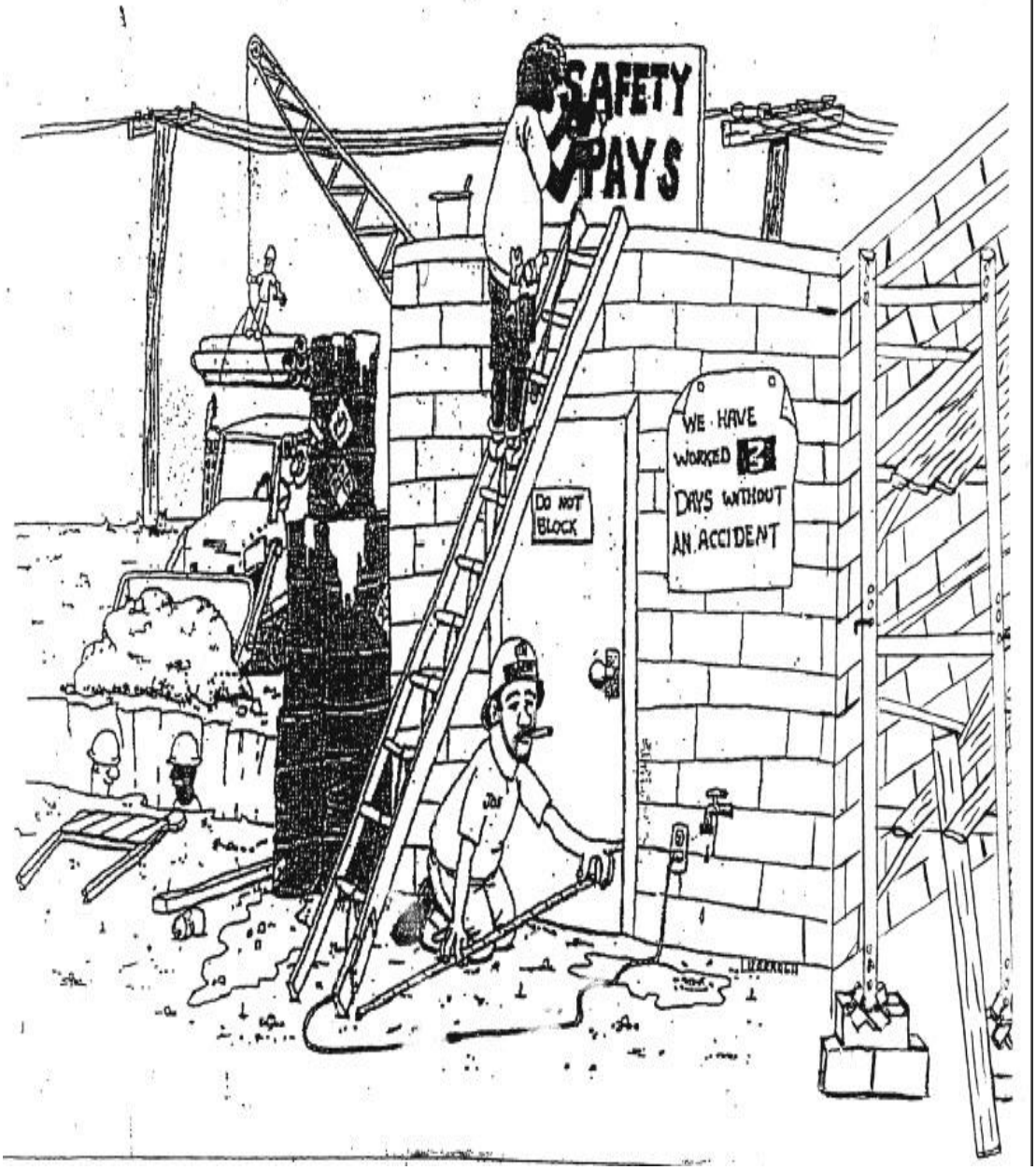
Construction Outreach Course

(29 CFR 1926)

Find 25 safety violations



Construction Outreach Course

(29 CFR 1926)

GENERAL 501 AND/OR CONSTRUCTION 500

Dr. Larry Wallace is a Safety Consultants OSHA-authorized Outreach Trainers and will come to your facility to conduct the OSHA 500-Construction (10 or 30 hour) or 501-General Industry Safety course for your group. The 10-hour class usually runs one and one-half days, while the 30-hour class is typically conducted during a span of four days.

Each one of the following topics must be covered during the 30-hour course; however we will certainly spend the majority of time focusing on those topics of most importance to your company. The agenda for the OSHA 10-hour class can be customized somewhat by selecting from the topics listed below (an asterisk denotes topics that are required to be included in the 10-hour class).

- Origins of OSHA/OSH Act*
- OSHA Standards, Inspections, Citations & Penalties*
- OSHA 300 & 301 Injury & Illness Recordkeeping*
- Walking/Working Surfaces*
- Fire Protection & Means of Egress*
- Electrical Equipment & Installations
- Hazardous Materials
- Personal Protective Equipment
- Respiratory Protection training (can include fit testing session)
- Occupational Noise & Hearing Conservation
- Permit-required Confined Spaces
- Lockout/Tagout and Try
- Material Handling (can include classroom training for Forklift operators)
- Hazard Communication
- Bloodborne Pathogens

OSH ACT, OSHA STANDARDS, INSPECTIONS, CITATIONS AND PENALTIES

Need for Legislation

More than 90 million Americans spend their days on the job. They are our most valuable national resource. Yet, until 1970, no uniform and comprehensive provisions existed for their protection against workplace safety and health hazards.

In 1970, the Congress considered annual figures such as these:

- Job related accidents accounted for more than 14,000 worker deaths
- Nearly 2½ million workers were disabled.
- Ten times as many person-days were lost from job-related disabilities as from strikes.
- Estimated new cases of occupational diseases totaled 300,000.

In terms of lost production and wages, medical expenses and disability compensation, the burden on the nation's commerce was staggering. Human cost was beyond calculation. Therefore, the Occupational Safety and Health Act of 1970 (the Act) was passed by a bipartisan Congress "...to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources."

OSHA's Purpose

Under the Act, the Occupational Safety and Health Administration (OSHA) was created within the Department of Labor to:

- Encourage employers and employees to reduce workplace hazards and to implement new or improve existing safety and health programs;
- Provide for research in occupational safety and health to develop innovative ways of dealing with occupational safety and health problems;
- Establish "separate but dependent responsibilities and rights" for employers and employees for the achievement of better safety and health conditions.
- Maintain a reporting and recordkeeping system to monitor job-related injuries and illnesses;
- Establish training programs to increase the number and competence of occupational safety and health personnel;
- Develop mandatory job safety and health standards and enforce them effectively; and
- Provide for the development, analysis, evaluation and approval of state occupational safety and health programs.

While OSHA continually reviews and redefines specific standards and practices, its basic purposes remain constant. OSHA strives to implement its mandate fully and firmly with fairness to all concerned. In all its procedures, from standards development through implementation and enforcement, OSHA guarantees employers and employees the right to be fully informed, to participate actively and to appeal actions.

The Act's Coverage

In general, coverage of the Act extends to all employers and their employees in the 50 states, the District of Columbia, Puerto Rico, and all other territories under Federal Government jurisdiction. Coverage is provided either directly by federal OSHA or through an OSHA-approved state program (see section on OSHA-Approved State Programs).

As defined by the Act, an employer is any "person engaged in a business affecting commerce who has employees, but does not include the United States or any State or political subdivision of a State." Therefore, the Act applies to employers and employees in such varied fields as manufacturing, construction, long shoring, agriculture, law and medicine, charity and disaster relief, organized labor and private education. Such coverage includes religious groups to the extent that they employ workers for secular purposes.

The following are not covered under the Act:

- Self-employed persons;
- Farms at which only immediate members of the farm employer's family are employed; and
- Working conditions regulated by other federal agencies under other federal statutes.

But even when another federal agency is authorized to regulate safety and health working conditions in a particular industry, if it does not do so in specific areas, then OSHA standards apply.

As OSHA develops effective safety and health standards of its own, standards issued under the following laws administered by the Department of Labor are superseded: the Walsh-Healey Act, the Service Contract Act, the Construction Safety Act, the Arts and Humanities Act and the Longshoremen's and Harbor Workers' Compensation Act.

Provisions for Federal Employees

Under the Act, federal agency heads are responsible for providing safe and healthful working conditions for their employees. The Act requires agencies to comply with standards consistent with those OSHA issues for private sector employers. OSHA conducts federal workplace inspections in response to employees' reports of hazards and as part of a special program which identifies federal workplaces with higher than average rates of injuries and illnesses.

Federal agency heads are required to operate comprehensive occupational safety and health programs that include: recording and analyzing injury/illness data, providing training to all personnel, and conducting self-inspections to ensure compliance with OSHA standards. OSHA conducts comprehensive evaluations of these programs to assess their effectiveness.

OSHA's federal sector authority is different from that in the private sector in several ways. The most significant difference is that OSHA cannot propose monetary penalties against another federal agency for failure to comply with OSHA standards. Instead, compliance issues unresolved at the local level are raised to higher organizational levels until resolved. Another significant difference is that OSHA does not have authority to protect federal employee "whistleblowers." However, the Whistleblower Protection Act of 1989 affords present and former federal employees (other than those in the U.S. Postal Service and certain intelligence agencies) an opportunity to file their reports of reprisal with the Office of Special Counsel, U.S. Merit Systems Protection Board.

Provisions for State and Local Governments

OSHA provisions do not apply to state and local governments in their role as employers. The Act does provide that any state desiring to gain OSHA approval for its private sector occupational safety and health program (see section on State Plans) must provide a program that covers its state and local government workers and that is at least as effective as its program for private employees. State plans may also cover only public sector employees.

STANDARDS

In carrying out its duties, OSHA is responsible for promulgating legally enforceable standards. OSHA standards may require conditions, or the adoption or use of one or more practices, means, methods or processes reasonably necessary and appropriate to protect workers on the job. It is the responsibility of employers to become familiar with standards applicable to their establishments and to ensure that employees have and use personal protective equipment when required for safety.

Employees must comply with all rules and regulations which are applicable to their own actions and conduct.

Where OSHA has not promulgated specific standards, employers are responsible for following the Act's general duty clause.

The general duty clause of the Act states that each employer "shall furnish ... a place of employment which is free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees."

States with OSHA-approved occupational safety and health programs must set standards that are at least as effective as the federal standards. Many state plan states adopt standards identical to the federal.

Where to Get Copies of Standards

OSHA standards fall into four major categories—General Industry, Maritime, Construction and Agriculture.

The Federal Register is one of the best sources of information on standards, since all OSHA standards are published there when adopted, as are all amendments, corrections, insertions or deletions. The Federal Register is available in many public libraries. Annual subscriptions are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. For the current price contact GPO.

Each year, the Office of Federal Register publishes all current regulations and standards in the Code of Federal Regulations (CFR), available at many libraries and from the Government Printing Office. OSHA's regulations are collected in Title 29 of the CFR, Part 1900-1999.

To assist the public in keeping current with OSHA standards, "OSHA Regulations, Documents & Technical Information on CD-ROM" was developed. The CD-ROM contains electronic copy of the text of all OSHA regulations (standards), selected documents, and technical information from the OSHA Computerized Information System (OCIS). Only the Federal Register can be used as the official source for OSHA regulations. The intent of the OSHA CD-ROM is to facilitate access to the regulations and other information produced by OSHA.

Some of the information on the CD-ROM includes:

- OSHA Regulations (Standards)
- OSH Act
- Standards Interpretations
- Federal Register Index
- Text and Preamble of Recent OSHA Standards

- Fact Sheets
- Directives
- Field Operations Manual
- OSHA Technical Manual
- Chemical Sampling Information
- Blood Lead Laboratories
- Consultants (Expert Witness)
- Library Catalog
- Variances

The OSHA CD-ROM is available from the Superintendent of Documents and is not available from OSHA or from the Department of Labor. Current prices for yearly subscriptions, which include quarterly updates, can be obtained from GPO.

Since states adopt and enforce their own standards under state law, copies of state standards may be obtained from the individual states.

Standards Development

OSHA can begin standards-setting procedures on its own initiative, or in response to petitions from other parties, including the Secretary of Health and Human Services (HHS); the National Institute for Occupational Safety and Health (NIOSH); U.S. Environmental Protection Agency (EPA); state and local governments; any nationally-recognized standards-producing organization; employer or labor representatives; or any other interested person.

Advisory Committees

If OSHA determines that a specific standard is needed, any of several advisory committees may be called upon to develop specific recommendations. There are two standing committees, and ad hoc committees may be appointed to examine special areas of concern to OSHA. All advisory committees, standing or ad hoc, must have members representing management, labor and state agencies, as well as one or more designees of the Secretary of HHS. The occupational safety and health professions and the general public also may be represented. The two standing advisory committees are:

- National Advisory Committee on Occupational Safety and Health (NACOSH), which advises, consults with, and makes recommendations to the Secretary of HHS and to the Secretary of Labor on matters regarding administration of the Act.
- Advisory Committee on Construction Safety and Health, which advises the Secretary of Labor on formulation of construction safety and health standards and other regulations.

NIOSH Recommendations

Recommendations for standards also may come from NIOSH, established by the Act as an agency of the Department of HHS.

NIOSH conducts research on various safety and health problems, provides technical assistance to OSHA and recommends standards for OSHA's adoption. While conducting its research, NIOSH may make workplace investigations, gather testimony from employers and employees and require that employers measure and report employee exposure to potentially hazardous materials. NIOSH also may require employers to provide medical examinations and tests to determine the incidence of occupational illness among employees. When such examinations and tests are required by NIOSH for research purposes, they may be paid for by NIOSH rather than the employer.

Standards Adoption

Once OSHA has developed plans to propose, amend or revoke a standard, it publishes these intentions in the Federal Register as a "Notice of Proposed Rulemaking," or often as an earlier "Advance Notice of Proposed Rulemaking."

An "Advance Notice" or a "Request for Information" is used, when necessary, to solicit information that can be used in drafting a proposal. The Notice of Proposed Rulemaking will include the terms of the new rule and provide a specific time (at least 30 days from the date of publication, usually 60 days or more) for the public to respond.

Interested parties who submit written arguments and pertinent evidence may request a public hearing on the proposal when none has been announced in the notice. When such a hearing is requested, OSHA will schedule one, and will publish, in advance, the time and place for it in the Federal Register.

After the close of the comment period and public hearing, if one is held, OSHA must publish in the Federal Register the full, final text of any standard amended or adopted and the date it becomes effective, along with an explanation of the standard and the reasons for implementing it. OSHA may also publish a determination that no standard or amendment needs to be issued.

Emergency Temporary Standards

Under certain limited conditions, OSHA is authorized to set emergency temporary standards that take effect immediately. First, OSHA must determine that workers are in grave danger due to exposure to toxic substances or agents determined to be toxic or physically harmful or to new hazards and that an emergency standard is needed to protect them. Then, OSHA publishes the emergency temporary standard in the Federal Register, where it also serves as a proposed permanent standard. It is then subject to the usual procedure for adopting a permanent standard except that a final ruling must be made within six months. The validity of an emergency temporary standard may be challenged in an appropriate U.S. Court of Appeals.

Appealing a Standard

No decision on a permanent standard is ever reached without due consideration of the arguments and data received from the public in written submissions and at hearings. Any person who may be adversely affected by a final or emergency standard, however, may file a petition (within 60 days of the rule's promulgation) for judicial review of the standard with the U.S. Court of Appeals for the circuit in which the objector lives or has his or her principal place of business. Filing an appeals petition, however, will not delay the enforcement of a standard, unless the Court of Appeals specifically orders it.

Variances

Employers may ask OSHA for a variance from a standard or regulation if they cannot fully comply by the effective date, due to shortages of materials, equipment or professional or technical personnel, or can prove their facilities or methods of operation provide employee protection "at least as effective" as that required by OSHA.

Employers located in states with their own occupational safety and health programs should apply to the state for a variance. If however, an employer operates facilities in states under federal OSHA jurisdiction and also in state plan states, the employer may apply directly to federal OSHA for a single variance applicable to all the establishments in question. OSHA will then work with the state plan states involved to determine if a variance can be granted which will satisfy state as well as federal OSHA requirements.

Temporary Variance

A temporary variance may be granted to an employer who cannot comply with a standard or regulation by its effective date due to unavailability of professional or technical personnel, materials or equipment, or because the necessary construction or alteration of facilities cannot be completed in time.

Employers must demonstrate to OSHA that they are taking all available steps to safeguard employees in the meantime, and that the employer has put in force an effective program for coming into compliance with the standard or regulation as quickly as possible.

A temporary variance may be granted for the period needed to achieve compliance or for one year, whichever is shorter. It is renewable twice, each time for six months. An application for a temporary variance must identify the standard or portion of a standard from which the variance is requested and the reasons why the employer cannot comply with the standard. The employer must document those measures already taken and to be taken (including dates) to comply with the standard.

The employer must certify that workers have been informed of the variance application, that a copy has been given to the employees' authorized representative, and that a summary of the application has been posted wherever notices are normally posted. Employees also must be informed that they have the right to request a hearing on the application.

The temporary variance will not be granted to an employer who simply cannot afford to pay for the necessary alterations, equipment, or personnel.

Permanent Variance

A permanent variance (alternative to a particular requirement or standard) may be granted to employers who prove their conditions, practices, means, methods, operations, or processes provide a safe and healthful workplace as effectively as would compliance with the standard.

In making a determination, OSHA weighs the employer's evidence and arranges a variance inspection and hearing where appropriate. If OSHA finds the request valid, it prescribes a permanent variance detailing the employer's specific exceptions and responsibilities under the ruling.

When applying for a permanent variance, the employer must inform employees of the application and of their right to request a hearing. Anytime after six months from the issuance of a permanent variance, the employer or employees may petition OSHA to modify or revoke it. OSHA also may do this of its own accord.

Interim Order

So that employers may continue to operate under existing conditions until a variance decision is made, they may apply to OSHA for an interim order. Application for an interim order may be made either at the same time as, or after, application for a variance. Reasons why the order should be granted may be included in the interim order application.

If OSHA denies the request, the employer is notified of the reason for denial.

If the interim order is granted, the employer and other concerned parties are informed of the order, and the terms of the order are published in the Federal Register. The employer must inform employees of the order by giving a copy to the authorized employee representative and by posting a copy wherever notices are normally posted.

Experimental Variance

If an employer is participating in an experiment to demonstrate or validate new job safety and health techniques, and that experiment has been approved by either the Secretary of Labor or the Secretary of HHS, a variance may be granted to permit the experiment.

Other

In addition to temporary, permanent, and experimental variances, the Secretary of Labor also may find certain variances justified when the national defense is impaired. For further information and assistance in applying for a variance, contact the nearest OSHA office.

Variances are not retroactive. An employer who has been cited for a standards violation may not seek relief from that citation by applying for a variance. The fact that a citation is outstanding, however, does not prevent an employer from filing a variance application.

Public Petitions

OSHA continually reviews its standards to keep pace with developing and changing industrial technology. Therefore, employers and employees should be aware that, just as they may petition OSHA for the development of standards, they may also petition OSHA for modification or revocation of standards.

Recordkeeping and Reporting

Before the Act became effective, no centralized and systematic method existed for monitoring occupational safety and health problems. Statistics on job injuries and illnesses were collected by some states and by some private organizations; national figures were based on not-altogether-reliable projections. With OSHA came the first basis for consistent, nationwide procedures—a vital requirement for gauging problems and solving them.

Employers of 11 or more employees must maintain records of occupational injuries and illnesses as they occur. The purposes of keeping records are to permit survey material to be compiled, to help define high hazard industries, and to inform employees of the status of their employer's record. Employers in state plan states are required to keep the same records as employers in other states.

OSHA recordkeeping is not required for certain retail trades and some service industries. Exempt employers, like nonexempt employers, must comply with OSHA standards, display the OSHA poster, and report to OSHA within 8 hours any accident that results in one or more fatalities or the hospitalization of three or more employees.

If an on-the-job accident occurs that results in the death of an employee or in the hospitalization of three or more employees, all employers, regardless of the number of employees, must report the accident, in detail, to the nearest OSHA office within 8 hours. In states with approved plans, employers report such accidents to the state agency responsible for safety and health programs.

Injury and Illness Records

Recordkeeping forms are maintained on a calendar year basis. They are not sent to OSHA or any other agency. They must be maintained for five years at the establishment and must be available for inspection by representatives of OSHA, HHS, or the designated state agency.

Many specific OSHA standards have additional recordkeeping and reporting requirements. (See section on Recordkeeping for additional information.)

KEEPING EMPLOYEES INFORMED

Employers are responsible for keeping employees informed about OSHA and about the various safety and health matters with which they are involved.

Federal OSHA and states with their own occupational safety and health programs require that each employer post certain materials at a prominent location in the workplace. These include:

- Job Safety and Health Protection workplace poster (OSHA 2203 or state equivalent) informing employees of their rights and responsibilities under the Act. Besides displaying the workplace poster, the employer must make available to employees, upon request, copies of the Act and copies of relevant OSHA rules and regulations. Any official edition of the poster is acceptable.
- Summaries of petitions for variances from standards or recordkeeping procedures.
- Copies of all OSHA citations for violations of standards. These must remain posted at or near the location of alleged violations for three days, or until the violations are corrected, whichever is longer.
- Log and Summary of Occupational Injuries and Illnesses (OSHA No. 200). The summary page of the log must be posted no later than February 1, and must remain in place until March 1.

