. An example of this process is the use of a water jet attached to a concrete saw. Ventilation controls, which remove silica dust before it enters the worker's breathing zone, also are effective. Because silica is so hazardous, respiratory protection is sometimes necessary in addition to engineering controls to limit exposure.

Train all employees on the hazards associated with silica. Hazardous materials taken on a job site are usually accompanied by MSDS which explain hazards associated with the material's use.

Substances such as silica, which is commonly encountered as a naturally occurring element on the job site, may not have an MSDS explaining the hazards. Free publications are available from OSHA and NIOSH; this information provides guidance for preventing silicosis in the construction industry.

## First aid and medical attention

Report all work-related injuries and illnesses, regardless of severity, immediately to management. Injured employees should receive proper, competent first aid or medical care. Each facility or job site should have at least one employee per shift who is trained to provide first aid or CPR. In the case of confined space entry, at least two employees must be trained to provide first aid and CPR in accordance with OSHA's confined space entry regulations. The administration of first aid or CPR in the first few minutes of an emergency prior to the arrival of doctors, nurses or a life squad can mean the difference between the life and death of an ill or injured employee.

Designated first-aid providers should be trained in first aid, and trained and certified in CPR. First-aid training should be appropriate for the industry and its risks, including but not limited to:

- Evaluating the safety and danger of the scene;
- Evaluating and treating the injuries and illnesses, including shock, bleeding, heart attack, choking, seizures, fractures and sprains, eye injuries, chemical and thermal burns, poisoning, chemical exposure, and handling an unconscious person.



First-aid providers appointed by management must be trained in bloodborne pathogen risks and the safety procedures necessary to avoid those risks. If these providers are exposed to bloodborne pathogens, management must offer them the Hepatitis B inoculation series and medical counseling. Advise first-aid providers acting as Good Samaritans of bloodborne pathogen risks and the necessary safety procedures.

Make provisions prior to commencement of the project for prompt medical attention in case of serious injury. Develop a medical emergency

response plan. The plan directs the company's action following an injury or illness. Specifically, it identifies:

- Emergency phone numbers;
- The address and location of the job;
- Individuals responsible for giving first aid on the job site;
- The process of referral to a local hospital, doctor or clinic;
- The location of emergency medical supplies and material safety data sheets;
- The location of safety equipment needed during a medical emergency that may include respirators, chemical splash suits, emergency lighting, safety harnesses and ropes;
- Reporting, documentation and the investigation of the incident.

Keep first-aid supplies in an accessible, convenient area, inspected on a monthly basis and replenished as necessary. It is essential that you train all employees in the accepted procedures for reporting injuries and illnesses, and for obtaining appropriate care. Prompt care can often avoid medical complications that can result from apparent minor injuries.

Proper reporting also allows for investigation of both accidents and incidents. Begin the investigation process as soon as you secure the scene and treat any injured employee. Compose investigation teams of management representatives, supervisors and employees. Investigate accidents and incidents completely to discover their true causes.

Investigation leads to the prevention of future accidents and, thus, the prevention of injury and death.

Consider accidents resulting in the serious injury or death of an employee, especially those witnessed by or involving other employees, as occasions to use outside services for critical incident stress debriefing (CISD), which may be available through the company's employee assistance program or through local agencies. CISD, or in some cases grief counseling, can be a good, tool for maintaining good mental health.