All employees have the right to examine any records kept by their employers regarding their exposure to hazardous materials, or the results of medical surveillance.

Occasionally, OSHA standards or NIOSH research activities will require an employer to measure and record employee exposure to potentially harmful substances. Employees have the right (in person or through their authorized representative) to be present during the measuring as well as to examine records of the results.

Under these substance-specific requirements, each employee or former employee has the right to see his or her examination records, and must be told by the employer if exposure has exceeded the levels set by standards. The employee must also be told what corrective measures are being taken.

In addition to having access to records, employees in manufacturing facilities must be provided information about all of the hazardous chemicals in their work areas. Employers are to provide this information by means of labels on containers, material safety data sheets, and training programs.

WORKPLACE INSPECTIONS

Authority to Inspect

To enforce its standards, OSHA is authorized under the Act to conduct workplace inspections. Every establishment covered by the Act is subject to inspection by OSHA compliance safety and health officers, who are chosen for their knowledge and experience in the occupational safety and health field. Compliance officers are vigorously trained in OSHA standards and in recognition of safety and health hazards. Similarly, states with their own occupational safety and health programs conduct inspections using qualified compliance safety and health officers.

Under the Act, "upon presenting appropriate credentials to the owner, operator or agent in charge," an OSHA compliance officer is authorized to:

- "Enter without delay and at reasonable times any factory, plant, establishment, construction site or other areas, workplace, or environment where work is performed by an employee of an employer; and to
- "Inspect and investigate during regular working hours, and at other reasonable times, and within reasonable limits and in a reasonable manner, any such place of employment and all pertinent conditions, structures, machines, apparatus, devices, equipment and materials therein, and to question privately any such employer, owner, operator, agent or employee."

Inspections are conducted without advance notice. There are, however, special circumstances under which OSHA may indeed give notice to the employer, but even then, such a notice will be less than 24 hours. These special circumstances include:

- Imminent danger situations which require correction as soon as possible;
- Inspections that must take place after regular business hours, or that require special preparation;
- Cases where notice is required to ensure that the employer and employee representative or other personnel will be present; and/or
- Situations in which the OSHA area director determines that advance notice would produce a more thorough or effective inspection.

Employers receiving advance notice of an inspection must inform their employees' representative or arrange for OSHA to do so.

If an employer refuses to admit an OSHA compliance officer, or if an employer attempts to interfere with the inspection, the Act permits appropriate legal action.

Based on a 1978 Supreme Court ruling (Marshall v. Barlow's, Inc.), OSHA may not conduct warrantless inspections without an employer's consent. It may however, inspect after acquiring a judicially authorized search warrant based upon administrative probable cause or upon evidence of a violation.

Inspection Priorities

Obviously, not all 6 million workplaces covered by the Act can be inspected immediately. The worst situations need attention first. Therefore, OSHA has established a system of inspection priorities.

Imminent Danger

Imminent danger situations are given top priority. An imminent danger is any condition where there is reasonable certainty that a danger exists that can be expected to cause death or serious physical harm immediately, or before the danger can be eliminated through normal enforcement procedures.

Serious physical harm is any type of harm that could cause permanent or prolonged damage to the body or which, while not damaging the body on a prolonged basis, could cause such temporary disability as to require in-patient hospital treatment. OSHA considers that "permanent or prolonged damage" has occurred when, for example, a part of the body is crushed or severed; an arm, leg or finger is amputated; or sight in one or both eyes is lost. This kind of damage also includes that which renders a part of the body either functionally useless or substantially reduced in efficiency on or off the job. An example: bones in a limb shattered so severely that mobility or dexterity will be permanently reduced.

Temporary disability requiring in-patient hospital treatment includes injuries such as simple fractures, concussions, burns, or wounds involving substantial loss of blood and requiring extensive suturing or other healing aids.

Injuries or illnesses that are difficult to observe are classified as serious if they inhibit a person in performing normal functions, cause reduction in physical or mental efficiency or shorten life.

Health hazards may constitute imminent danger situations when they present a serious and immediate threat to life or health. For a health hazard to be considered an imminent danger, there must be a reasonable expectation (1) that toxic substances such as dangerous fumes, dusts or gases are present, and (2) that exposure to them will cause immediate and irreversible harm to such a degree as to shorten life or cause reduction in physical or mental efficiency, even though the resulting harm is not immediately apparent.

Employees should inform the supervisor or employer immediately if they detect or even suspect an imminent danger situation in the workplace. If the employer takes no action to eliminate the danger, an employee or the authorized employee representative may notify the nearest OSHA office and request an inspection. The request should identify the workplace location, detail the hazard or condition and include the employee's name, address and telephone number. Although the employer has the right to see a copy of the complaint if an inspection results, the name of the employee will be withheld if the employee so requests.

The OSHA area director reviews the information and immediately determines whether there is a reasonable basis for the allegation. If it is decided the case has merit, the area director will assign a compliance officer to conduct an immediate inspection of the workplace.

Upon inspection, if an imminent danger situation is found, the compliance officer will ask the employer to voluntarily abate the hazard and to remove endangered employees from exposure. Should the employer fail to do this, OSHA, through the regional solicitor, may apply to the nearest Federal District Court for appropriate legal action to correct the situation. Before the OSHA inspector leaves the workplace, he or she will advise all affected employees of the hazard and post an imminent danger notice. Judicial action can produce a temporary restraining order (immediate shutdown) of the operation or section of the workplace where the imminent danger exists. Should OSHA "arbitrarily or capriciously" decline to bring court action, the affected employees may sue the Secretary of Labor to compel the Secretary to do so.

Walking off the job because of potentially unsafe workplace conditions is not ordinarily an employee right. To do so may result in disciplinary action by the employer. However, an employee does have the right to refuse (in good faith) to be exposed to an imminent danger. OSHA rules protect employees from discrimination if:

- Where possible, he or she asked the employer to eliminate the danger, and the employer failed to do so; and
- The danger is so imminent that there is not sufficient time to have the danger eliminated through normal enforcement procedures; and

- The danger facing the employee is so grave that "a reasonable person" in the same situation would conclude there is a real danger of death or serious physical harm; and
- The employee has no reasonable alternative to refusing to work under these conditions (e.g., asking for reassignment to another area).

Catastrophes and Fatal Accidents

Second priority is given to investigation of fatalities and catastrophes resulting in hospitalization of three or more employees. Such situations must be reported to OSHA by the employer within 8 hours. Investigations are made to determine if OSHA standards were violated and to avoid recurrence of similar accidents.

Employee Complaints

Third priority is given to employee complaints of alleged violation of standards or of unsafe or unhealthful working conditions. (Also included in this category are serious referrals of unsafe or unhealthful working conditions from other sources, such as local or state agencies or departments.)

The Act gives each employee the right to request an OSHA inspection when the employee feels he or she is in imminent danger from a hazard or when he or she feels that there is a violation of an OSHA standard that threatens physical harm. OSHA will maintain confidentiality if requested, will inform the employee of any action it takes regarding the complaint and, if requested, will hold an informal review of any decision not to inspect. Just as in situations of imminent danger, the employee's name will be withheld from the employer, if the employee so requests.

Programmed High-Hazard Inspections

Next in priority are programmed, or planned, inspections aimed at specific high-hazard industries, occupations or health substances. Industries are selected for inspection on the basis of factors such as the death, injury and illness incidence rates, and employee exposure to toxic substances. Special emphasis may be regional or national in scope, depending on the distribution of the workplaces involved. States with their own occupational safety and health programs may use somewhat different systems to identify high-hazard industries for inspection.

Follow-up Inspections

A follow-up inspection determines whether previously cited violations have been corrected. If an employer has failed to abate a violation, the compliance officer informs the employer that he/she is subject to "Notification of Failure to Abate" alleged violations and may face additional proposed daily penalties while such failure or violations continues.

Inspection Process

Prior to inspection, the compliance officer becomes familiar with as many relevant facts as possible about the workplace, taking into account such things as the history of the establishment, the nature of the business and the particular standards likely to apply. Preparing for the inspection also involves selecting appropriate equipment for detecting and measuring fumes, gases, toxic substances, noise, etc.

Inspector's Credentials

An inspection begins when the OSHA compliance officer arrives at the establishment. He or she displays official credentials and asks to meet an appropriate employer representative. Employers should always insist upon seeing the compliance officer's credentials.

An OSHA compliance officer carries U.S. Department of Labor credentials bearing his or her photograph and a serial number than can be verified by phoning the nearest OSHA office. Anyone who tries to collect a penalty at the time of inspection, or promotes the sale of a product or service at any time, is not an OSHA compliance officer. Posing as a compliance officer is a violation of law; suspected impostors should be promptly reported to local law enforcement agencies.

Opening Conference

In the opening conference, the compliance officer (CSHO) explains why the establishment was selected. The CSHO also will ascertain whether an OSHA-funded consultation program is in progress or whether the facility is pursuing or has received an inspection exemption; if so, the inspection (if programmed) is usually terminated.

The compliance officer then explains the purpose of the visit, the scope of the inspection, and the standards that apply. The employer will be given a copy of any employee complaint that may be involved. If the employee has so requested, his or her name will not be revealed.

The employer is asked to select an employer representative to accompany the compliance officer during the inspection.

An authorized employee representative also is given the opportunity to attend the opening conference and to accompany the compliance officer during inspection. If the employees are represented by a recognized bargaining representative, the union ordinarily will designate the employee representative to accompany the compliance officer. Similarly, if there is a plant safety committee, the employee members of the committee will designate the employee representative (in the absence of a recognized bargaining representative). Where neither employee group exists, the employee representative may be selected by the employees themselves, or the compliance officer will determine if any employee suitably represents the interest of other employees. Under no circumstances may the employer select the employee representative for the walk around.

The Act does not require that there be an employee representative for each inspection. Where there is no authorized employee representative, however, the compliance officer must consult with a reasonable number of employees concerning safety and health matters in the workplace; such consultations may be held privately.

Inspection Tour

After the opening conference, the compliance officer and accompanying representatives proceed through the establishment, inspecting work areas for compliance with OSHA standards.

The route and duration of the inspection are determined by the compliance officer. While talking with employees, the compliance officer makes every effort to minimize any work interruptions. The compliance officer observes conditions, consults with employees, may take photos (for record purposes), takes instrument readings and examines records.

Trade secrets observed by the compliance officer must and will be kept confidential. An inspector who releases confidential information without authorization is subject to a $1,000 fine and/or one year in jail. The employer may require that the employee representative have a security clearance for any area in question.

Employees are consulted during the inspection tour. The compliance officer may stop and question workers in private about safety and health conditions and practices in their workplaces. Each employee is protected under the Act from discrimination for exercising safety and health rights.

Posting and recordkeeping are checked. The compliance officer will inspect records of deaths, injuries and illnesses which the employer is required to keep. He or she will check to see that a copy of the totals from the last page of OSHA No. 200 has been posted and that the OSHA workplace poster (OSHA 2203) is prominently displayed. Where records of employee exposure to toxic substances and harmful physical agents have been required, they also are examined.

The evaluation of the employer's safety and health program is an integral part of any OSHA inspection. Examples of safety and health programs can be found in the "Safety and Health Program Management Guidelines" published January 26, 1989 in the Federal Register (54 FR 3904), in the ANSI A10.33 Safety and Health Program Requirements for Multi-Employer Projects, and in Owner and Contractor Association model programs that meet the 29 CFR 1926 Subpart C standards.

Any evaluation of an employer's general safety and health program must also cover the evaluation of programs related to specific OSHA standards or to recognized hazards cited under the General Duty Clause. Depending on the type of industry and the operations involved, these may include: emergency action plan, fire prevention plan, emergency response plan, lockout/tagout program, respirator program, confined space entry program, hazard communication program, etc.

During the course of the inspection, the CSHO will point out to the employer any unsafe or unhealthful working conditions observed. At the same time, the CSHO will discuss possible corrective action if the employer so desires. An inspection tour may cover part or all of an establishment, even if the inspection resulted from a specific complaint, fatality or catastrophe.

Some apparent violations detected by the compliance officer can be corrected immediately. Even though corrected, however, the apparent violations may still serve as the basis for a citation and/or notice of proposed penalty. (For cases where imminent danger situations are detected, see p. 19).

Closing Conference

After the inspection tour, a closing conference is held between the compliance officer and the employer or the employer representative. It is a time for free discussion of problems and needs; a time for frank questions and answers.

The compliance officer discusses with the employer all unsafe or unhealthful conditions observed on the inspection and indicates all apparent violations for which a citation may be issued or recommended. The employer is told of appeal rights. The compliance officer does not indicate any proposed penalties. Only the OSHA area director has that authority, and only after having received a full report.

During the closing conference, the employer may wish to produce records to show compliance efforts and to provide information which can help OSHA determine how much time may be needed to abate an alleged violation. When appropriate, more than one closing conference may be held. This is usually necessary when health hazards are being evaluated or when laboratory reports are required.

A closing discussion will be held with the employees, or their representative if requested, to discuss matters of direct interest to employees. The employees' representative may be present at the closing conference. The CSHO explains that OSHA area offices are full-service resource centers that provide a number of services such as: guest speakers, handout packages of materials that can be distributed to interested persons, the availability of training and technical materials on safety and health matters, and many other services.

Citations Issued by the Area Director

After the compliance officer reports findings, the area director determines what citations, if any will be issued, and what penalties, if any, will be proposed.

Citations inform the employer and employees of the regulations and standards alleged to have been violated and of the proposed length of time set for their abatement. The employer will receive citations and notices of proposed penalties by certified mail. The employer must post a copy of each citation at or near the place a violation occurred, for three days or until the violation is abated, whichever is longer.

Penalties

These are the types of violations that may be cited and the penalties that may be proposed:

- ***Other Than Serious Violation***—A violation that has a direct relationship to job safety and health, but probably would not cause death or serious physical harm. A proposed penalty of up to $7,000 for each violation is discretionary. A penalty for an other-than-serious violation may be adjusted downward by as much as 95 percent, depending on the employer's good faith (demonstrated efforts to comply with the Act), history of previous violations, and size of business. When the adjusted penalty amounts to less than $100, no penalty is proposed.
- ***Serious Violation***—A violation where there is substantial probability that death or serious physical harm could result and that the employer knew, or should have known, of the hazard. A mandatory penalty of up to $7,000 for each violation is proposed. A penalty for a serious violation may be adjusted downward, based on the employer's good faith, history of previous violations, the gravity of the alleged violation, and size of business.
- ***Willful Violation***—A violation that the employer knowingly commits or commits with plain indifference to the law. The employer either knows that what he or she is doing constitutes a violation, or is aware that a hazardous condition existed and made no reasonable effort to eliminate it. Penalties of up to $70,000 may be proposed for each willful violation, with a minimum penalty of $5,000 for each violation. A proposed penalty for a willful violation may be adjusted downward, depending on the size of the business and its history of previous violations. Usually, no credit is given for good faith. If an employer is convicted of a willful violation of a standard that has resulted in the death of an employee, the offense is punishable by a court-imposed fine or by imprisonment for up to six months, or both. A fine of up to $250,000 for an individual, or $500,000 for a corporation, may be imposed for a criminal conviction.
- ***Repeated Violation*** – A violation of any standard, regulation, rule, or order where, upon re-inspection, a substantially similar violation can bring a fine of up to $70,000 for each such violation. To be the basis of a repeated citation, the original citation must be final; a citation under contest may not serve as the basis for a subsequent repeated citation.
- ***Failure to Abate Prior Violation*** – Failure to abate a prior violation may bring a civil penalty of up to $7,000 for each day the violation continues beyond the prescribed abatement date.
- ***De Minimis Violation*** – De minimis violations are violations of standards which have no direct or immediate relationship to safety or health. Whenever de minimis conditions are found during an inspection, they are documented in the same way as any other violation, but are not included on the citation.

Additional violations for which citations and proposed penalties may be issued upon conviction:

- Falsifying records, reports or applications can bring a fine of $10,000 or up to six months in jail, or both.
- Violations of posting requirements can bring a civil penalty of up to $7,000.
- Assaulting a compliance officer, or otherwise resisting, opposing, intimidating, or interfering with a compliance officer while they are engaged in the performance of their duties is a criminal offense, subject to a fine of not more than $5,000 and imprisonment for not more than three years.

Citation and penalty procedures may differ somewhat in states with their own occupational safety and health programs.

Appeals Process

Appeals by Employees

If an inspection was initiated due to an employee complaint, the employee or authorized employee representative may request an informal review of any decision not to issue a citation.

Employees may not contest citations, amendments to citations, penalties or lack of penalties. The may contest the time in the citation for abatement of a hazardous condition. They also may contest an employer's Petition for Modification of Abatement (PMA) which requests an extension of the abatement period. Employees must contest the PMA within 10 working days of its posting or within 10 working days after an authorized employee representative has received a copy. Within 15 working days of the employer's receipt of the citation, the employee may submit a written objection to OSHA. The OSHA area director forwards the objection to the Occupational Safety and Health Review Commission, which operates independently of OSHA.

Employees may request an informal conference with OSHA to discuss any issues raised by an inspection, citation, notice of proposed penalty or employer's notice of intention to contest.

Appeals by Employers

When issued a citation or notice of a proposed penalty, an employer may request an informal meeting with OSHA's area director to discuss the case. Employee representatives may be invited to attend the meeting. The area director is authorized to enter into settlement agreements that revise citations and penalties to avoid prolonged legal disputes.

Petition for Modification of Abatement

Upon receiving a citation, the employer must correct the cited hazard by the prescribed date unless he or she contests the citation or abatement date. Factors beyond the employer's reasonable control may prevent the completion of corrections by that date.

The written petition should specify all steps taken to achieve compliance, the additional time needed to achieve complete compliance, the reasons such additional time is needed, all temporary steps being taken to safeguard employees against the cited hazard during the intervening period, that a copy of the PMA was posted in a conspicuous place at or near each place where a violation occurred, and that the employee representative (if there is one) received a copy of the petition.

Notice of Contest

If the employer decides to contest either the citation, the time set for abatement, or the proposed penalty, he or she has 15 working days from the time the citation and proposed penalty are received in which to notify the OSHA area director in writing. An orally expressed disagreement will not suffice. This written notification is called a "Notice of Contest."

There is no specific format for the Notice of Contest; however it must clearly identify the employer's basis for filing the citation, notice of proposed penalty, abatement period, or notification of failure to correct violations.

A copy of the Notice of Contest must be given to the employees' authorized representative. If any affected employees are not represented by a recognized bargaining agent, a copy of the notice must be posted in a prominent location in the workplace, or else served personally upon each unrepresented employee.

Review Procedure

If the written Notice of Contest has been filed within the required 15 working days, the OSHA area director forwards the case to the Occupational Safety and Health Review Commission (OSHRC). The Commission is an independent agency not associated with OSHA or the Department of Labor. The Commission assigns the case to an administrative law judge.

The judge may disallow the contest if it is found to be legally invalid, or a hearing may be scheduled for a public place near the employer's workplace. The employer and the employees have the right to participate in the hearing; the OSHRC does not require that they be represented by attorneys.

Once the administrative law judge has ruled, any party to the case may request a further review by OSHRC. Any of the three OSHRC commissioners also may, at his or her own motion, bring a case before the Commission for review. Commission rulings may be appealed to the appropriate U.S. Court of Appeals.

Appeals In State Plan States

States with their own occupational safety and health programs have a state system for review and appeal of citations, penalties, and abatement periods. The procedures are generally similar to federal OSHA's , but cases are heard by a state review board or equivalent authority.

The Act encourages states to develop and operate, under OSHA guidance, state job safety and health plans.

Once a state plan is approved, OSHA funds up to 50 percent of the program's operating costs. State plans are required to provide standards and enforcement programs, as well as voluntary compliance activities which are at least as effective as the federal program. State plans developed for the private sector also must, to the extent permitted by state law, provide coverage for state and local government employees. OSHA rules also permit states to develop plans limited in coverage to public sector (state and local government) employees only; in such cases, private sector employment remains under federal jurisdiction.

To gain OSHA approval as a developmental plan, a state must have adequate legislative authority and must demonstrate that within three years it will provide standards-setting, enforcement and appeals procedures; public employee protection; a sufficient number of competent enforcement personnel; and training, education and technical assistance programs. If, at any time during this period or later, it appears that the state is capable of enforcing standards in accordance with the above requirements, OSHA may enter into an "operational status agreement" with the state. OSHA generally limits its enforcement activity to areas not covered by the state in the agreement and suspends all concurrent federal enforcement. Scheduled accident and complaint inspections are generally the primary responsibility of the state. OSHA closely monitors state programs.

When all developmental steps concerning resources, procedures, and other requirements have been completed and approved, OSHA then certifies that a state has the legal, administrative, and enforcement means necessary to operate effectively. This action renders no judgment on how well or poorly a state is actually operating its program but merely attests to the structural completeness of its program. After this certification there is a period of at least one year to determine if a state is effectively providing safety and health protection.

Employers and employees should find out if their state operates an OSHA-approved state program and , if so, become familiar with it (see list of states with their own occupational safety and health programs). State safety and health standards under approved plans must keep pace with federal standards, and state plans must guarantee employer and employee rights as does OSHA. If it is found that the state is operating at least as effectively as federal OSHA and other requirements including compliance staffing levels are met, final approval of the plan may be granted and federal authority will cease in those areas over which the state has jurisdiction.

Anyone finding inadequacies or other problems in the administration of a state's program may file a complaint about state program administration (CASPA) with the appropriate regional administrator for OSHA. The complainant's name is kept confidential. OSHA investigates all such complaints and, where complaints are found to be valid, requires appropriate corrective action on the part of the state.

Services Available

Consultation Assistance

Consultation assistance is available to employers who want help in establishing and maintaining a safe and healthful workplace. Largely funded by OSHA, the service is provided at no cost to the employer. No penalties are proposed or citations issued for hazards identified by the consultant.

The service is provided to the employer with the assurance that his or her name and firm and any information about the workplace will not be routinely reported to OSHA inspection staff.

Primarily developed for smaller employers with more hazardous operations, the consultation service is delivered by state government agencies or universities employing professional safety consultants and health consultants. When delivered at the worksite, consultation assistance includes an opening conference with the employer to explain the ground rules for consultation, a walk through the workplace to identify any specific hazards and to examine those aspects of the employer's safety and health program which relate to the scope of the visit, and a closing conference followed by a written report to the employer of the consultant's finding and recommendations.

This process begins with the employer's request for consultation and the commitment to correct any serious job safety and health hazards identified by the consultant. Possible violations of OSHA standards will not be reported to OSHA enforcement staff unless the employer fails or refuses to eliminate or control worker exposure to any identified serious hazard or imminent danger situation. In such unusual circumstances, OSHA may investigate and begin enforcement action.

Employers who receive a comprehensive consultation visit, correct all identified hazards, and demonstrate that an effective safety and health program is in operation may be exempted from OSHA programmed enforcement inspections (not complaint or accident investigations) for a period of one year. Comprehensive consultation assistance includes an appraisal of all mechanical, physical, work practice, and environmental hazards of the workplace and all aspects of the employer's present job safety and health program.

Additional information concerning consultation assistance, including a directory of OSHA-funded consultation projects, can be obtained by requesting OSHA publication No. 3047, Consultation Services for the Employer.

Voluntary Protection Programs

The Voluntary Protection Programs (VPPs) represent one part of OSHA's effort to extend worker protection beyond the minimum required by OSHA standards. These programs, along with others such as expanded on-site consultation services and full-service area offices, are cooperative approaches which, when coupled with an effective enforcement program, expand worker protection to help meet the goals of the Occupational Safety and Health Act of 1970.

The three VPPs—Star, Merit, and Demonstration—are designed to:

- Recognize outstanding achievement of those who have successfully incorporated comprehensive safety and health programs into their total management system;
- Motivate others to achieve excellent safety and health results in the same outstanding way; and
- Establish a relationship between employers, employees, and OSHA that is based on cooperation rather than coercion.

The *Star Program* is the most demanding and the most prestigious. It is open to an employer in any industry who has successfully managed a comprehensive safety and health program to reduce injury rates below the national average for the industry. Specific requirements for the program include: management commitment and employee participation; a high quality worksite analysis program; hazard prevention and control programs; and comprehensive safety and health training for all employees. These requirements must all be in place and operating effectively.

The *Merit Program* is primarily a stepping stone to Star Program participation. An employer with a basic safety and health program built around the Star requirements who is committed to improving the company's program and who has the resources to do so within a specified period of time may work with OSHA to meet Star qualifications.

The *Demonstration Program* is for companies that provide Star-quality worker protection in industries where certain Star requirements may not be appropriate or effective. It allows OSHA both the opportunity to recognize outstanding safety and health programs that would otherwise be unreached by the VPP and to determine if general Star requirements can be changed to include these companies as Star participants.

OSHA reviews an employer's VPP application and conducts an on-site review to verify that the safety and health program described is in operation at the site. Evaluations are conducted on a regular basis, annually for Merit and Demonstration programs, and triennially for Star. All participants must send their injury information annually to their OSHA regional office. Sites participating in the VPP are not scheduled for programmed inspection; however, any employee complaints, serious accidents or significant chemical releases that may occur are handled according to routine enforcement procedures.

An employer may make application for any VPP at the nearest OSHA regional office. Once OSHA is satisfied that, on paper, the employer qualifies for the program, an on-site review will be scheduled. The review team presents its findings in a written report for the company's review prior to submission to the Assistant Secretary of Labor, who heads OSHA. If approved, the employer receives a letter from the Assistant Secretary informing the site of its participation in the VPP. A certificate of approval and flag are presented at a ceremony held at or near the approved worksite. Star sites receiving reapproval after each triennial evaluation receive plaques at similar ceremonies.

The VPPs described are available in states under federal jurisdiction. Some state plan states have similar programs. Interested companies in these states should contact the appropriate state designee for more information.

Additional information on the VPP is available from OSHA national, regional, and area offices.

Training and Education

OSHA's area offices are full-service centers offering a variety of informational services such as availability for speaking engagements, publication, audiovisual aids on workplace hazards, and technical advice.

The OSHA Training Institute in Des Plaines, IL, provides basic and advanced training and education in safety and health for federal and state compliance officers; state consultants; other federal agency personnel; and private sector employers, employees and their representatives. Institute courses cover areas such as electrical hazards, machine guarding, ventilation and ergonomics. The Institute facility includes classrooms, laboratories, a library, and an audiovisual unit. The laboratories contain various demonstrations and equipment, such as power presses, woodworking and welding shops, a complete industrial ventilation unit and a sound demonstration laboratory. More than 60 courses are available for personnel in the private sector dealing with subjects such as safety and health in the construction industry and methods of voluntary compliance with OSHA standards.

OSHA also provides funds to nonprofit organizations to conduct workplace training and education in subjects where OSHA identifies areas of unmet needs for safety and health education in the workplace annually and invites grant applications to address these needs. Current grant subjects include agricultural health and safety, and hazard communication programs for small businesses that do not have safety and health staff to assist them.

Organizations awarded grants use funds to develop training and educational programs, reach out to worker and employers for whom their program is appropriate, and provide these programs to workers and employers.

Grants are awarded annually, with a one-year renewal possible. Grant recipients are expected to contribute 20 percent of the total grant cost.

EMPLOYER RESPONSIBILITIES AND RIGHTS

Employers have certain responsibilities and rights under the Occupational Safety and Health Act of 1970.

The checklists that follow provide a review of many of these. Employer responsibilities and rights in states with their own occupational safety and health programs are generally the same as in federal OSHA states.

Responsibilities

As an employer, you must:

- Meet your general duty responsibility to provide a workplace free from recognized hazards that are causing or are likely to cause death or serious physical harm to employees, and comply with standards, rules and regulations issued under the Act.
- Be familiar with mandatory OSHA standards and make copies available to employees for review upon request.
- Inform all employees about OSHA.
- Examine workplace conditions to make sure they conform to applicable standards.
- Minimize or reduce hazards.
- Make sure employees have and use safe tools and equipment (including appropriate personal protective equipment), and that such equipment is properly maintained.
- Use color codes, posters, labels, or signs when needed to warn employees of potential hazards.
- Establish or update operating procedures and communicate them so that employees follow safety and health requirements.
- Provide training required by OSHA standards (e.g., hazard communication, lead, etc).
- Report to the nearest OSHA office within 8 hours any fatal accident or one that results in the hospitalization of three or more employees.
- Keep OSHA-required records of work-related injuries and illnesses, and post a copy of the totals from the last page of OSHA No. 200 during the entire month of February each year. (This applies to employers with 11 or more employees.)
- Post, at a prominent location within the workplace, the OSHA poster (OSHA 2203) informing employees of their rights and responsibilities. (In states operating OSHA-approved job safety and health programs, the state's equivalent poster and/or OSHA 2203 may be required.)
- Provide employees, former employees and their representatives access to the Log and Summary of Occupational Injuries and Illnesses (OSHA 300) at a reasonable time and in a reasonable manner.
- Provide access to employee medical records and exposure records to employees or their authorized representatives.
- Cooperate with the OSHA compliance officer by furnishing names of authorized employee representatives who may be asked to accompany the compliance officer during an inspection. (If none, the compliance officer will consult with a reasonable number of employees concerning safety and health in the workplace.)

- Not discriminate against employees who properly exercise their rights under the Act.
- Post OSHA citations at or near the worksite involved. Each citation, or copy thereof, must remain posted until the violation has been abated, or for three working days, whichever is longer.
- Abate cited violations within the prescribed period.

Rights

As an employer, you have the right to:

- Seek advice and off-site consultation as needed by writing, calling or visiting the nearest OSHA office. (OSHA will not inspect merely because an employer requests assistance.)
- Be active in your industry association's involvement in job safety and health.
- Request and receive proper identification of the OSHA compliance officer prior to inspection.
- Be advised by the compliance officer of the reason for an inspection.
- Have an opening and closing conference with the compliance officer.
- Accompany the compliance officer on the inspection.
- File a Notice of Contest with the OSHA area director within 15 working days of receipt of a notice of citation and proposed penalty.
- Apply to OSHA for a temporary variance from a standard if unable to comply because of the unavailability of materials, equipment or personnel needed to make necessary changes within the required time.
- Apply to OSHA for a permanent variance from a standard if you can furnish proof that your facilities or method of operation provide employee protection at least as effective as that required by the standard.
- Take an active role in developing safety and health standards through participation in OSHA Standard Advisory Committees, through nationally recognized standards-setting organizations and through evidence and views presented in writing or at hearings.
- Be assured of the confidentiality of any trade secrets observed by an OSHA compliance officer during an inspection.
- Submit a written request to NIOSH for information on whether any substance in your workplace has potentially toxic effects in the concentrations being used.

EMPLOYEE RESPONSIBILITIES AND RIGHTS

Although OSHA does not cite employees for violations of their responsibilities, each employee "shall comply with all occupational safety and health standards and all rules, regulations, and orders Issued under the Act" that are applicable.

Employee responsibilities and rights in states with their own occupational safety and health programs are generally the same as for workers in federal OSHA states.

Responsibilities

As an employee, you should:

- Read the OSHA poster at the job-site.
- Comply with all applicable OSHA standards.
- Follow all employer safety and health rules and regulations, and wear or use prescribed protective equipment while engaged in work.
- Report hazardous conditions to the supervisor.
- Cooperate with the OSHA compliance officer conducting an inspection if he or she inquires about safety and health conditions in your workplace.
- Exercise your rights under the Act in a responsible manner. **11(c)**

Rights: Protection for Using Rights

Employees have a right to seek safety and health on the job without fear of punishment. That right is spelled out in Section 11(c) of the Act.

The law says employers shall not punish or discriminate against workers for exercising rights such as:

- Complaining to an employer, union, OSHA or any other government agency about job safety and health hazards;
- Filing safety or health grievances;
- Participating on a workplace safety and health committee or in union activities concerning job safety and health.
- Participating in OSHA inspections, conferences, hearings, or other OSHA-related activities.

If an employee is exercising these or other OSHA rights, the employer is not allowed to discriminate against that worker in any way, such as through firing, demotion, taking away seniority or other earned benefits, transferring the worker to an undesirable job or shift, or threatening or harassing the worker.

If the employer has knowingly allowed the employee to do something in the past (such as leaving work early), he or she may be violating the law by punishing the worker for doing the same thing following a protest of hazardous conditions. If the employer knows that a number of workers are doing the same thing wrong, he or she cannot legally single out for punishment the worker who has taken part in safety and health activities.

Workers believing they have been punished for exercising safety and health rights must contact the nearest OSHA office within 30 days of the time they learn of the alleged discrimination. A union representative can file the 11(c) complaint for the worker.

The worker does not have to complete any forms. An OSHA staff member will complete the forms, asking what happened and who was involved.

Following a complaint, OSHA investigates. If an employee has been illegally punished for exercising safety and health rights, OSHA asks the employer to restore that worker's job earning and benefits. If necessary, and if it can prove discrimination, OSHA takes the employer to court. In such cases the worker does not pay any legal fees.

If a state agency has an OSHA-approved state program, employees may file their complaint with either federal OSHA or a state agency under its laws.

Section 405: Surface Transportation Assistance Act

Section 405 of the Surface Transportation Assistance Act (STAA) provides protection from reprisal by employers for truckers and certain other employees in the trucking industry involved in activity related to interstate commercial motor vehicle safety and health. Secretary of Labor's Order No. 9-83 (48 FR 35736, August 5, 1983) delegated to the Assistant Secretary of OSHA the authority to investigate and to issue findings and preliminary orders under Section 405.

Employees who believe they have been discriminated against for exercising their rights under Section 405 can file a complaint with OSHA within 180 days of the incident. The Secretary will then investigate the complaint and , within 60 days after it was filed, issue findings as to whether there is a reason to believe Section 405 has been violated.

If the Secretary finds that a complaint has merit, he/she also will issue an order requiring, where appropriate abatement of the violation, reinstatement with back pay and related compensation, payment of compensatory damages, and the payment of the employee's expenses in bringing the complaint. Either the employee or employer may object to the findings. If no objection is filed within 30 days, the finding and order are final. If a timely filed objection is made, however, the objecting party is entitled to a hearing on the objection before an Administrative Law Judge of the Department of Labor.

Within 120 days of the hearing, the Secretary will issue a final order. A party aggrieved by the final order may seek judicial review in a court of appeals within 60 days of the final order.

The following activities of truckers and certain employees involved in interstate commercial motor vehicle operation are protected under Section 405.

- Filing of safety or health complaints with OSHA or another regulatory agency relating to a violation of a commercial motor vehicle safety rule, regulation, standard, or order.
- Instituting or causing to be instituted any proceedings relating to a violation of a commercial motor vehicle safety rule, regulation, standard or order.
- Testifying in any such proceedings relating to the above items.
- Refusing to operate a vehicle when such operation constitutes a violation of any Federal rules, regulations, standards or orders applicable to commercial motor vehicle safety or health; or because of the employee's reasonable apprehension of serious injury to himself or the public due to the unsafe condition of the equipment.
- Complaints under Section 405 are filed in the same manner as complaints under 11(c). The filing period for Section 405 is 180 days from the alleged discrimination, rather than 30 days as under Section 11(c).

Other Rights

As an employee, you have the right to:

- Review copies of appropriate OSHA standards, rules, regulations and requirements that the employer should have available at the workplace.
- Request information from your employer on safety and health hazards in the area, on precautions that may be taken, and on procedures to be followed if an employee is involved in an accident or is exposed to toxic substances.
- Receive adequate training and information on workplace safety and health hazards.
- Request the OSHA area director to investigate if you believe hazardous conditions or violations of standards exist in your workplace.
- Have your name withheld from your employer, upon request to OSHA, if you file a written and signed complaint.
- Be advised of OSHA actions regarding your complaint and have an informal review, if requested, of any decision not to inspect or to issue a citation.
- Have your authorized employee representative accompany the OSHA compliance officer during the inspection tour.
- Respond to questions from the OSHA compliance officer, particularly if there is no authorized employee representative accompanying the compliance officer.
- Observe any monitoring or measuring of hazardous materials and have the right to see these records, and your medical records, as specified under the Act.
- Have your authorized representative, or yourself, review the Log and Summary of Occupational Injuries (OSHA 300) at a reasonable time and in a reasonable manner.
- Request a closing discussion with the compliance officer following an inspection.
- Submit a written request to NIOSH for information on whether any substance in your workplace has potentially toxic effects in the concentration being used and have your name withheld from your employer if you so request.
- Object to the abatement period set in the citation issued to your employer by writing to the OSHA area director within 15 working days of the issuance of the citation.
- Participate in hearings conducted by the Occupational Safety and Health Review Commission.
- Be notified by your employer if he or she applies for a variance from an OSHA standard, and testify at a variance hearing and appeal the final decision.
- Submit information or comment to OSHA on the issuance, modification, or revocation of OSHA standards and request a public hearing.

KEEPING UP TO DATE ON OSHA

Clearly, OSHA cannot succeed in its mission without fully informed employers and employees. If you have questions about OSHA, contact your nearest OSHA office.

OSHA publications and fact sheets are issued to detail various facets of OSHA policy and regulations. Your OSHA regional or area office can provide you with a listing of current materials.

You are encouraged to learn all you can about OSHA, its aims, policies, programs and practices, because you are the reason for them. The more you know about OSHA, the better you can contribute to its pursuit of safe and healthful working conditions for all Americans.

HAZARD COMMUNICATION STANDARD

Summary

Protection under OSHA's Hazard Communication Standard (HCS) includes all workers exposed to hazardous chemicals in all industrial sectors. This standard is based on a simple concept—that employees have both a need and a right to know the hazards and the identities of the chemicals they are exposed to when working. They also need to know what protective measures are available to prevent adverse effects from occurring.

Scope of Coverage

More than 30 million workers are potentially exposed to one or more chemical hazards. There are an estimated 650,000 existing hazardous chemical products, and hundreds of new ones are being introduced annually. This poses a serious problem for exposed workers and their employers.

Benefits

The HCS covers both physical hazards (such as flammability or the potential for explosions), and health hazards (including both acute and chronic effects). By making information available to employers and employees about these hazards, and recommended precautions for safe use, proper implementation of the HCS will result in a reduction of illnesses and injuries caused by chemicals. Employers will have the information they need to design an appropriate protective program. Employees will be better able to participate in these programs effectively when they understand the hazards involved, and to take steps to protect themselves. Together, these employer and employee actions will prevent the occurrence of adverse effects caused by the use of chemicals in the workplace.

Requirements

The HCS established uniform requirements to make sure that the hazards of all chemicals imported into, produced, or used in U.S. workplaces are evaluated and that this hazard information is transmitted to affected employers and exposed employees.

Chemical manufacturers and importers must convey the hazard information they learn from their evaluations to downstream employers by means of labels on containers and material safety data sheets (MSDS's). In addition, all covered employers must have a hazard communication program to get this information to their employees through labels on containers, MSDS's, and training.

This program ensures that all employers receive the information they need to inform and train their employees properly and to design and put in place employee protection programs. It also provides necessary hazard information to employees so they can participate in, and support, the protective measures in place at their workplaces.

All employers in addition to those in manufacturing and importing are responsible for informing and training workers about the hazards in their workplaces, retaining warning labels, and making available MSDS's with hazardous chemicals.

Some employees deal with chemicals in sealed containers under normal conditions of use (such as in the retail trades, warehousing and truck and marine cargo handling). Employers of these employees must assure that labels affixed to incoming containers of hazardous chemicals are kept in place. They must

maintain and provide access to MSDS's received, or obtain MSDS's if requested by an employee. And they must train workers on what to do in the event of a spill or leak. However, written hazard communication programs will not be required for this type of operation.

All workplaces where employees are exposed to hazardous chemicals must have a written plan which describes how the standard will be implemented in that facility. The only work operations which do not have to comply with the written plan requirements are laboratories and work operations where employees only handle chemicals in sealed containers.

The written program must reflect what employees are doing in a particular workplace. For example, the written plan must list the chemicals present at the site, indicate who is responsible for the various aspects of the program in that facility and where written materials will be made available to employees.

The written program must describe how the requirements for labels and other forms of warning, material safety data sheets, and employee information and training are going to be met in the facility.

Effect on State Right-To-Know Laws

The HCS preempts all state (in states without OSHA-approved job safety and health programs) or local laws which relate to an issue covered by HCS without regard to whether the state law would conflict with, complement, or supplement the federal standard, and without regard to whether the state law appears to be "at least as effective as" the federal standard.

The only state worker right-to-know laws authorized would be those established in states and jurisdictions that have OSHA-approved state programs.

These states and jurisdictions include: Alaska, Arizona, California, Connecticut (state and municipal employees only), Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, New York (state and municipal employees only), North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virgin Islands, Virginia, Washington, and Wyoming.

Federal Workers

Under the hazard communication standard federal workers are covered by executive order.

Definitions Applicable to This Subpart – §1926.155

"Approved" means equipment that has been listed or approved by a nationally recognized testing laboratory such as Factory Mutual Engineering Corp., or Underwriters' Laboratories, Inc., or Federal agencies such as Bureau of Mines, or U.S. Coast Guard, which issue approvals for such equipment.

"Closed container" means a container so sealed by means of a lid or other device that neither liquid nor vapor will escape from it at ordinary temperatures.

"Combustible liquid" means any liquid having a flash point at or above 140 deg. F (60 deg. C), and below 200 deg. F (93.4 deg. C).

"Combustion" means any chemical process that involves oxidation sufficient to produce light or heat.

"Fire brigade" means an organized group of employees that are knowledgeable, trained, and skilled in the safe evacuation of employees during emergency situations and in assisting in fire fighting operations.

"Fire resistance" means so resistant to fire that, for specified time and under conditions of a standard heat intensity, it will not fail structurally and will not permit the side away from the fire to become hotter than a specified temperature. For purposes of this part, fire resistance shall be determined by the Standard Methods of Fire Tests of Building Construction and Materials, NFPA 251-1969.

"Flammable" means capable of being easily ignited, burning intensely, or having a rapid rate of flame spread.

"Flammable liquid" means any liquid having a flash point below 140 deg. F and having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100 deg. F.

"Flash point" of the liquid means the temperature at which it gives off vapor sufficient to form an ignitable mixture with the air near the surface of the liquid or within the vessel used as determined by appropriate test procedure and apparatus as specified below.

1. The flash point of liquids having a viscosity less than 45 Saybolt Universal Second(s) at 100 deg. F (37.8 deg. C) and a flash point below 175 deg. F (79.4 deg. C) shall be determined in accordance with the Standard Method of Test for Flash Point by the Tag Closed Tester, ASTM D-56-69.
2. The flash point of liquids having a viscosity of 45 Saybolt Universal Second(s) or more at 175 deg. F. (79.4 deg. C) or higher shall be determined in accordance with the Standard Method of Test for Flash Point by the Pensky Martens Closed Tester, ASTM D-93-69.

"Liquefied petroleum gases," "LPG" and "LP Gas" mean and include any material which is composed predominantly of any of the following hydrocarbons, or mixtures of them, such as propane, propylene, butane (normal butane or iso-butane), and butylenes.

"Portable tank" means a closed container having a liquid capacity more than 60 U.S. gallons, and not intended for fixed installation.

"Safety can" means an approved closed container, of not more than 5 gallons capacity, having a flash-arresting screen, spring-closing lid and spout cover and so designed that it will safely relieve internal pressure when subjected to fire exposure.

"Vapor pressure" means the pressure, measured in pounds per square inch (absolute), exerted by a volatile liquid as determined by the Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method), ASTM D-323-58.

Fire Protection – §1926.150

General Requirements

The employer shall be responsible for the development of a fire protection program to be followed throughout all phases of the construction and demolition work, and shall provide for the firefighting equipment as specified in this subpart. As fire hazards occur, there shall be no delay in providing the necessary equipment.

Access to all available firefighting equipment shall be maintained at all times. All firefighting equipment, provided by the employer, shall be conspicuously located.

All firefighting equipment shall be periodically inspected and maintained in operating condition. Defective equipment shall be immediately replaced.

As warranted by the project, the employer shall provide a trained and equipped firefighting organization (Fire Brigade) to assure adequate protection to life.

Water Supply

A temporary or permanent water supply, of sufficient volume, duration, and pressure, required to properly operate the firefighting equipment shall be made available as soon as combustible materials accumulate.

Where underground water mains are to be provided, they shall be installed, completed, and made available for use as soon as practicable.

Portable Firefighting Equipment

Fire Extinguishers and Small Hose Lines

A fire extinguisher, rated not less than 2A, shall be provided for each 3,000 square feet of the protected building area, or major fraction thereof. Travel distance from any point of the protected area to the nearest fire extinguisher shall not exceed 100 feet.

One 55-gallon open drum of water with two fire pails may be substituted for a fire extinguisher having a 2A rating.

A ½-inch diameter garden-type hose line, not to exceed 100 feet in length and equipped with a nozzle, may be substituted for a 2A-rated fire extinguisher, providing it is capable of discharging a minimum of 5 gallons per minute with a minimum hose stream range of 30 feet horizontally. The garden-type hose lines shall be mounted on conventional racks or reels. The number and location of hose racks or reels shall be such that at least one hose stream can be applied to all points in the area.

One or more fire extinguishers, rated not less than 2A, shall be provided on each floor. In multistory buildings, at least one fire extinguisher shall be located adjacent to stairway.

Extinguishers and water drums, subject to freezing, shall be protected from freezing.

A fire extinguisher, rated not less than 10B, shall be provided within 50 feet of wherever more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are being used on the jobsite. This requirement does not apply to the integral fuel tanks of motor vehicles.

Carbon tetrachloride and other toxic vaporizing liquid fire extinguishers are prohibited.

Portable fire extinguishers shall be inspected periodically and maintained in accordance with Maintenance and Use of Portable Fire Extinguishers, NFPA No. 10A-1970. Fire extinguishers which have been listed or approved by a nationally recognized testing laboratory shall be used to meet the requirements of this subpart.

Table F-1 in §1926.150(c)(1)(x) may be used as a guide for selecting the appropriate portable fire extinguishers.

Fire Hose and Connections

One hundred feet, or less, of 1½-inch hose, with a nozzle capable of discharging water at 25 gallons or more per minute, may be substituted for a fire extinguisher rated not more than 2A in the designated area provided that the hose line can reach all points in the area.

If fire hose connections are not compatible with local firefighting equipment, the contractor shall provide adapters, or equivalent, to permit connections.

During demolition involving combustible materials, charged hose lines, supplied by hydrants, water tank trucks with pumps, or equivalent, shall be made available.

Fixed Firefighting Equipment

Sprinkler Protection

If the facility being constructed includes the installation of automatic sprinkler protection, the installation shall closely follow the construction and be placed in service as soon as applicable laws permit following completion of each story.

During demolition or alterations, existing automatic sprinkler installations shall be retained in service as long as reasonable. The operation of sprinkler control valves shall be permitted only by properly authorized persons. Modification of sprinkler systems to permit alterations or additional demolition should be expedited so that the automatic protection may be returned to service as quickly as possible. Sprinkler control valves shall be checked daily at close of work to ascertain that the protection is in service.

Standpipes

In all structures in which standpipes are required, or where standpipes exist in structures being altered, they shall be brought up as soon as applicable laws permit, and shall be maintained as construction progresses in such a manner that they are always ready for fire protection use. The standpipes shall be provided with Siamese fire department connections on the outside of the structure, at the street level, which shall be conspicuously marked. There shall be at least one standard hose outlet at each floor.

Fire Alarm Devices

An alarm system, e.g., telephone system, siren, etc., shall be established by the employer whereby employees on the site and the local fire department can be alerted for an emergency. The alarm code and reporting instructions shall be conspicuously posted at phones and at employee entrances.

Fire Cutoffs

Fire walls and exit stairways, required for the completed buildings, shall be given construction priority. Fire doors, with automatic closing devices, shall be hung on openings as soon as practicable.

Fire cutoffs shall be retained in buildings undergoing alterations or demolition until operations necessitate their removal.

Fire Prevention – §1926.151

Ignition Hazards

Electrical wiring and equipment for light, heat, or power purposes shall be installed in compliance with the requirements of Subpart K, Electrical.

Internal combustion engine powered equipment shall be so located that the exhausts are well away from combustible materials. When the exhausts are piped to outside the building under construction, a clearance of at least 6 inches shall be maintained between such piping and combustible material.

Smoking shall be prohibited at or in the vicinity of operations which constitute a fire hazard, and shall be conspicuously posted: "No Smoking or Open Flame."

Portable battery powered lighting equipment, used in connection with the storage, handling, or use of flammable gases or liquids, shall be of the type approved for the hazardous locations.

The nozzle of air, inert gas, and steam lines or hoses, when used in the cleaning or ventilation of tanks and vessels that contain hazardous concentrations of flammable gases or vapors, shall be bonded to the tank or vessel shell. Bonding devices shall not be attached or detached in hazardous concentrations of flammable gases or vapors.

Temporary Buildings

No temporary building shall be erected where it will adversely affect any means of exit.

Temporary buildings, when located within another building or structure, shall be of either noncombustible construction or of combustible construction having a fire resistance of not less than 1 hour.

Temporary buildings, located other than inside another building and not used for the storage, handling, or use of flammable or combustible liquids, flammable gases, explosives, or blasting agents, or similar hazardous occupancies, shall be located at a distance of not less than 10 feet from another building or structure. Groups of temporary buildings, not exceeding 2,000 square feet in aggregate, shall, for the purposes of this part, be considered a single temporary building.

Open Yard Storage

Combustible materials shall be piled with due regard to the stability of piles and in no case higher than 20 feet.

Driveways between and around combustible storage piles shall be at least 15 feet wide and maintained free from accumulation of rubbish, equipment, or other articles or materials. Driveways shall be so spaced that a maximum grid system unit of 50 feet by 150 feet is produced.

The entire storage site shall be kept free from accumulation of unnecessary combustible materials. Weeds and grass shall be kept down and a regular procedure provided for the periodic cleanup of the entire area. When there is a danger of an underground fire, that land shall not be used for combustible or flammable storage.

Method of piling shall be solid wherever possible and in orderly and regular piles. No combustible material shall be stored outdoors within 10 feet of a building or structure.

Portable fire extinguishing equipment, suitable for the fire hazard involved, shall be provided at convenient, conspicuously accessible locations in the yard area. Portable fire extinguishers, rated not less than 2A, shall be placed so that maximum travel distance to the nearest unit shall not exceed 100 feet.

Indoor Storage

Storage shall not obstruct, or adversely affect, means of exit. All materials shall be stored, handled, and piled with due regard to their fire characteristics.

Non compatible materials, which may create a fire hazard, shall be segregated by a barrier having a fire resistance of at least 1 hour.

Material shall be piled to minimize the spread of fire internally and to permit convenient access for firefighting. Stable piling shall be maintained at all times. Aisle space shall be maintained to safely accommodate the widest vehicle that may be used within the building for firefighting purposes.

Clearance of at least 36 inches shall be maintained between the top level of the stored material and the sprinkler deflectors.

Clearance shall be maintained around lights and heating units to prevent ignition of combustible materials.

A clearance of 24 inches shall be maintained around the path of travel of fire doors unless a barricade is provided, in which case no clearance is needed. Material shall not be stored within 36 inches of a fire door opening.

Flammable and Combustible Liquids – §1926.152

General Requirements

Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids. Approved metal safety cans shall be used for the handling and use of flammable liquids in quantities greater than one gallon, except that this shall not apply to those flammable liquid materials which are highly viscid (extremely hard to pour), which may be used and handled in original shipping containers. For quantities of one gallon or less, only the original container or approved metal safety cans shall be used for storage, use, and handling of flammable liquids.

Flammable or combustible liquids shall not be stored in areas used for exits, stairways, or normally used for the safe passage of people.

Indoor Storage of Flammable and Combustible Liquids

No more than 25 gallons of flammable or combustible liquids shall be stored in a room outside of an approved storage cabinet. For storage of liquefied petroleum gas, see §1926.153.

Quantities of flammable and combustible liquid in excess of 25 gallons shall be stored in an acceptable or approved cabinet meeting the following requirements:

i. Acceptable wooden storage cabinets shall be constructed in the following manner, or equivalent: The bottom, sides, and top shall be constructed of an exterior grade of plywood at least 1 inch in thickness, which shall not break down or delaminate under standard fire test conditions. All joints shall be rabbeted and shall be fastened in two directions with flathead wood screws. When more than one door is used, there shall be a rabbeted overlap of not less than 1 inch. Steel hinges shall be mounted in such a manner as to not lose their holding capacity due to loosening or burning out of the screws when subjected to fire. Such cabinets shall be painted inside and out with fire retardant paint.

ii. Approved metal storage cabinets will be acceptable.

iii. Cabinets shall be labeled in conspicuous lettering, “Flammable—Keep Fire Away.”

Not more than 60 gallons of flammable or 120 gallons of combustible liquids shall be stored in any one storage cabinet. Not more than three such cabinets may be located in a single storage area. Quantities in excess of this shall be stored in an inside storage room.

Inside storage rooms shall be constructed to meet the required fire-resistive rating for their use. Such construction shall comply with the test specifications set forth in Standard Methods of Fire Test of Building Construction and Material, NFPA 251-1969.

Where an automatic extinguishing system is provided, the system shall be designed and installed in an approved manner. Openings to other rooms or buildings shall be provided with noncombustible liquid-tight raised sills or ramps at least 4 inches in height, or the floor in the storage area shall be at least 4 inches below the surrounding floor. Openings shall be provided with approved self-closing fire doors. The room shall be liquid-tight where the walls join the floor. A permissible alternate to the sill or ramp is an open-grated trench, inside of the room, which drains to a safe location. Where other portions of the building or other buildings are exposed, windows shall be protected as set forth in the Standard for Fire Doors and Windows, NFPA No. 80-1970, for Class E or F openings. Wood of at least 1-inch nominal thickness may be used for shelving, racks, dunnage, scuffboards, floor overlay, and similar installations.

Materials which will react with water and create a fire hazard shall not be stored in the same room with flammable or combustible liquids.

Storage in inside storage rooms shall comply with Table F-2:

TABLE F-2

Fire Protection Provided (gal per sq. ft. floor area)	**Fire Resistance**	**Maximum Size**	**Total Allowable Quantities**
Yes	2 hrs.	500 sq. ft.	10
No	2 hrs.	500 sq. ft.	4
Yes	1 hr.	150 sq. ft.	5
No	1 hr.	150 sq. ft.	2

Note: Fire protection system shall be sprinkler, water spray, carbon dioxide or other system approved by a nationally recognized testing laboratory for this purpose.

Electrical wiring and equipment located in inside storage rooms shall be approved for Class I, Division 1, Hazardous Locations. For definition of Class I, Division 1, Hazardous Locations, see §1926.449.

Every inside storage room shall be provided with either a gravity or a mechanical exhausting system. Such system shall commence not more than 12 inches above the floor and be designed to provide for a complete change of air within the room at least 6 times per hour. If a mechanical exhausting system is used, it shall be controlled by a switch located outside of the door. The ventilating equipment and any lighting fixtures shall be operated by the same switch. An electric pilot light shall be installed adjacent to the switch if flammable liquids are dispensed within the room. Where gravity ventilation is provided, the fresh air intake, as well as the exhausting outlet from the room, shall be on the exterior of the building in which the room is located.

In every inside storage room there shall be maintained one clear aisle at least 3 feet wide. Containers over 30 gallons capacity shall not be stacked one upon the other.

Flammable and combustible liquids in excess of that permitted in inside storage rooms shall be stored outside of buildings in accordance with paragraph “Storage Outside Buildings” of this section.

The quantity of flammable or combustible liquids kept in the vicinity of spraying operations shall be the minimum required for operations and should ordinarily not exceed a supply for 1 day or one shift. Bulk storage of portable containers of flammable or combustible liquids shall be in a separate, constructed building detached from other important buildings or cut off in a standard manner.

Storage Outside Buildings

Storage of containers (not more than 60 gallons each) shall not exceed 1,100 gallons in any one pile or area. Piles or groups of containers shall be separated by a 5-foot clearance. Piles or groups of containers shall not be nearer than 20 feet to a building.

Within 200 feet of each pile of containers, there shall be a 12-foot-wide access way to permit approach of fire control apparatus.

The storage area shall be graded in a manner to divert possible spills away from buildings or other exposures, or shall be surrounded by a curb or earth dike at least 12 inches high. When curbs or dikes are used, provisions shall be made for draining off accumulations of ground or rain water, or spills of flammable or combustible liquids. Drains shall terminate at a safe location and shall be accessible to operation under fire conditions.

Outdoor portable tank storage:

i. Portable tanks shall not be nearer than 20 feet from any building. Two or more portable tanks, grouped together, having a combined capacity in excess of 2,200 gallons, shall be separated by a 5-foot-clear area. Individual portable tanks exceeding 1,100 gallons shall be separated by a 5-foot-clear area.

ii. Within 200 feet of each portable tank, there shall be a 12-foot-wide access way to permit approach of fire control apparatus.

Storage areas shall be kept free of weeds, debris, and other combustible material not necessary to the storage.

Portable tanks, not exceeding 660 gallons, shall be provided with emergency venting and other devices, as required by chapters III and IV of NFPA 30-1969, The Flammable and Combustible Liquids Code.

Portable tanks, in excess of 660 gallons, shall have emergency venting and other devices, as required by chapters II and III of The Flammable and Combustible Liquids Code, NFPA 30-1969.

Fire Control for Flammable or Combustible Liquid Storage

At least one portable fire extinguisher, having a rating of not less than 20-B units, shall be located outside of, but not more than 10 feet from, the door opening into any room used for storage of more than 60 gallons of flammable or combustible liquids.

At least one portable fire extinguisher having a rating of not less than 20-B units shall be located not less than 25 feet, nor more than 75 feet, from any flammable liquid storage area located outside.

When sprinklers are provided, they shall be installed in accordance with the Standard for the Installation of Sprinkler Systems, NFPA 13-1969.

At least one portable fire extinguisher having a rating of not less than 20-B:C units shall be provided on all tank trucks or other vehicles used for transporting and/or dispensing flammable or combustible liquids.

Dispensing Liquids

Areas in which flammable or combustible liquids are transferred at one time, in quantities greater than 5 gallons from one tank or container to another tank or container, shall be separated from other operations by 25-feet distance or by construction having a fire resistance of at least 1 hour. Drainage or other means

shall be provided to control spills. Adequate natural or mechanical ventilation shall be provided to maintain the concentration of flammable vapor at or below 10 percent of the lower flammable limit.

Transfer of flammable liquids from one container to another shall be done only when containers are electrically interconnected (bonded).

Flammable or combustible liquids shall be drawn from or transferred into vessels, containers, or tanks within a building or outside only through a closed piping system, from safety cans, by means of a device drawing through the top, or from a container, or portable tanks, by gravity or pump, through an approved self-closing valve. Transferring by means of air pressure on the container or portable tanks is prohibited.

The dispensing units shall be protected against collision damage. Dispensing devices and nozzles for flammable liquids shall be of an approved type.

Handling Liquids at Point of Final Use

Flammable liquids shall be kept in closed containers when not actually in use.

Leakage or spillage of flammable or combustible liquids shall be disposed of promptly and safely.

Flammable liquids may be used only where there are no open flames or other sources of ignition within 50 feet of the operation, unless conditions warrant greater clearance.

Service and Refueling Areas

Flammable or combustible liquids shall be stored in approved closed containers, in tanks located underground, or in above-ground portable tanks.

The tank trucks shall comply with the requirements covered in the Standard for Tank Vehicles for Flammable and Combustible Liquids, NFPA No. 385-1966.

The dispensing hose shall be an approved type, and the dispensing nozzle shall be an approved automatic-closing type without a latch-open device.

Underground tanks shall not be abandoned.

Clearly identified and easily accessible switch(es) shall be provided at a location remote from dispensing devices to shut off the power to all dispensing devices in the event of an emergency.

Heating equipment of an approved type may be installed in the lubrication or service area where there is no dispensing or transferring of flammable liquids, provided the bottom of the heating unit is at least 18 inches above the floor and is protected from physical damage.

Heating equipment installed in lubrication or service areas, where flammable liquids are dispensed, shall be of an approved type for garages, and shall be installed at least 8 feet above the floor.

There shall be no smoking or open flames in the areas used for fueling, servicing fuel systems for internal combustion engines, receiving or dispensing of flammable or combustible liquids. Conspicuous and legible signs prohibiting smoking shall be posted.

The motors of all equipment being fueled shall be shut off during the fueling operation.

Each service or fueling area shall be provided with at least one fire extinguisher having a rating of not less than 20-B:C located so that an extinguisher will be within 75 feet of each pump, dispenser, underground fill pipe opening, and lubrication or service area.

Scope

This section applies to the handling, storage, and use of flammable and combustible liquids with a flashpoint below 200 deg. F (93.33 deg. C). This section does not apply to: (1) Bulk transportation of flammable and combustible liquids; and (2) Storage, handling, and use of fuel oil tanks and containers connected with oil burning equipment.

Tank Storage

Refer to §1926.152(i) for design, construction, and installation requirements for flammable or combustible liquid storage tanks.

Piping, Valves, and Fittings

Refer to §1926.152(j) for design, fabrication, assembly, test, and inspection requirements for piping systems containing flammable or combustible liquids.

Marine Service Stations

Refer to §1926.152(k) for dispensing, tanks and pumps, and piping service stations where flammable or combustible liquids used as fuels are stored and dispensed.

Liquefied Petroleum Gas (LP-GAS) – §1926.153

Approval of Equipment and Systems

Each system shall have containers, valves, connectors, manifold valve assemblies, and regulators of an approved type.

All cylinders shall meet the Department of Transportation specification identification requirements published in 49 CFR Part 178, Shipping Container Specifications.

As used in this section, “Containers” are defined as all vessels, such as tanks, cylinders, or drums, used for transportation or storing liquefied petroleum gases.

Welding on LP-Gas Containers

Welding is prohibited on containers.

Container Valves and Container Accessories

Valves, fittings, and accessories connected directly to the container, including primary shut off valves, shall have a rated working pressure of at least 250 p.s.i.g. and shall be of material and design suitable for LP-Gas service.

Connections to containers, except safety relief connections, liquid level gauging devices, and plugged openings, shall have shutoff valves located as close to the container as practicable.

Safety Devices

Every container and every vaporizer shall be provided with one or more approved safety relief valves or devices. These valves shall be arranged to afford free vent to the outer air with discharge not less than 5 feet horizontally away from any opening into a building which is below such discharge.

Shutoff valves shall not be installed between the safety relief device and the container, or the equipment or piping to which the safety relief device is connected, except that a shutoff valve may be used where the arrangement of this valve is such that full required capacity flow through the safety relief device is always afforded.

Container safety relief devices and regulator relief vents shall be located not less than 5 feet in any direction from air openings into sealed combustion system appliances or mechanical ventilation air intakes.

Dispensing

Filling of fuel containers for trucks or motor vehicles from bulk storage containers shall be performed not less than 10 feet from the nearest masonry-walled building, or not less than 25 feet from the nearest building or other construction and, in any event, not less than 25 feet from any building opening.

Filling of portable containers or containers mounted on skids from storage containers shall be performed not less than 50 feet from the nearest building.

Requirements for Appliances

Any appliance that was originally manufactured for operation with a gaseous fuel other than LP-Gas, and is in good condition, may be used with LP-Gas only after it is properly converted, adapted, and tested for performance with LP-Gas before the appliance is placed in use.

Containers shall be upright upon firm foundations or otherwise firmly secured. The possible effect on the outlet piping of settling shall be guarded against by a flexible connection or special fitting.

Containers and Equipment Used Inside of Buildings or Structures

When operational requirements make portable use of containers necessary, and their location outside of buildings or structures is impracticable, containers and equipment shall be permitted to be used inside of buildings or structures in accordance with paragraphs (h)(2) through (11) of this section.

"Containers in use" means connected for use.

Systems utilizing containers having a water capacity greater than 2½ pounds (nominal 1 pound LP-Gas capacity) shall be equipped with excess flow valves. Such excess flow valves shall be either integral with the container valves or in the connections to the container valve outlets.

Regulators shall be either directly connected to the container valves or to manifolds connected to the container valves. The regulator shall be suitable for use with LP-Gas. Manifolds and fittings connecting containers to pressure regulator inlets shall be designed for at least 250 p.s.i.g. service pressure.

Valves on containers having water capacity greater than 50 pounds (nominal 20 pounds LP-Gas capacity) shall be protected from damage while in use or storage.

Aluminum piping or tubing shall not be used.

Hose shall be designed for a working pressure of at least 250 p.s.i.g. Design, construction, and performance of hose, and hose connections shall have their suitability determined by listing by a nationally recognized testing agency. The hose length shall be as short as practicable. Hoses shall be long enough to permit compliance with spacing provisions of paragraphs (h)(1) through (13) of this section, without kinking or straining, or causing hose to be so close to a burner as to be damaged by heat.

Portable heaters, including salamanders, shall be equipped with an approved automatic device to shut off the flow of gas to the main burner, and pilot if used, in the event of flame failure. Such heaters, having inputs above 50,000 B.t.u. per hour, shall be equipped with either a pilot, which must be lighted and proved before the main burner can be turned on, or an electrical ignition system.

Note: The provisions of this subparagraph do not apply to portable heaters under 7,500 B.t.u. per hour input when used with containers having a maximum water capacity of 2 ½ pounds.

Container valves, connectors, regulators, manifolds, piping, and tubing shall not be used as structural supports for heaters.

Containers, regulating equipment, manifolds, pipe, tubing, and hose shall be located to minimize exposure to high temperatures or physical damage.

Containers having a water capacity greater than 2½ pounds (nominal 1 pound LP-Gas capacity) connected for use shall stand on a firm and substantially level surface and, when necessary, shall be secured in an upright position.

The maximum water capacity of individual containers shall be 245 pounds (nominal 100 pounds LP-Gas capacity).

For temporary heating, heaters (other than integral heater-container units) shall be located at least 6 feet from any LP-Gas container. This shall not prohibit the use of heaters specifically designed for attachment to the container or to a supporting standard, provided they are designed and installed so as to prevent direct or radiant heat application from the heater onto the containers. Blower and radiant type heaters shall not be directed toward any LP-Gas container within 20 feet.

If two or more heater-container units, of either the integral or nonintegral type, are located in an unpartitioned area on the same floor, the container or containers of each unit shall be separated from the container or containers of any other unit by at least 20 feet.

When heaters are connected to containers for use in an unpartitioned area on the same floor, the total water capacity of containers, manifolded together for connection to a heater or heaters, shall not be greater than 735 pounds (nominal 300 pounds LP-Gas capacity). Such manifolds shall be separated by at least 20 feet.

Storage of containers awaiting use shall be in accordance with paragraphs (j) and (k) of this section.

Multiple Container Systems

Valves in the assembly of multiple container systems shall be arranged so that replacement of containers can be made without shutting off the flow of gas in the system. This provision is not to be construed as requiring an automatic changeover device.

Heaters shall be equipped with an approved regulator in the supply line between the fuel cylinder and the heater unit. Cylinder connectors shall be provided with an excess flow valve to minimize the flow of gas in the event the fuel line becomes ruptured.

Regulators and low-pressure relief devices shall be rigidly attached to the cylinder valves, cylinders, supporting standards, the building walls, or otherwise rigidly secured, and shall be so installed or protected from the elements.

Storage of LPG Containers

Storage of LPG within buildings is prohibited.

Storage Outside of Buildings

Storage outside of buildings, for containers awaiting use, shall be located from the nearest building or group of buildings, in accordance with the following:

TABLE F-3

Quantity of LP-Gas Stored	Distance (feet)
500 lbs. or less	0
501 to 6,000 lbs.	10
6,001 to 10,000 lbs.	20
Over 10,000 lbs	25

Containers shall be in a suitable ventilated enclosure or otherwise protected against tampering.

Fire Protection

Storage locations shall be provided with at least one approved portable fire extinguisher having a rating of not less than 20-B:C.

Systems Utilizing Containers Other Than DOT Containers

This paragraph applies specifically to systems utilizing storage containers other than those constructed in accordance with DOT specifications. Paragraph (b) of this section applies to this paragraph unless otherwise noted in paragraph (b) of this section.

Containers with foundations attached (portable or semiportable containers with suitable steel "runners" or "skids" and popularly known in the industry as "skid tanks") shall be designed, installed, and used in accordance with these rules subject to the following provisions:

i. If they are to be used at a given general location for a temporary period not to exceed 6 months they need not have fire-resisting foundations or saddles but shall have adequate ferrous metal supports.

ii. They shall not be located with the outside bottom of the container shell more than 5 feet (1.52 m) above the surface of the ground unless fire-resisting supports are provided.

iii. The bottom of the skids shall not be less than 2 inches (5.08 cm) or more than 12 inches (30.48 cm) below the outside bottom of the container shell.

iv. Flanges, nozzles, valves, fittings, and the like, having communication with the interior of the container, shall be protected against physical damage.

v. When not permanently located on fire-resisting foundations, piping connections shall be sufficiently flexible to minimize the possibility of breakage or leakage of connections if the container settles, moves, or is otherwise displaced.

vi. Skids, or lugs for attachment of skids, shall be secured to the container in accordance with the code or rules under which the container is designed and built (with a minimum factor of safety of four) to withstand loading in any direction equal to four times the weight of the container and attachments when filled to the maximum permissible loaded weight.

Field welding where necessary shall be made only on saddle plates or brackets which were applied by the manufacturer of the tank.

Marking of Gas Cylinders

When LP-Gas and one or more other gases are stored or used in the same area, the containers shall be marked to identify their content. Marking shall be in compliance with American National Standard Z48.1-1954, Method of Marking Portable Compressed Gas Containers To Identify the Material Contained.

Damage From Vehicles

When damage to LP-Gas systems from vehicular traffic is a possibility, precautions against such damage shall be taken.

Temporary Heating Devices – §1926.154

Ventilation

Fresh air shall be supplied in sufficient quantities to maintain the health and safety of workers. Where natural means of fresh air supply is inadequate, mechanical ventilation shall be provided.

When heaters are used in confined spaces, special care shall be taken to provide sufficient ventilation in order to ensure proper combustion, maintain the health and safety of workers, and limit temperature rise in the area.

Clearance and Mounting

Heaters not suitable for use on wood floors shall not be set directly upon them or other combustible materials. When such heaters are used, they shall rest on suitable heat insulating material or at least 1-inch concrete, or equivalent. The insulating material shall extend beyond the heater 2 feet or more in all directions.

Heaters used in the vicinity of combustible tarpaulins, canvas, or similar coverings shall be located at least 10 feet from the coverings. The coverings shall be securely fastened to prevent ignition or upsetting of the heater due to wind action on the covering or other material.

Stability

Heaters, when in use, shall be set horizontally level, unless otherwise permitted by the manufacturer's markings.

Solid Fuel Salamanders

Solid fuel salamanders are prohibited in buildings and on scaffolds.

Oil-Fired Heaters

Flammable liquid-fired heaters shall be equipped with a primary safety control to stop the flow of fuel in the event of flame failure. Barometric or gravity oil feed shall not be considered a primary safety control.

Heaters designed for barometric or gravity oil feed shall be used only with the integral tanks.

Heaters specifically designed and approved for use with separate supply tanks may be directly connected for gravity feed, or an automatic pump, from a supply tank.

SCAFFOLDING

On August 30, 1996, OSHA issued revised scaffold standards, known as "Safety Standards for Scaffolds Used in the Construction Industry", and found in Title 29 Code of Federal Regulations (CFR) Part 1926, Subpart L. The following information applies to the previous standard. While it still contains relevant safety information, the reader should refer to the current Standard for compliance.

See Scaffolding Safety and Health Topics site.

Scaffolding – §1926.451(1)

General Requirements

Scaffolds shall be erected in accordance with requirements of this section.

The footing or anchorage for scaffolds shall be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Unstable objects such as barrels, boxes, loose brick, or concrete blocks, shall not be used to support scaffolds or planks.

No scaffold shall be erected, moved, dismantled, or altered except under the supervision of competent persons.

Guardrails and toeboards shall be installed on all open sides and ends of platforms more than 10 feet above the ground or floor, except needle beam scaffolds and floats [see paragraphs (p) and (w) of this section]. Scaffolds 4 feet to 10 feet in height, having a minimum horizontal dimension in either direction of less than 45 inches, shall have standard guardrails installed on all open sides and ends of the platform.

Guardrails shall be 2 x 4 inches, or the equivalent, approximately 42 inches high, with a midrail, when required. Supports shall be at intervals not to exceed 8 feet. Toeboards shall be a minimum of 4 inches in height.

Where persons are required to work or pass under the scaffold, scaffolds shall be provided with a screen between the toeboard and the guardrail, extending along the entire opening, consisting of No. 18 gauge U.S. Standard wire = - inch mesh, or the equivalent.

Scaffolds and their components shall be capable of supporting without failure at least 4 times the maximum intended load.

Any scaffold including accessories such as braces, brackets, trusses, screw legs, ladders, etc. damaged or weakened from any cause shall be immediately repaired or replaced.

All load-carrying timber members of scaffold framing shall be a minimum of 1,500 fiber (Stress Grade) construction grade lumber. All dimensions are nominal sizes as provided in the American Lumber Standards, except that where rough sizes are noted, only rough or undressed lumber of the size specified will satisfy minimum requirements.

All planking shall be Scaffold Grades, or equivalent, as recognized by approved grading rules for the species of wood used.

The maximum permissible span for 1 <- x 9-inch or wider plank of full thickness shall be 4 feet with medium duty loading of 50 p.s.f.

All planking of platforms shall be overlapped (minimum 12 inches), or secured from movement.

An access ladder or equivalent safe access shall be provided.

Scaffold planks shall extend over their end supports not less than 6 inches nor more than 12 inches.

The poles, legs, or uprights of scaffolds shall be plumb, and securely and rigidly braced to prevent swaying and displacement.

Overhead protection shall be provided for employees on a scaffold exposed to overhead hazards.

Slippery conditions on scaffolds shall be eliminated as soon as possible after they occur.

No welding, burning, riveting, or open flame work shall be performed on any staging suspended by means of fiber or synthetic rope. Only treated or protected fiber or synthetic ropes shall be used for or near any work involving the use of corrosive substances or chemicals. Specific requirements for boatswain's chairs and float or ship scaffolds are contained in paragraphs (l) and (w) of this section.

Wire, synthetic, or fiber rope used for scaffold suspension shall be capable of supporting at least 6 times the rated load.

The use of shore or lean-to scaffolds is prohibited.

Lumber sizes, when used in this subpart, refer to nominal sizes except where otherwise stated.

Materials being hoisted onto a scaffold shall have a tag line.

Employees shall not work on scaffolds during storms or high winds.

Tools, materials, and debris shall not be allowed to accumulate in quantities to cause a hazard.

Wood Pole Scaffolds

Scaffold poles shall bear on a foundation of sufficient size and strength to spread the load from the pole over a sufficient area to prevent settlement. All poles shall be set plumb.

Where wood poles are spliced, the ends shall be squared and the upper section shall rest squarely on the lower section. Wood splice plates shall be provided on at least two adjacent sides and shall be not less than 4 feet in length, overlapping the abutted ends equally, and have the same width and not less than the cross-sectional area of the pole. Splice plates or other materials of equivalent strength may be used.

Independent pole scaffolds shall be set as near to the wall of the building as practicable.

All pole scaffolds shall be securely guyed or tied to the building or structure. Where the height or length exceeds 25 feet, the scaffold shall be secured at intervals not greater than 25 feet vertically and horizontally. And the ends shall be secured to prevent their dislodgment.

When a scaffold materially changes its direction, the platform planks shall be laid to prevent tipping. The planks that meet the corner putlog at an angle shall be laid first, extending over the diagonally placed putlog far enough to have a good safe bearing, but not far enough to involve any danger from tipping. The planking running in the opposite direction at an angle shall be laid so as to extend over and rest on the first layer of planking.

When moving platforms to the next level, the old platform shall be left undisturbed until the new putlogs or bearers have been set in place, ready to receive the platform planks.

Guardrails, made of lumber not less than 2 x 4 inches (or other material providing equivalent protection), approximately 42 inches high, with a midrail of 1 x 6 inch lumber (or other material providing equivalent protection), and toeboards, shall be installed at all open sides and ends on all scaffolds more than 10 feet

above the ground or floor. Toe boards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a)(6) of this section, when required.

All wood pole scaffolds 60 feet or less in height shall be constructed and erected in accordance with Tables L-4 to 10. If they are over 60 feet in height, they shall be designed by a qualified engineer competent in this field, and it shall be constructed and erected in accordance with such design.

Tube and Coupler Scaffolds

A light duty tube and coupler scaffold shall have all posts, bearers, runners, and bracing of nominal 2-inch O.D. steel tubing. The posts shall be spaced no more than 6 feet apart by 10 feet along the length of the scaffold. Other structural metals when used must be designed to carry an equivalent load. No dissimilar metals shall be used together.

A medium duty tube and coupler scaffold shall have all posts, runners, and bracing of nominal 2-inch O.D. steel tubing. Posts spaced not more than 6 feet apart by 8 feet along the length of the scaffold shall have bearers of nominal 2 =-inch O.D. steel tubing. Posts spaced not more than 5 feet apart by 8 feet along the length of the scaffold shall have bearers of nominal 2-inch O.D. steel tubing. Other structural metals, when used, must be designed to carry an equivalent load. No dissimilar metals shall be used together.

A heavy duty tube and coupler scaffold shall have all posts, runners, and bracing of nominal 2-inch O.D. steel tubing, with the posts spaced not more than 6 feet by 6 feet-6 inches. Other structural metals, when used, must be designed to carry an equivalent load. No dissimilar metals shall be used together.

Tube and coupler scaffolds shall be limited in heights and working levels to those permitted in Tables L-10, 11, and 12. Drawings and specifications of all tube and coupler scaffolds above the limitations in Tables L-10, 11, and 12 shall be designed by a qualified engineer competent in this field.

All tube and coupler scaffolds shall be constructed and erected to support four times the maximum intended loads, as set forth in Tables L-10, 11, and 12, or as set forth in the specifications by a licensed professional engineer competent in this field.

Posts shall be accurately spaced, erected on suitable bases, and maintained plumb.

Runners shall be erected along the length of the scaffold, located on both the inside and the outside posts at even height. Runners shall be interlocked to the inside and the outside posts at even heights. Runners shall be interlocked to form continuous lengths and coupled to each post. The bottom runners shall be located as close to the base as possible. Runners shall be placed not more than 6 feet-6 inches on centers.

Bearers shall be installed transversely between posts and shall be securely coupled to the posts bearing on the runner coupler. When coupled directly to the runners, the coupler must be kept as close to the posts as possible.

Bearers shall be at least 4 inches but not more than 12 inches longer than the post spacing or runner spacing.

Cross bracing shall be installed across the width of the scaffold at least every third set of posts horizontally and every fourth runner vertically. Such bracing shall extend diagonally from the inner and outer runners upward to the next outer and inner runners.

Longitudinal diagonal bracing on the inner and outer rows of poles shall be installed at approximately a

45 deg. angle from near the base of the first outer post upward to the extreme top of the scaffold. Where the longitudinal length of the scaffold permits, such bracing shall be duplicated beginning at every fifth post. In a similar manner, longitudinal diagonal bracing shall also be installed from the last post extending back and upward toward the first post. Where conditions preclude the attachment of this bracing to the posts, it may be attached to the runners.

The entire scaffold shall be tied to and securely braced against the building at intervals not to exceed 30 feet horizontally and 26 feet vertically.

Guardrails, made of lumber not less than 2 x 4 inches (or other material providing equivalent protection), approximately 42 inches high, with a midrail of 1 x 6 inch lumber (or other material providing equivalent protection), and toeboard shall be installed at all open sides and ends on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a)(6) of this section.

Tubular Welded Frame Scaffolds

Metal tubular frame scaffolds, including accessories such as braces, brackets, trusses, screw legs, ladders, etc., shall be designed, constructed, and erected to safely support four times the maximum rated load.

Spacing of panels or frames shall be consistent with the loads imposed.

Scaffolds shall be properly braced by cross bracing or diagonal braces, or both, for securing vertical members together laterally, and the cross braces shall be of such length as will automatically square and aline vertical members so that the erected scaffold is always plumb, square, and rigid. All brace connections shall be made secure.

Scaffold legs shall be set on adjustable bases or plain bases placed on mud sills or other foundations adequate to support the maximum rated load.

The frames shall be placed one on top of the other with coupling or stacking pins to provide proper vertical alinement of the legs.

Where uplift may occur, panels shall be locked together vertically by pins or other equivalent suitable means.

To prevent movement, the scaffold shall be secured to the building or structure at intervals not to exceed 30 feet horizontally and 26 feet vertically.

Maximum permissible spans or planking shall be in conformity with paragraph (a)(10) of this section.

Drawings and specifications for all frame scaffolds over 125 feet in height above the base plates shall be designed by a registered professional engineer.

Guardrails made of lumber, not less than 2 x 4 inches (or other material providing equivalent protection), and approximately 42 inches high, with a midrail of 1 x 6 inch lumber (or other material providing equivalent protection), and toeboards, shall be installed at all open sides and ends on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a)(6) of this section.

Manually Propelled Mobile Scaffolds

When free-standing mobile scaffold towers are used, the height shall not exceed four times the minimum base dimension.

Casters shall be properly designed for strength and dimensions to support four times the maximum intended load. All casters shall be provided with a positive locking device to hold the scaffold in position.

Scaffolds shall be properly braced by cross bracing and horizontal bracing conforming with paragraph (d)(3) of this section.

Platforms shall be tightly planked for the full width of the scaffold except for necessary entrance opening. Platforms shall be secured in place.

A ladder or stairway shall be provided for proper access and exit and shall be affixed or built into the scaffold and so located that when in use it will not have a tendency to tip the scaffold. A landing platform must be provided at intervals not to exceed 35 feet.

The force necessary to move the mobile scaffold shall be applied near or as close to the base as practicable and provision shall be made to stabilize the tower during movement from one location to another. Scaffolds shall only be moved on level floors, free of obstructions and openings.

The employer shall not allow employees to ride on manually propelled scaffolds unless the following conditions exist:

i. The floor or surface is within 3 degrees of level, and free from pits, holes, or obstructions;

ii. The minimum dimension of the scaffold base when ready for rolling, is at least one-half of the height. Outriggers, if used, shall be installed on both sides of staging;

iii. The wheels are equipped with rubber or similar resilient tires;

iv. All tools and materials are secured or removed from the platform before the mobile scaffold is moved.

Scaffolds in use by any persons shall rest upon a suitable footing and shall stand plumb. The casters or wheels shall be locked to prevent any movement.

Mobile scaffolds constructed of metal members shall also conform to applicable provisions of paragraphs (b), (c), or (d) of this section, depending on the material of which they are constructed.

Guardrails made of lumber, not less than 2 x 4 inches (or other material providing equivalent protection), approximately 42 inches high, with a midrail, of 1 x 6 inch lumber (or other material providing equivalent protection), and toeboards, shall be installed at all open sides and ends on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a)(6) of this section.

Elevating and Rotating Work Platforms

Applicable requirements of American National Standards Institute A92.2-1969, Vehicle Mounted Elevating and Rotating Work Platforms, shall be complied with for such equipment, as required by the provisions of 1926.556.

Outrigger Scaffolds

Outrigger beams shall extend not more than 6 feet beyond the face of the building. The inboard end of outrigger beams, measured from the fulcrum point to anchorage point, shall be not less than 1 = times the outboard end in length. The beams shall rest on edge, the sides shall be plumb, and the edges shall be horizontal. The fulcrum point of the beam shall rest on a secure bearing at least 6 inches in each horizontal dimension. The beam shall be secured in place against movement and shall be securely braced at the fulcrum point against tipping.

The inboard ends of outrigger beams shall be securely anchored either by means of struts bearing against sills in contact with the overhead beams or ceiling, or by means of tension members secured to the floor joists underfoot, or by both if necessary. The inboard ends of outrigger beams shall be secured against

tipping and the entire supporting structure shall be securely braced in both directions to prevent any horizontal movement.

Unless outrigger scaffolds are designed by a registered professional engineer competent in this field, they shall be constructed and erected in accordance with Table L-13. Outrigger scaffolds, designed by a registered professional engineer, shall be constructed and erected in accordance with such design.

Planking shall be laid tight and shall extend to within 3 inches of the building wall. Planking shall be secured to the beams.

Guardrails made of lumber, not less than 2 x 4 inches (or other material providing equivalent protection), approximately 42 inches high, with a midrail of 1 x 6 inch lumber (or other material providing equivalent protection), and toeboards, shall be installed at all open sides and ends on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a)(6) of this section.

Masons' Adjustable Multiple-Point Suspension Scaffolds

The scaffold shall be capable of sustaining a working load of 50 pounds per square foot and shall not be loaded in excess of that figure.

The scaffold shall be provided with hoisting machines that meet the requirements of Underwriters' Laboratories or Factory Mutual Engineering Corporation.

The platform shall be supported by wire ropes, capable of supporting at least 6 times the intended load, suspended from overhead outrigger beams.

The scaffold outrigger beams shall consist of structural metal securely fastened or anchored to the frame or floor system of the building or structure.

Each outrigger beam shall be equivalent in strength to at least a standard 7-inch, 15.3-pound steel I-beam, at least 15 feet long, and shall not project more than 6 feet 6 inches beyond the bearing point.

Where the overhang exceeds 6 feet 6 inches, outrigger beams shall be composed of stronger beams or multiple beams and be installed under the supervision of a competent person.

All outrigger beams shall be set and maintained with their webs in a vertical position.

A stop bolt shall be placed at each end of every outrigger beam.

The outrigger beam shall rest on suitable wood bearing blocks.

The free end of the suspension wire ropes shall be equipped with proper size thimbles and secured by splicing or other equivalent means. The running ends shall be securely attached to the hoisting drum and at least four turns of wire rope shall at all times remain on the drum. The use of fiber rope is prohibited.

Where a single outrigger beam is used, the steel shackles or clevises with which the wire ropes are attached to the outrigger beams shall be placed directly over the hoisting drums.

The scaffold platform shall be equivalent in strength to at least 2-inch planking. [For maximum planking spans, see paragraph (a)(11) of this section.]

When employees are at work on the scaffold and an overhead hazard exists, overhead protection shall be provided on the scaffold, not more than 9 feet above the platform, consisting of 2-inch planking, or material of equivalent strength, laid tight, and extending not less than the width of the scaffold.

Each scaffold shall be installed or relocated under the supervision of a competent person.

Guardrails made of lumber, not less than 2 x 4 inches (or other material providing equivalent protection), approximately 42 inches high, with a midrail, and toeboards, shall be installed at all open sides and ends on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a)(6) of this section.

(Swinging Scaffolds) Two-Point Suspension

Two-point suspension scaffold platforms shall be not less than 20 inches nor more than 36 inches wide overall. The platform shall be securely fastened to the hangers by U-bolts or by other equivalent means.

The hangers of two-point suspension scaffolds shall be made of mild steel, or other equivalent materials, having a cross-sectional area capable of sustaining 4 times the maximum rated load, and shall be designed with a support for guardrail, intermediate rail, and toeboard.

When hoisting machines are used on two-point suspension scaffolds, such machines shall be of a design tested and approved by Underwriters' Laboratories or Factory Mutual Engineering Corporation.

The roof irons or hooks shall be of mild steel, or other equivalent material, of proper size and design, securely installed and anchored. Tiebacks of >-inch manila rope, or the equivalent, shall serve as a secondary means of anchorage, installed at right angles to the face of the building, whenever possible, and secured to a structurally sound portion of the building.

Two-point suspension scaffolds shall be suspended by wire, synthetic, or fiber ropes capable of supporting at least 6 times the rated load. All other components shall be capable of supporting at least four times the rated load.

The sheaves of all blocks, consisting of at least one double and one single block, shall fit the size and type of rope used.

All wire ropes, fiber and synthetic ropes, slings, hangers, platforms, and other supporting parts shall be inspected before every installation. Periodic inspections shall be made while the scaffold is in use.

On suspension scaffolds designed for a working load of 500 pounds, no more than two employees shall be permitted to work at one time. On suspension scaffolds with a working load of 750 pounds, no more than three employees shall be permitted to work at one time. Each employee shall be protected by an approved safety life belt attached to a lifeline. The lifeline shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines, which will safely suspend the employee in case of a fall. In order to keep the lifeline continuously attached, with a minimum of slack, to a fixed structure, the attachment point of the lifeline shall be appropriately changed as the work progresses.

Two-point suspension scaffolds shall be securely lashed to the building or structure to prevent them from swaying. Window cleaners' anchors shall not be used for this purpose.

The platform of every two-point suspension scaffold shall be one of the following types:

i. "Ladder-type platforms." The side stringer shall be of clear straight-grained spruce or materials of equivalent strength and durability. The rungs shall be of straight-grained oak, ash, or hickory, at least 1 -inch in diameter, with -inch tenons mortised into the side stringers at least seven-eighths inch. The stringers shall be tied together with tie rods not less than one-quarter inch in diameter, passing through the stringers and riveted up tight against washers on both ends. The flooring strips shall be spaced not more than five-eighths inch apart except at the side rails where the space may be 1 inch. Ladder-type platforms shall be constructed in accordance with Table L-14.

ii. "Plank-type platforms." Plank-type platforms shall be composed of not less than nominal 2- x 10-inch unspliced planks, properly cleated together on the underside, starting 6 inches from each end;

intervals in between shall not exceed 4 feet. The plank-type platform shall not extend beyond the hangers more than 12 inches. A bar or other effective means shall be securely fastened to the platform at each end to prevent its slipping off the hanger. The span between hangers for plank-type platforms shall not exceed 8 feet.

iii. "Beam-type platforms." Beam platforms shall have side stringers of lumber not less than 2 x 6 inches set on edge. The span between hangers shall not exceed 12 feet when beam platforms are used. The flooring shall be supported on 2- x 6-inch cross beams, laid flat and set into the upper edge of the stringers with a snug fit, at intervals of not more than 4 feet, securely nailed in place. The flooring shall be of 1- x 6-inch material properly nailed. Floor boards shall not be spaced more than one-half inch apart.

iv. "Light metal-type platforms," when used, shall be tested and listed according to Underwriters' Laboratories or Factory Mutual Engineering Corporation.

Guardrails made of lumber, not less than 2 x 4 inches (or other material providing equivalent protection), approximately 42 inches high, with a midrail, and toeboards, shall be installed at all open sides and ends on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a)(6) of this section.

Stone Setters' Adjustable Multiple-Point Suspension Scaffolds

The scaffold shall be capable of sustaining a working load of 25 pounds per square foot and shall not be overloaded. Scaffolds shall not be used for storage of stone or other heavy materials.

When used, the hoisting machine and its supports shall be of a type tested and listed by Underwriters' Laboratories or Factory Mutual Engineering Corporation.

The platform shall be securely fastened to the hangers by U-bolts or other equivalent means. [For materials and spans, see subdivision (ii) of paragraph (i)(10), Plank-Type Platforms, and Table L-14 of this section.]

The scaffold unit shall be suspended from metal outriggers, iron brackets, wire rope slings, or iron hooks.

Outriggers, when used, shall be set with their webs in a vertical position, securely anchored to the building or structure and provided with stop bolts at each end.

The scaffold shall be supported by wire rope capable of supporting at least 6 times the rated load. All other components shall be capable of supporting at least 4 times the rated load.

The free ends of the suspension wire ropes shall be equipped with proper size thimbles, secured by splicing or other equivalent means. The running ends shall be securely attached to the hoisting drum and at least four turns of wire rope shall remain at the drum at all times.

When two or more scaffolds are used on a building or structure, they shall not be bridged one to the other, but shall be maintained at even height with platforms abutting closely.

Guardrails made of lumber, not less than 2 x 4 inches (or other material providing equivalent protection), approximately 42 inches high, with a midrail, and toeboards, shall be installed at all open sides and ends on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a)(6) of this section.

Single-Point Adjustable Suspension Scaffolds

The scaffolding, including power units or manually operated winches, shall be of a type tested and listed by Underwriters' Laboratories or Factory Mutual Engineering Corporation.

The power units may be either electrically or air motor driven.

All power-operated gears and brakes shall be enclosed.

In addition to the normal operating brake, all power-driven units shall have an emergency brake which engages automatically when the normal speed of descent is exceeded.

The hoisting machines, cables, and equipment shall be regularly serviced and inspected.

The units may be combined to form a two-point suspension scaffold. Such scaffold shall then comply with paragraph (i) of this section.

The supporting cable shall be vertical for its entire length, and the basket shall not be swayed nor the cable fixed to any intermediate points to change the original path of travel.

Suspension methods shall conform to applicable provisions of paragraphs (h) and (i) of this section.

Guards, midrails, and toeboards shall completely enclose the cage or basket. Guardrails shall be no less than 2 x 4 inches or the equivalent, approximately 42 inches above the platform. Midrails shall be 1 x 6 inches or the equivalent, installed equidistant between the guardrail and the platform. Toeboards shall be a minimum of 4 inches in height.

For additional details not covered in this paragraph, applicable technical portions of American National Standards Institute, A120.1-1970, Power-Operated Devices for Exterior Building Maintenance Powered Platforms, shall be used.

Boatswain's Chairs

The chair seat shall not be less than 12 x 24 inches, and 1-inch thickness. The seat shall be reinforced on the underside by cleats securely fastened to prevent the board from splitting.

The two fiber rope seat slings shall be of -inch diameter, reeved through the four seat holes so as to cross each other on the underside of the seat.

Seat slings shall be of at least $^{6}/_{8}$-inch wire rope when an employee is conducting a heat-producing process, such as gas or arc welding.

The employee shall be protected by a safety belt and lifeline in accordance with 1926.104. The attachment point of the lifeline to the structure shall be appropriately changed as the work progresses.

The tackle shall consist of correct size ball bearing or bushed blocks and properly spliced -inch diameter first-grade manila rope, or equivalent.

The roof irons, hooks, or the object to which the tackle is anchored, shall be securely installed. Tiebacks, when used, shall be installed at right angles to the face of the building and securely fastened.

Carpenters' Bracket Scaffolds

The brackets shall consist of a triangular wood frame not less than 2 x 3 inches in cross section, or of metal of equivalent strength. Each member shall be properly fitted and securely joined.

Each bracket shall be attached to the structure by means of one of the following:

i. A bolt, no less than five-eighths inch in diameter, which shall extend through to the inside of the building wall;

ii. A metal stud attachment device; extending from the bottom of each square to the top of the next square, shall be provided on both front and rear sides of the scaffold.

Platform planks shall be at least 2- x 10-inch nominal size. The ends of the planks shall overlap the bearers of the squares and each plank shall be supported by not less than three squares.

Bricklayers' square scaffolds shall not exceed three tiers in height and shall be so constructed and arranged that one square shall rest directly above the other. The upper tiers shall stand on a continuous row of planks laid across the next lower tier and be nailed down or otherwise secured to prevent displacement.

Scaffolds shall be level and set upon a firm foundation.

Horse Scaffolds

Horse scaffolds shall not be constructed or arranged more than two tiers or 10 feet in height.

The members of the horses shall be not less than those specified in Table L-16.

Horses shall be spaced not more than 5 feet for medium duty and not more than 8 feet for light duty.

When arranged in tiers, each horse shall be placed directly over the horse in the tier below.

On all scaffolds arranged in tiers, the legs shall be nailed down or otherwise secured to the planks to prevent displacement or thrust and each tier shall be substantially cross braced.

Horses or parts which have become weak or defective shall not be used.

Guardrails made of lumber, not less than 2 x 4 inches (or other material providing equivalent protection), approximately 42 inches high, with a midrail, of 1 x 6 inch lumber (or other material providing equivalent protection), and toeboards, shall be installed at all open sides and ends on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a)(6) of this section.

Needle Beam Scaffold

Wood needle beams shall be not less than 4 x 6 inches in size, with the greater dimension placed in a vertical direction. Metal beams or the equivalent, conforming to paragraphs (a)(8) and (10) of this section, may be used and shall not be altered or moved horizontally while they are in use.

Ropes or hangers shall be provided for supports. The span between supports on the needle beam shall not exceed 10 feet for 4- x 6-inch timbers. Rope supports shall be equivalent in strength to 1-inch diameter first-grade manila rope.

The ropes shall be attached to the needle beams by a scaffold hitch or a properly made eye splice. The loose end of the rope shall be tied by a bowline knot or by a round turn and a half hitch.

The scaffold hitch shall be arranged so as to prevent the needle beam from rolling or becoming otherwise displaced.

The platform span between the needle beams shall not exceed 8 feet when using 2-inch scaffold plank. For spans greater than 8 feet, platforms shall be designed based on design requirements for the special span. The overhang of each end of the platform planks shall be not less than 6 inches and not more than 12 inches.

When needle beam scaffolds are used, the planks shall be secured against slipping.

All unattached tools, bolts, and nuts used on needle beam scaffolds shall be kept in suitable containers, properly secured.

One end of a needle beam scaffold may be supported by a permanent structural member conforming to paragraphs (a)(8) and (10) of this section.

Each employee working on a needle beam scaffold shall be protected by a safety belt and lifeline in accordance with 1926.104.

Plasterers', Decorators', and Large Area Scaffolds

Plasterers', lathers', and ceiling workers' inside scaffolds shall be constructed in accordance with the general requirements set forth for independent wood pole scaffolds. [See paragraph (b) and Tables L-7, 8, and 9 of this section.]

All platform planks shall be laid with the edges close together.

When independent pole scaffold platforms are erected in sections, such sections shall be provided with connecting runways equipped with substantial guardrails.

Guardrails made of lumber, not less than 2 x 4 inches (or other material providing equivalent protection), approximately 42 inches high, with a midrail of 1 x 6 inch lumber (or other material providing equivalent protection), and toeboards, shall be installed on all open sides and ends of all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a)(6) of this section.

Interior Hung Scaffolds

An interior hung scaffold shall be hung or suspended from the roof structure or ceiling beams.

The suspending wire or fiber rope shall be capable of supporting at least 6 times the rated load. The rope shall be wrapped at least twice around the supporting members and twice around t he bearers of the scaffold, with each end of the wire rope secured by at least three standard wire-rope clips properly installed.

For hanging wood scaffolds, the following minimum nominal size material shall be used:

i. Supporting bearers 2 x 10 inches on edge;

ii. Planking 2 x 10 inches, with maximum span 7 feet for heavy duty and 10 feet for light duty or medium duty.

Steel tube and coupler members may be used for hanging scaffolds with both types of scaffold designed to sustain a uniform distributed working load up to heavy duty scaffold loads with a safety factor of four.

Guardrails made of lumber, not less than 2 x 4 inches (or other material providing equivalent protection), approximately 42 inches high, with a midrail of 1 x 6 inch lumber (or other material providing equivalent protection), and toeboards, shall be installed at all open sides and ends on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a)(6) of this section.

Ladder Jack Scaffolds

All ladder jack scaffolds shall be limited to light duty and shall not exceed a height of 20 feet above the floor or ground.

All ladders used in connection with ladder jack scaffolds shall be heavy-duty ladders and shall be designed and constructed in accordance with American National Standards Institute A 14.1-1968, Safety Code for Portable Wood Ladders, and A 14.2-1968, Safety Code for Portable Metal Ladders. Cleated ladders shall not be used for this purpose.

The ladder jack shall be so designed and constructed that it will bear on the side rails in addition to the ladder rungs, or if bearing on rungs only, the bearing area shall be at least 10 inches on each rung.

Ladders used in conjunction with ladder jacks shall be so placed, fastened, held, or equipped with devices so as to prevent slipping.

The wood platform planks shall be not less than 2 inches nominal in thickness. Both metal and wood platform planks shall overlap the bearing surface not less than 12 inches. The span between supports for wood shall not exceed 8 feet. Platform width shall be not less than 18 inches.

Not more than two employees shall occupy any given 8 feet of any ladder jack scaffold at any one time.

Window Jack Scaffolds

Window jack scaffolds shall be used only for the purpose of working at the window opening through which the jack is placed.

Window jacks shall not be used to support planks placed between one window jack and another or for other elements of scaffolding.

Window jack scaffolds shall be provided with guardrails unless safety belts with lifelines are attached and provided for employee.

Not more than one employee shall occupy a window jack scaffold at any one time.

Roofing Brackets

Roofing brackets shall be constructed to fit the pitch of the roof. Brackets shall be secured in place by nailing in addition to the pointed metal projections. When it is impractical to nail brackets, rope supports shall be used. When rope supports are used, they shall consist of first-grade manila of at least >-inch diameter, or equivalent.

A catch platform shall be installed below the working area of roofs more than 16 feet from the ground to eaves with a slope greater than 4 inches in 12 inches without a parapet. In width, the platform shall extend 2 feet beyond the protection of the eaves and shall be provided with a guardrail, midrail, and toeboard. This provision shall not apply where employees engaged in work upon such roofs are protected by a safety belt attached to a lifeline.

Crawling Boards or Chicken Ladders

Crawling boards shall be not less than 10 inches wide and 1 inch thick, having cleats 1 x 1 = inches. The cleats shall be equal in length to the width of the board and spaced at equal intervals not to exceed 24 inches. Nails shall be driven through and clinched on the underside. The crawling board shall extend from the ridge pole to the eaves when used in connection with roof construction, repair, or maintenance.

A firmly fastened lifeline of at least >-inch diameter rope, or equivalent, shall be strung beside each crawling board for a handhold.

Crawling boards shall be secured to the roof by means of adequate ridge hooks or other effective means.

Float or Ship Scaffolds

Float or ship scaffolds shall not be used to support more than three men and a few light tools, such as those needed for riveting, bolting, and welding. They shall be constructed as designed in paragraphs (w) (2) through (6) of this section unless substitute designs and materials provide equivalent strength, stability, and safety.

The platform shall be not less than 3 feet wide and 6 feet long, made of >-inch plywood, equivalent to American Plywood Association Grade B-B, Group I, Exterior, or other similar material.

Under the platform, there shall be two supporting bearers made from 2- x 4-inch, or 1- x 10-inch, rough, “selected lumber,” or better. They shall be free of knots or other flaws and project 6 inches beyond the platform on both sides. The ends of the platform shall extend 6 inches beyond the outer edges of the bearers. Each bearer shall be securely fastened to the platform.

An edging of wood not less than ¾ x 1 = inches or equivalent shall be placed around all sides of the platform to prevent tools from rolling off.

Supporting ropes shall be 1-inch diameter manila rope or equivalent, free from deterioration, chemical damage, flaws, or other imperfections. Rope connections shall be such that the platform cannot shift or slip. If two ropes are used with each float, they shall be arranged so as to provide four ends which are to be securely fastened to an overhead support. Each of the two supporting ropes shall be hitched around one end of bearer and pass under the platforms to the other end of the bearer where it is hitched again, leaving sufficient rope at each end for the supporting ties.

Each employee shall be protected by an approved safety lifebelt and lifeline, in accordance with 1926.104.

Form Scaffolds

Form scaffolds shall be constructed of wood or other suitable materials, such as steel or aluminum members of known strength characteristics. All scaffolds shall be designed and erected with a minimum safety factor of 4, computed on the basis of the maximum rated load.

All scaffold planking shall be a minimum of 2- x 10-inch nominal Scaffold Grade, as recognized by approved grading rules for the species of lumber used, or equivalent material. Maximum permissible spans shall not exceed 8 feet on centers for 2- x 10-inch nominal planking. Scaffold planks shall be either nailed or bolted to the ledgers or of such length that they overlap the ledgers at least 6 inches. Unsupported projecting ends of scaffolding planks shall be limited to a maximum overhang of 12 inches.

Scaffolds shall not be loaded in excess of the working load for which they were designed.

Figure-four form scaffolds:

i. Figure-four scaffolds are intended for light duty and shall not be used to support loads exceeding 25 pounds per square foot unless specifically designed for heavier loading. For minimum design criteria, see Table L-17.

ii. Figure-four form scaffold frames shall be spaced not more than 8 feet on centers and constructed from sound lumber, as follows: The outrigger ledger shall consist of two pieces of 1- x 6-inch or heavier material nailed on opposite sides of the vertical form support. Ledgers shall project not more than 3 feet 6 inches from the outside of the form support and shall be substantially braced and secured to prevent tipping or turning. The knee or angle brace shall intersect the ledger at least 3 feet from the form at an angle of approximately 45 deg., and the lower end shall be nailed to a vertical support. The platform shall consist of two or more 2- x 10-inch planks, which shall be of such length that they extend at least 6 inches beyond ledgers at each end unless secured to the ledgers. When planks are secured to the ledgers (nailed or bolted), a wood filler strip shall be used between the ledgers. Unsupported projecting ends of planks shall be limited to an overhang of 12 inches.

Metal bracket form scaffolds:

i. Metal brackets or scaffold jacks which are an integral part of the form shall be securely bolted or welded to the form. Folding type brackets shall be either bolted or secured with a locking-type pin when extended for use.

ii. “Clip-on” or “hook-over” brackets may be used, provided the form walers are bolted to the form or secured by snap ties or shea-bolt extending through the form and securely anchored.

iii. Metal brackets shall be spaced not more than 8 feet on centers.

iv. Scaffold planks shall be either bolted to the metal brackets or of such length that they overlap the brackets at each end by at least 6 inches. Unsupported projecting ends of scaffold planks shall be limited to a maximum overhang of 12 inches.

v. Metal bracket form scaffolds shall be equipped with wood guardrails, intermediate rails, toeboards, and scaffold planks meeting the minimum dimensions shown in Table L-18. (Metal may be substituted for wood, providing it affords equivalent or greater design strength.)

Wooden bracket form scaffolds:

i. Wooden bracket form scaffolds shall be an integral part of the form panel. The minimum design criteria set forth herein and in Table L-19 cover scaffolding intended for light duty and shall not be used to support loads exceeding 25 pounds per square foot, unless specifically designed for heavier loading.

ii. Scaffold planks shall be either nailed or bolted to the ledgers or of such length that they overlap the ledgers at each end by at least 6 inches. Unsupported projecting ends of scaffold planks shall be limited to a maximum overhang of 12 inches.

iii. Guardrails and toeboards shall be installed on all open sides and ends of platforms and scaffolding over 10 feet above floor or ground. Guardrails shall be made of lumber 2 x 4 inch nominal dimension (or other material providing equivalent protection), approximately 42 inches high, supported at intervals not to exceed 8 feet. Guardrails shall be equipped with midrails constructed of 1 x 6 inch nominal lumber (or other material providing equivalent protection). Toeboards shall extend not less than 4 inches above the scaffold plank.

Pump Jack Scaffolds

Pump jack scaffolds shall:

i. Not carry a working load exceeding 500 pounds; and

ii. Be capable of supporting without failure at least four times the maximum intended load.

iii. The manufactured components shall not be loaded in excess of the manufacturer's recommended limits.

Pump jack brackets, braces, and accessories shall be fabricated from metal plates and angles. Each pump jack bracket shall have two positive gripping mechanisms to prevent any failure or slippage.

The platform bracket shall be fully decked and the planking secured. Planking, or equivalent, shall conform with paragraph (a) of this section.

When wood scaffold planks are used as platforms, poles used for pump jacks shall not be spaced more than 10 feet center to center. When fabricated platforms are used that fully comply with all other provisions of this paragraph (y), pole spacing may exceed 10 feet center to center.

Poles shall not exceed 30 feet in height.

Poles shall be secured to the work wall by rigid triangular bracing, or equivalent, at the bottom, top, and other points as necessary, to provide a maximum vertical spacing of not more than 10 feet between braces. Each brace shall be capable of supporting a minimum of 225 pounds tension or compression.

For the pump jack bracket to pass bracing already installed, an extra brace shall be used approximately 4 feet above the one to be passed until the original brace is reinstalled.

All poles shall bear on mud sills or other adequate firm foundations.

Pole lumber shall be two 2 x 4's, of Douglas fir, or equivalent, straight-grained, clear, free of cross-grain, shakes, large loose or dead knots, and other defects which might impair strength.

When poles are constructed of two continuous lengths, they shall be two by fours, spiked together with the seam parallel to the bracket, and with 10d common nails, no more than 12 inches center to center, staggered uniformly from opposite outside edges.

If two by fours are spliced to make up the pole, the splices shall be so constructed as to develop the full strength of the member.

A ladder, in accordance with 1926.1053, shall be provided for access to the platform during use.

Not more than two persons shall be permitted at one time upon a pump jack scaffold between any two supports.

Pump jacks scaffolds shall be provided with standard guardrails as defined in 1926.451(a)(5), but no guardrail is required when safety belts with lifelines are provided for employees.

When a work bench is used at an approximate height of 42 inches, the top guardrail may be eliminated, if the work bench is fully decked, the planking secured, and is capable of withstanding 200 pounds force in any direction.

Employees shall not be permitted to use a work bench as a scaffold platform.

Definitions Applicable to this Subpart – §1926.452

Bearer. A horizontal member of a scaffold upon which the platform rests and which may be supported by ledgers.

Boatswain's Chair. A seat supported by slings attached to a suspended rope, designed to accommodate one worker in a sitting position.

Brace. A tie that holds one scaffold member in a fixed position with respect to another member.

Bricklayers' Square Scaffold. A scaffold composed of framed wood squares which support a platform, limited to light and medium duty.

Carpenters' Bracket Scaffold. A scaffold consisting of wood or metal brackets supporting a platform.

Coupler. A device for locking together the component parts of a tubular metal scaffold. (The material used for the couplers shall be of a structural type, such as a drop-forged steel, malleable iron, or structural grade aluminum.)

Crawling Board or Chicken Ladder. A plank with cleats spaced and secured at equal intervals, for use by a worker on roofs, not designed to carry any material.

Double Pole or Independent Pole Scaffold. A scaffold supported from the base by a double row of uprights, independent of support from the walls and constructed of uprights, ledgers, horizontal platform bearers, and diagonal bracing.

Float or Ship Scaffold. A scaffold hung from overhead supports by means of ropes and consisting of a substantial platform having diagonal bracing underneath, resting upon and securely fastened to two parallel plank bearers at right angles to the span.

Guardrail. A rail secured to uprights and erected along the exposed sides and ends of platforms.

Heavy Duty Scaffold. A scaffold designed and constructed to carry a working load not to exceed 75 pounds per square foot.

Horse Scaffold. A scaffold for light or medium duty, composed of horses supporting a work platform.

Interior Hung Scaffold. A scaffold suspended from the ceiling or roof structure.

Ladder Jack Scaffold. A light duty scaffold supported by brackets attached to ladders.

Ledgers (stringers). A horizontal scaffold member which extends from post to post and which supports the putlogs or bearers forming a tie between the posts.

Light duty scaffold. A scaffold designed and constructed to carry a working load not to exceed 25 pounds per square foot.

Manually Propelled Mobile Scaffold. A portable rolling scaffold supported by casters.

Masons' Adjustable Multiple-Point Suspension Scaffold. A scaffold having a continuous platform supported by bearers suspended by wire rope from overhead supports, so arranged and operated as to permit the raising or lowering of the platform to desired working positions.

Maximum Rated Load. The total of all loads including the working load, the weight of the scaffold, and such other loads as may be reasonably anticipated.

Medium Duty Scaffold. A scaffold designed and constructed to carry a working load not to exceed 50 pounds per square foot.

Midrail. A rail approximately midway between the guardrail and platform, secured to the uprights erected along the exposed sides and ends of platforms.

Needle Beam Scaffold. A light duty scaffold consisting of needle beams supporting a platform.

Outrigger Scaffold. A scaffold supported by outriggers or thrustouts projecting beyond the wall or face of the building or structure, the inboard ends of which are secured inside of such building or structure.

Putlog. A scaffold member upon which the platform rests.

Roofing or Bearer Bracket. A bracket used in slope roof construction, having provisions for fastening to the roof or supported by ropes fastened over the ridge and secured to some suitable object.

Runner. The lengthwise horizontal bracing or bearing members or both.

Scaffold. Any temporary elevated platform and its supporting structure used for supporting workmen or materials, or both.

Single-Point Adjustable Suspension Scaffold. A manually or power-operated unit designed for light duty use, supported by a single wire rope from an overhead support so arranged and operated as to permit the raising or lowering of platform to desired working positions.

Single-Pole Scaffold. Platforms resting on putlogs or cross beams, the outside ends of which are supported on ledgers secured to a single row of posts or uprights, and the inner ends of which are supported on or in a wall.

Stone Setters' Adjustable Multiple-Point Suspension Scaffold. A swinging type scaffold having a platform supported by hangers suspended at four points so as to permit the raising or lowering of the platform to the desired working position by the use of hoisting machines.

Toeboard. A barrier secured along the sides and ends of a platform to guard against the falling of material.

Tube and Coupler Scaffold. An assembly consisting of tubing which serves as posts, bearers, braces, ties, and runners, a base supporting the posts, and special couplers which serve to connect the uprights and to join the various members.

Tubular Welded Frame Scaffold. A sectional panel or frame metal scaffold substantially built up of prefabricated welded sections which consists of posts and horizontal bearer with intermediate members.

Two-Point Suspension Scaffold (Swinging Scaffold). A scaffold, the platform of which is supported by hangers (stirrups) at two points, suspended from overhead supports so as to permit the raising or lowering of the platform to the desired working position by tackle or hoisting machines.

Window Jack Scaffold. A scaffold, the platform of which is supported by a bracket or jack which projects through a window opening.

Working Load. Load imposed by workers, materials, and equipment.

Manually Propelled Mobile Ladder Stands and Scaffolds (Towers) – §1926.453

Application

This section is intended to prescribe rules and requirements for the design, construction, and use of mobile work platforms (including ladder stands but not including aerial ladders) and rolling (mobile) scaffolds (towers). This standard is promulgated to aid in providing for the safety of life, limb, and property, by establishing minimum standards for structural design requirements and for the use of mobile work platforms and towers.

Working Loads

Work platforms and scaffolds shall be capable of carrying the design load under varying circumstances depending upon the conditions of use. Therefore, all parts and appurtenances necessary for their safe and efficient utilization must be integral parts of the design.

Specific design and construction requirements are not a part of this section because of the wide variety of materials and design possibilities. However, the design shall be such as to produce a mobile ladder stand or scaffold that will safely sustain the specified loads. The material selected shall be of sufficient strength to meet the test requirements and shall be protected against corrosion or deterioration.

The design working load of ladder stands shall be calculated on the basis of one or more 200-pound (90.6 kg) persons together with 50 pounds (22.65 kg) of equipment each.

The design load of all scaffolds shall be calculated on the basis of:

- "Light" – Designed and constructed to carry a working load of 25 pounds per square foot (1.05 $^{kg}/_{m^2}$).
- "Medium" – Designed and constructed to carry a working load of 50 pounds per square foot (2.1 kg/m2).
- "Heavy" – Designed and constructed to carry a working load of 75 pounds per square foot (3.15 $^{k}g/_{m2}$).

All ladder stands and scaffolds shall be capable of supporting at least four times the design working load.

The materials used in mobile ladder stands and scaffolds shall be of standard manufacture and conform to standard specifications of strength, dimensions, and weights, and shall be selected to safely support the design working load.

Nails, bolts, or other fasteners used in the construction of ladders, scaffolds, and towers shall be of adequate size and in sufficient numbers at each connection to develop the designed strength of the unit. Nails shall be driven full length. (All nails should be immediately withdrawn from dismantled lumber.)

All exposed surfaces shall be free from sharp edges, burrs or other safety hazards.

Work Levels

The maximum work level height shall not exceed four (4) times the minimum or least base dimensions of any mobile ladders and or scaffold. Where the basic mobile unit does not meet this requirement, suitable outrigger frames shall be employed to achieve this least base dimension, or provisions shall be made to guy or brace the unit against tipping.

The minimum platform width for any work level shall not be less than 20 inches (50.8 cm) for mobile scaffolds (towers). Ladder stands shall have a minimum step width of 16 inches (40.64 cm).

The supporting structure for the work level shall be rigidly braced, using adequate cross bracing or diagonal bracing with rigid platforms at each work level.

The steps of ladder stands shall be fabricated from slip resistant treads.

The work level platform of scaffolds (towers) shall be wood, aluminum, or plywood planking, steel or expanded metal, for the full width of the scaffold, except for necessary openings. Work platforms shall be secured in place. All planking shall be 2-inch (5.08 cm) (nominal) scaffold grade minimum 1,500 f. (stress grade) construction grade lumber or equivalent.

All scaffold work levels 10 feet (3.04 m) or higher above the ground or floor shall have a standard (4-inch (10.16 cm) nominal) toeboard.

All work levels 10 feet (3.04 m) or higher above the ground or floor shall have a guardrail of 2- by 4-inch nominal or the equivalent installed no less than 36 inches (0.912 m) or more than 42 inches (106.68 cm) high, with a midrail, when required, of 1- by 4-inch nominal lumber or equivalent.

A climbing ladder or stairway shall be provided for proper access and egress, and shall be affixed or built into the scaffold and so located that its use will not have a tendency to tip the scaffold. A landing platform shall be provided at intervals not to exceed 30 feet (9.12 m).

Wheels or Casters

Wheels or casters shall be properly designed for strength and dimensions to support four (4) times the design working load.

All scaffold casters shall be provided with a positive wheel and/or swivel lock to prevent movement. Ladder stands shall have at least two (2) of the four (4) casters and shall be of the swivel type.

Where leveling of the elevated work platform is required, screw jacks or other suitable means for adjusting the height shall be provided in the base section of each mobile unit.

Mobile Tubular Welded Sectional Folding Scaffolds

Units including sectional stairway and sectional ladder scaffolds shall be designed to comply with the requirements of paragraph (a) of this section.

Stairway

An integral stairway and work platform shall be incorporated into the structure of each sectional folding stairway scaffold.

Bracing

An integral set of pivoting and hinged folding diagonal and horizontal braces and a detachable work platform shall be incorporated into the structure of each sectional folding ladder scaffold.

Sectional Folding Stairway Scaffolds

Sectional folding stairway scaffolds shall be designed as medium duty scaffolds except for high clearance. These special base sections shall be designed as light duty scaffolds. When upper sectional folding stairway scaffolds are used with a special high clearance base, the load capacity of the entire scaffold shall be reduced accordingly. The width of a sectional folding stairway scaffold shall not exceed 4 = feet (1.368 m). The maximum length of a sectional folding stairway scaffold shall not exceed 6 feet (1.824 m).

Sectional Folding Ladder Scaffolds

Sectional folding ladder scaffolds shall be designed as light duty scaffolds including special base (open end) sections which are designed for high clearance. For certain special applications the 6'-(1.824 m) folding ladder scaffolds, except for special high clearance base sections, shall be designed for use as medium duty scaffolds. The width of a sectional folding ladder scaffold shall not exceed 4 = feet (1.368 m). The maximum length of a sectional folding ladder scaffold shall not exceed 6 feet 6 inches (1.976 m) for a 6'-(1.824 m) long unit, 8 feet 6 inches (2.584 m) for an 8'-(2.432 m) unit or 10 feet 6 inches (3.192 m) for a 10'-(3.04 m) long unit.

End Frames

The end frames of sectional ladder and stairway scaffolds shall be designed so that the horizontal bearers provide supports for multiple planking levels.

Erection

Only the manufacturer of the scaffold or his qualified designated agent shall be permitted to erect or supervise the erection of scaffolds exceeding 50 feet (15.2 m) in height above the base, unless such structure is approved in writing by a licensed professional engineer, or erected in accordance with instructions furnished by the manufacturer.

1. The following requirements from 29 CFR Part 1910 (General Industry) have been identified as applicable to construction (29 CFR 1926.451, Scaffolding): 1910.21(g)(9); 1910.28(a)(15); 1910.28(a)(18); 1910.28(a)(20);1910.29(a); 1910.29(c).

FALL PROTECTION

Introduction

In the construction industry in the U.S., falls are the leading cause of worker fatalities. Each year, on average, between 150 and 200 workers are killed and more than 100,000 are injured as a result of falls at construction sites. OSHA recognizes that accidents involving falls are generally complex events frequently 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. For example, employers and employees need to do the following:

- Where protection is required, select fall protection systems appropriate for given situations.
- Use proper construction and installation of safety systems.
- Supervise employees properly.
- Use safe work procedures.
- Train workers in the proper selection, use, and maintenance of all protection systems.

Scope and Application

OSHA has revised its construction industry safety standards (29 Code of Federal Regulations, Subpart M, Fall Protection, 1926.500, 1926.501, 1926.502, and 1926.503) and developed systems and procedures designed to prevent employees from falling off, onto, or through working levels and to protect employees from being struck by falling objects (Federal Register, August 9, 1994, pp. 40672-40753). The performance-oriented requirements make it easier for employers to provide the necessary protection.

The rule covers most construction workers except those inspecting, investigating, or assessing workplace conditions prior to the actual start of work or after all work has been completed.

The rule identifies areas or activities where fall protection is needed. These include, but are not limited to, ramps, runways, and other walkways; excavations; hoist areas; holes; formwork and reinforcing steel; leading edge work; unprotected sides and edges; overhand bricklaying and related work; roofing work; precast concrete erection; wall openings; residential construction; and other walking/working surfaces. The rule sets a uniform threshold height of 6 feet (1.8 meters), thereby providing consistent protection. This means that construction employers must protect their employees from fall hazards and falling objects whenever an affected employee is 6 feet (1.8 meters) or more above a lower level. Protection must also be provided for construction workers who are exposed to the hazard of falling into dangerous equipment.

Under the new standard, employers will be able to select fall protection measures compatible with the type of work being performed. Fall protection generally can be provided through the use of guardrail systems, safety net systems, personal fall arrest systems, positioning device systems, and warning line systems, among others.

The OSHA rule clarifies what an employer must do to provide fall protection for employees, such as identifying and evaluating fall hazards and providing specific training. Requirements to provide fall protection for workers on scaffolds and ladders and for workers engaged in steel erection of buildings arc covered in other subparts of OSHA regulations.

Provisions of the Standard

The new standard prescribes the duty to provide fall protection, sets the criteria and practices for fall protection systems, and requires training. It covers hazard assessment and fall protection and safety monitoring systems. Also addressed are controlled access zones, safety nets, and guardrail, personal fall arrest, warning line, and positioning device systems.

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. Employees are not permitted to work on those surfaces until it has been determined that the surfaces have the requisite strength and structural integrity to support the workers. Once employers have determined that the surface is safe for employees to work on, the employer must select one of the options listed for the work operation if a fall hazard is present.

For example, if an employee is exposed to falling 6 feet (l .8 meters) or more from an unprotected side or edge, the employer must select either a guardrail system, safety net system, or personal fall arrest system to protect the worker. Similar requirements are prescribed for other fall hazards as follows.

Controlled Access Zones

A Controlled access zone is a work area designated and clearly marked in which certain types of work (such as overhand bricklaying) may take place without the use of conventional fall protection systems-guardrail, personal arrest or safety net-to protect the employees working in the zone.

Controlled access zones are used to keep out workers other than those authorized to enter work areas from which guardrails have been removed. Where there are no guardrails, masons are the only workers allowed in controlled access zones.

Controlled access zones, when created to limit entrance to areas where leading edge work and other operations are taking place, must be defined by a control line or by any other means that restrict access. Control lines shall consist of ropes, wires, tapes or equivalent materials, and supporting stanchions, and each must be:

- Flagged or otherwise clearly marked at not more than 6-foot (1.8 meters) intervals with high-visibility material;
- Rigged and supported in such a way that the lowest point (including sag) is not less than 39 inches (1 meter) from the walking/working surface and the highest point is not more than 45 inches (1.3 meters)-nor more than 50 inches (1.3 meters) when overhand bricklaying operations are being performed-from the walking/working surface;
- Strong enough to sustain stress of not less than 200 pounds (0.88 kilonewtons). Control lines shall extend along the entire length of the unprotected or leading edge and shall be approximately parallel to the unprotected or leading edge.
- Control lines also must be connected on each side to a guardrail system or wall.

When control lines are used, they shall be erected not less than 6 feet (1.8 meters) nor more than 25 feet (7.6 meters) from the unprotected or leading edge, except when precast concrete members are being erected. In the latter case, the control line is to be erected not less than 6 feet (1.8 meters) nor more than 60 feet (18 meters) or half the length of the member being erected, whichever is less, from the leading edge.

Controlled access zones when used to determine access to areas where overhand bricklaying and related work are taking place are to be defined by a control line erected not less than 10 feet (3 meters) nor more than 15 feet (4.6 meters) from the working edge. Additional control lines must be erected at each end to enclose the controlled access zone. Only employees engaged in overhand bricklaying or related work are permitted in the controlled access zones.

On floors and roofs where guardrail systems are not in place prior to the beginning of overhand bricklaying operations, controlled access zones will be enlarged as necessary to enclose all points of access, material handling areas, and storage areas. On floors and roofs where guardrail systems are in place, but need to be removed to allow overhand bricklaying work or leading edge work to take place, only that portion of the guardrail necessary to accomplish that day's work shall be removed.

Excavations

Each employee at the edge of an excavation 6 feet (1.8 meters) or more deep shall be protected from falling by guardrail systems, fences, barricades, or covers. Where walkways are provided to permit employees to cross over excavations, guardrails are required on the walkway if it is 6 feet (1.8 meters) or more above the excavation.

Formwork and Reinforcing Steel

For employees, while moving vertically and/or horizontally on the vertical face of rebar assemblies built in place, fall protection is not required when employees are moving. OSHA considers the multiple hand holds and foot holds on rebar assemblies as providing similar protection as that provided by a fixed ladder; consequently, no fall protection is necessary while moving point to point for heights below 24 feet (7.3 meters). An employee must be provided with fall protection when climbing or otherwise moving at a height more than 24 feet (7.3 meters), the same as for fixed ladders.

Hoist Areas

Each employee in a hoist area shall be protected from falling 6 feet (1.8 meters) or more by guardrail systems or personal fall arrest systems. If guardrail systems (or chain gate or guardrail) or portions thereof must be removed to facilitate hoisting operations, as during the landing of materials, and a worker must lean through the access opening or out over the edge of the access opening to receive or guide equipment and materials, that employee must be protected by a personal fall arrest system.

Holes

Personal fall arrest systems, covers, or guardrail systems shall be erected around holes (including skylights) that are more than 6 feet (1.8 meters) above lower levels.

Leading Edges

Each employee who is constructing a leading edge 6 feet (1.8 meters) or more above lower levels shall be protected by guardrail systems, safety net systems, or personal fall arrest systems. If the employer can demonstrate that it is infeasible or creates a greater hazard to implement these systems, he or she must develop and implement a fall protection plan that meets the requirements of 29 CFR 1926.502(k).

Overhand Bricklaying and Related Work

Each employee performing overhand bricklaying and related work 6 feet (1.8 meters) or more above lower levels shall be protected by guardrail systems, safety net systems, or personal fall arrest systems, or shall work in a controlled access zone. All employees reaching more than 10 inches (25 cm) below the level of a walking/working surface on which they are working shall be protected by a guardrail system, safety net system, or personal fall arrest system.

Precast Concrete Erection and Residential Construction

Each employee who is 6 feet (1.8 meters) or more above lower levels while erecting precast concrete members and related operations such as grouting of precast concrete members and each employee engaged in residential construction, shall be protected by guardrail systems, safety net systems, or personal fall arrest systems. Where the employer can demonstrate, however, that it is infeasible or creates a greater hazard to use those systems, the employer must develop and implement a fall protection plan that meets the requirements of 29 CFR 1926.502(k).

Ramps, Runways, and Other Walkways

Each employee using ramps, runways, and other walkways shall be protected from falling 6 feet (1.8 meters) or more by guardrail systems.

Roofing *Low-*

slope Roofs

Each employee engaged in roofing activities on low-slope roofs with unprotected sides and edges 6 feet (1.8 meters) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, personal fall arrest systems or a combination of a warning line system and guardrail system, warning line system and safety net system, warning line system and personal fall arrest system, or warning line system and safety monitoring system. On roofs 50 feet (15.24 meters) or less in width, the use of a safety monitoring system without a warning line system is permitted.

Steep Roofs

Each employee on a steep roof with unprotected sides and edges 6 feet (1.8 meters) or more above lower levels shall be protected by guardrail systems with toeboards, safety net systems, or personal fall arrest systems.

Wall Openings

Each employee working on, at, above, or near wall openings (including those with chutes attached) where the outside bottom edge of the wall opening is 6 feet (1.8 meters) or more above lower levels and the inside bottom edge of the wall opening is less than 39 inches (1.0 meter) above the walking/working surface must be protected from falling by the use of a guardrail system, a safety net system, or a personal fall arrest system.

Fall Protection Systems Criteria and Practices

Guardrail Systems

If the employer chooses to use guardrail systems to protect workers from falls, the systems must meet the following criteria. Toprails and midrails of guardrail systems must be at least one-quarter inch (0.6 centimeters) nominal diameter or thickness to prevent cuts and lacerations. If wire rope is used for toprails, it must be flagged at not more 6 feet intervals (1.8 meters) with high-visibility material. Steel and plastic banding cannot be used as toprails or midrails. Manila, plastic, or synthetic rope used for toprails or midrails must be inspected as frequently as necessary to ensure strength and stability.

The top edge height of toprails, or (equivalent) guardrails must be 42 inches (1.1 meters) plus or minus 3 inches (8 centimeters), above the walking/working level. When workers are using stilts, the top edge height of the top rail, or equivalent member, must be increased an amount equal to the height of the stilts.

Screens, midrails, mesh, intermediate vertical members, or equivalent intermediate structural members must be installed between the top edge of the guardrail system and the walking/working surface when there are no walls or parapet walls at least 21 inches (53 centimeters) high. When midrails are used, they

must be installed at a height midway between the top edge of the guardrail system and the walking/working level. When screens and mesh are used, they must extend from the top rail to the walking/working level and along the entire opening between top rail supports. Intermediate members, such as balusters, when used between posts, shall not be more than 19 inches (48 centimeters) apart.

Other structural members, such as additional midrails and architectural panels, shall be installed so that there are no openings in the guardrail system more than 19 inches (48 centimeters).

The guardrail system must be capable of withstanding a force of at least 200 pounds (890 newtons) applied within 2 inches of the top edge in any outward or downward direction. When the 200 pound (890 newtons) test is applied in a downward direction, the top edge of the guardrail must not deflect to a height less than 39 inches (1 meter) above the walking/working level.

Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members shall be capable of withstanding a force of at least 150 pounds (667 newtons) applied in any downward or outward direction at any point along the midrail or other member.

Guardrail systems shall be surfaced to protect workers from punctures or lacerations and to prevent clothing from snagging.

The ends of top rails and midrails must not overhang terminal posts, except where such overhang does not constitute a projection hazard.

When guardrail systems are used at hoisting areas, a chain, gate, or removable guardrail section must be placed across the access opening between guardrail sections when hoisting operations are not taking place.

At holes, guardrail systems must be set up on all unprotected sides or edges. When holes are used for the passage of materials, the hole shall have not more than two sides with removable guardrail sections. When the hole is not in use, it must be covered or provided with guardrails along all unprotected sides or edges.

If guardrail systems are used around holes that are used as access points (such as ladderways), gates must be used or the point of access must be offset to prevent accidental walking into the hole.

If guardrails are used at unprotected sides or edges of ramps and runways, they must be erected on each unprotected side or edge.

Personal Fall Arrest Systems

These consist of an anchorage, connectors, and a body belt or body harness and may include a deceleration device, lifeline, or suitable combinations. If a personal fall arrest system is used for fall protection, it must do the following:

- Limit maximum arresting force on an employee to 900 pounds (4 kilonewtons) when used with a body belt;
- Limit maximum arresting force on an employee to 1,800 pounds (8 kilonewtons) when used with a body harness;
- Be rigged so that an employee can neither free fall more than 6 feet (1.8 meters) nor contact any lower level;
- Bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet (1.07 meters); and
- Have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet (1.8 meters) or the free fall distance permitted by the system, whichever is less.

As of January 1, 1998, the use of a body belt for fall arrest is prohibited.

Personal fall arrest systems must be inspected prior to each use for wear damage, and other deterioration. Defective components must be removed from service. Dee-rings and snaphooks must have a minimum tensile strength of 5,000 pounds (22.2 kilonewtons). Dee-rings and snaphooks shall be proof-tested to a minimum tensile load of 3,600 pounds (16 kilonewtons) without cracking, breaking, or suffering permanent deformation.

Snaphooks shall be sized to be compatible with the member to which they will be connected, or shall be of a locking configuration.

Unless the snaphook is a locking type and designed for the following connections, they shall not be engaged (a) directly to webbing, rope or wire rope; (b) to each other; (c) to a dee-ring to which another snaphook or other connecter is attached; (d) to a horizontal lifeline; or (e) to any object incompatible in shape or dimension relative to the snaphook, thereby causing the connected object to depress the snaphook keeper and release unintentionally.

OSHA considers a hook to be compatible when the diameter of the dee-ring to which the snaphook is attached is greater than the inside length of the snaphook when measured from the bottom (hinged end) of the snaphook keeper to the inside curve of the top of the snaphook. Thus, no matter how the dee-ring is positioned or moved (rolls) with the snaphook attached, the dee-ring cannot touch the outside of the keeper, thus depressing it open. As of January 1, 1998, the use of nonlocking snaphooks is prohibited. On suspended scaffolds or similar work platforms with horizontal lifelines that may become vertical lifelines, the devices used to connect to a horizontal lifeline shall be capable of locking in both directions on the lifeline.

Horizontal lifelines shall be designed, installed, and used under the supervision of a qualified person, as part of a complete personal fall arrest system that maintains a safety factor of at least two. Lifelines shall be protected against being cut or abraded.

Self-retracting lifelines and lanyards that automatically limit free fall distance to 2 feet (0.6 l meters) or less shall be capable of sustaining a minimum tensile load of 3,000 pounds (13.3 kilonewtons) applied to the device with the lifeline or lanyard in the fully extended position.

Self-retracting lifelines and lanyards that do not limit free fall distance to 2 feet (0.61 meters) or less, ripstitch lanyards, and tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,000 pounds (22.2 kilonewtons) applied to the device with the lifeline or lanyard in the fully extended position.

Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses shall be made of synthetic fibers.

Anchorages shall be designed, installed, and used under the supervision of a qualified person, as part of a complete personal fall arrest system that maintains a safety factor of at least two, i.e., capable of supporting at least twice the weight expected to be imposed upon it. Anchorages used to attach personal fall arrest systems shall be independent of any anchorage being used to support or suspend platforms and must be capable of supporting at least 5,000 pounds (22.2 kilonewtons) per person attached.

Lanyards and vertical lifelines must have a minimum breaking strength of 5,000 pounds (22.2 kilonewtons).

Positioning Device Systems

These body belt or body harness systems are to be set up so that a worker can free fall no farther than 2 feet (0.6 meters). They shall be secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds (13.3 kilonewtons), whichever is greater. Requirements for snaphooks, dee-rings, and other connectors used with positioning device systems must meet the same criteria as those for personal fall arrest systems.

Safety Monitoring Systems

When no other alternative fall protection has been implemented, the employer shall implement a safety monitoring system. Employers must appoint a competent person to monitor the safety of workers and the employer shall ensure that the safety monitor:

- Is competent in the recognition of fall hazards;
- Is capable of warning workers of fall hazard dangers and in detecting unsafe work practices;
- Is operating on the same walking/working surfaces of the workers and can see them;
- Is close enough to work operations to communicate orally with workers and has no other duties to distract from the monitoring function.

Mechanical equipment shall not be used or stored in areas where safety monitoring systems are being used to monitor employees engaged in roofing operations on low-sloped roofs.

No worker, other than one engaged in roofing work (on low-sloped roofs) or one covered by a fall protection plan, shall be allowed in an area where an employee is being protected by a safety monitoring system.

All workers in a controlled access zone shall be instructed to promptly comply with fall hazard warnings issued by safety monitors.

Safety Net Systems

Safety nets must be installed as close as practicable under the walking/working surface on which employees are working and never more than 30 feet (9.1 meters) below such levels. Defective nets shall not be used. Safety nets shall be inspected at least once a week for wear, damage, and other deterioration. The maximum size of each safety net mesh opening shall not exceed 36 square inches (230 square centimeters) nor be longer than 6 inches (15 centimeters) on any side, and the openings, measured center-to-center, of mesh ropes or webbing, shall not exceed 6 inches (15 centimeters). All mesh crossings shall be secured to prevent enlargement of the mesh opening. Each safety net or section shall have a border rope for webbing with a minimum breaking strength of 5,000 pounds (22.2 kilonewtons). Connections between safety net panels shall be as strong as integral net components and be spaced no more than 6 inches (15 centimeters) apart.

Safety nets shall be installed with sufficient clearance underneath to prevent contact with the surface or structure below.

When nets are used on bridges, the potential fall area from the walking/working surface to the net shall be unobstructed.

Safety nets must extend outward from the outermost projection of the work surface as follows:

Vertical distance from working level to horizontal plane of net	**Minimum required horizontal distance** of outer edge of net from the edge of the working surface
Up to 5 feet (1.5 meters)	8 feet (2.4 meters)
More than 5 feet (1.5 meters) up to 10 feet (3 meters)	10 feet (3 meters)
More than 10 feet (3 meters)	13 feet (3.9 meters)

Safety nets shall be capable of absorbing an impact force of a drop test consisting of a 400-pound (180 kilogram) bag of sand 30 inches (76 centimeters) in diameter dropped from the highest walking/working surface at which workers are exposed, but not from less than 42 inches (1.1 meters) above that level.

Items that have fallen into safety nets including-but not restricted to, materials, scrap, equipment, and tools-must be removed as soon as possible and at least before the next work shift.

Warning Line Systems

Warning line systems consist of ropes, wires, or chains, and supporting stanchions and are set up as follows:

- Flagged at not more than 6-foot (1.8 meters) intervals with high-visibility material;
- Rigged and supported so that the lowest point (including sag) is no less than 34 inches (0.9 meters) from the walking/working surface and its highest point is no more than 39 inches (1 meter) from the walking/working surface.
- Stanchions, after being rigged with warning lines, shall be capable of resisting, without tipping over, a force of at least 16 pounds (71 newtons) applied horizontally against the stanchion, 30 inches (0.8 meters) above the walking/working surface, perpendicular to the warning line and in the direction of the floor, roof, or platform edge;
- The rope, wire, or chain shall have a minimum tensile strength of 500 pounds (2.22 kilonewtons) and after being attached to the stanchions, must support without breaking, the load applied to the stanchions as prescribed above.
- Shall be attached to each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in the adjacent section before the stanchion tips over.

Warning lines shall be erected around all sides of roof work areas. When mechanical equipment is being used, the warning line shall be erected not less than 6 feet (1.8 meters) from the roof edge parallel to the direction of mechanical equipment operation, and not less than 10 feet (3 meters) from the roof edge perpendicular to the direction of mechanical equipment operation.

When mechanical equipment is not being used, the warning line must be erected not less than 6 feet (1.8 meters) from the roof edge.

Covers

Covers located in roadways and vehicular aisles must be able to support at least twice the maximum axle load of the largest vehicle to which the cover might be subjected. All other covers must be able to support at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time. To prevent accidental displacement resulting from wind, equipment, or workers' activities, all covers must be secured. All covers shall be color coded or bear the markings "HOLE" or "COVER."

Protection from Falling Objects

When guardrail systems are used to prevent materials from falling from one level to another, any openings must be small enough to prevent passage of potential falling objects. No materials or equipment except masonry and mortar shall be stored within 4 feet (1.2 meters) of working edges. Excess mortar, broken or scattered masonry units, and all other materials and debris shall be kept clear of the working area by removal at regular intervals.

During roofing work, materials and equipment shall not be stored within 6 feet (1.8 meters) of a roof edge unless guardrails are erected at the edge, and materials piled, grouped, or stacked near a roof edge must be stable and self-supporting.

Canopies

When used as protection from falling objects canopies must be strong enough to prevent collapse and to prevent penetration by any objects that may fall onto them.

Toeboards

When toeboards are used as protection from falling objects, they must be erected along the edges of the overhead walking/working surface for a distance sufficient to protect persons working below. Toeboards shall be capable of withstanding a force of at least 50 pounds (222 newtons) applied in any downward or outward direction at any point along the toeboard. Toeboards shall be a minimum of 3.5 inches (9 centimeters) tall from their top edge to the level of the walking/working surface, have no more than 0.25 inches (0.6 centimeters) clearance above the walking/working surface, and be solid or have openings no larger than l inch (2.5 centimeters) in size.

Where tools, equipment, or materials are piled higher than the top edge of a toeboard, panelling or screening must be erected from the walking/working surface or toeboard to the top of a guardrail system's top rail or midrail, for a distance sufficient to protect employees below.

Training

Employers must provide a training program that teaches employees who might be exposed to fall hazards how to recognize such hazards and how to minimize them. Employees must be trained in the following areas: (a) the nature of fall hazards in the work area; (b) the correct procedures for erecting, maintaining, disassembling, and inspecting fall protection systems; (c) the use and operation of controlled access zones and guardrail, personal fall arrest, safety net, warning line, and safety monitoring systems; (d) the role of each employee in the safety monitoring system when the system is in use; (e) the limitations on the use of mechanical equipment during the performance of roofing work on low-sloped roofs; (f) the correct procedures for equipment and materials handling and storage and the erection of overhead protection; and, (g) employees' role in fall protection plans.

Employers must prepare a written certification that identifies the employee trained and the date of the training. The employer or trainer must sign the certification record. Retraining also must be provided when necessary.

GLOSSARY

Anchorage – A secure point of attachment for lifelines, lanyards or deceleration devices.

Body belt – A strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device.

Body harness – Straps that may be secured about the person in a manner that distributes the fall-arrest forces over at least the thighs, pelvis, waist, chest, and shoulders with a means for attaching the harness to other components of a personal fall arrest system.

Connector – A device that is used to couple (connect) parts of a personal fall arrest system or positioning device system together.

Controlled Access Zone – A work area designated and clearly marked in which certain types of work (such as overhand bricklaying) may take place without the use of conventional fall protection systems-guardrail, personal arrest or safety net-to protect the employees working in the zone.

Deceleration device – Any mechanism-such as rope, grab, ripstitch lanyard, specially-woven lanyard, tearing or deforming lanyards, automatic self-retracting lifelines/lanyards-which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limits the energy imposed on an employee during fall arrest.

Deceleration distance – The additional vertical distance a falling person travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which a deceleration device begins to operate.

Guardrail system – A barrier erected to prevent employees from falling to lower levels.

Hole – A void or gap 2 inches (5.1 centimeters) or more in the least dimension in a floor, roof, or other walking/working surface.

Lanyard – A flexible line of rope, wire rope, or strap that generally has a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline, or anchorage.

Leading edge – The edge of a floor, roof, or formwork for a floor or other walking/working surface (such as the deck) which changes location as additional floor, roof, decking, or formwork sections are placed, formed or constructed.

Lifeline – A component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline) and that serves as a means for connecting other components of a personal fall arrest system to the anchorage.

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

Opening – A gap or void 30 inches (76 centimeters) or more high and 18 inches (46 centimeters) or more wide, in a wall or partition, through which employees can fall to a lower level.

Personal fall arrest system – A system including but not limited to an anchorage, connectors, and a body belt or body harness used to arrest an employee in a fall from a working level. As of January 1, 1998, the use of a body belt for fall arrest is prohibited.

Positioning device system – A body belt or body harness system rigged to allow an employee to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning backwards.

Rope grab – A deceleration device that travels on a lifeline and automatically, by friction, engages the lifeline and locks to arrest a fall.

Safety-monitoring system – A safety system in which a competent person is responsible for recognizing and warning employees of fall hazards.

Self-retracting lifeline/lanyard – A deceleration device containing a drum-wound line which can be slowly extracted from, or retracted onto, the drum under minimal tension during normal employee movement and which, after onset of a fall, automatically locks the drum and arrests the fall.

Snaphook – A connector consisting of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released automatically closes to retain the object.

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

Toeboard – A low protective barrier that prevents material and equipment from falling to lower levels and which protects personnel from falling.

Unprotected sides and edges – Any side or edge (except at entrances to points of access) of a walking/ working surface (e.g. floor, roof, ramp, or runway) where there is no wall or guardrail system at least 39 inches (1 meter) high.

Walking/working surface – Any surface, whether horizontal or vertical, on which an employee walks or works, including but not limited to floors, roofs, ramps, bridges, runways, formwork, and concrete reinforcing steel. Does not include ladders, vehicles, or trailers on which employees must be located to perform their work duties.

Warning line system – A barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge and which designates an area in which roofing work may take place without the use of guardrail, body belt, or safety net systems to protect employees in the area.

EXCAVATIONS

Introduction

The Occupational Safety and Health Administration (OSHA) issued its first Excavation and Trenching Standard in 1971 to protect workers from excavation hazards. Since then, OSHA has amended the standard several times to increase worker protection and to reduce the frequency and severity of excavation accidents and injuries. Despite these efforts, excavation-related accidents resulting in injuries and fatalities continue to occur.

To better assist excavation firms and contractors, OSHA completely updated the existing standard to simplify many of the existing provisions, add and clarify definitions, eliminate duplicate provisions and ambiguous language, and give employers added flexibility in providing protection for employees. The standard was effective as of March 5, 1990.

In addition, the standard provides several new appendices. One appendix provides a consistent method of soil classification. Others provide sloping and benching requirements, pictorial examples of shoring and shielding devices, timber tables, hydraulic shoring tables, and selection charts that provide a graphic summary of the requirements contained in the standard.

This discussion highlights the requirements in the updated standard for excavation and trenching operations, provides methods for protecting employees against cave-ins, and describes safe work practices for employees.

Scope and Application

OSHA's revised rule applies to all open excavations made in the earth's surface, which includes trenches.

According to the OSHA construction safety and health standards, a trench is referred to as a narrow excavation made below the surface of the ground in which the depth is greater than the width-the width not exceeding 15 feet. An excavation is any man-made cut, cavity, trench, or depression in the earth's surface formed by earth removal. This can include excavations for anything from cellars to highways.

General Requirements

Planning for Safety

Many on-the-job accidents are a direct result of inadequate initial planning. Correcting mistakes in shoring and/or sloping after work has begun slows down the operation, adds to the cost, and increases the possibility of an excavation failure. The contractor should build safety into the pre-bid planning in the same way all other pre-bid factors are considered.

It is a good idea for contractors to develop safety checklists before preparing a bid, to make certain there is adequate information about the job site and all needed items are on hand.

These checklists should incorporate elements of the relevant OSHA standards as well as other information necessary for safe operations.

Before preparing a bid, these specific site conditions should be taken into account:

- Traffic
- Nearness of structures and their conditions
- Soil

- Surface and ground water
- The water table
- Overhead and underground utilities
- Weather

These and other conditions can be determined by job site studies, observations, test borings for soil type or conditions, and consultations with local officials and utility companies.

Before any excavation actually begins, the standard requires the employer to determine the estimated location of utility installations—sewer, telephone, fuel, electric, water lines, or any other underground installations—that may be encountered during digging. Also, before starting the excavation, the contractor must contact the utility companies or owners involved and inform them, within established or customary local response times, of the proposed work. The contractor must also ask the utility companies or owners to find the exact location of the underground installations. If they cannot respond within 24 hours (unless the period required by state or local law is longer), or if they cannot find the exact location of the utility installations, the contractor may proceed with caution. To find the exact location of underground installations, workers must use safe and acceptable means. If underground installations are exposed, OSHA regulations also require that they be removed, protected or properly supported.

When all the necessary specific information about the job site is assembled, the contractor is ready to determine the amount, kind, and cost of the safety equipment needed. A careful inventory of the safety items on hand should be made before deciding what additional safety material must be acquired. No matter how many trenching, shoring and backfilling jobs have been done in the past, each job should be approached with the utmost care and preparation.

Before Beginning the Job

It is important, before beginning the job, for the contractor to establish and maintain a safety and health program for the work site that provides adequate systematic policies, procedures, and practices to protect employees from, and allow them to recognize, job-related safety and health hazards.

An effective program includes provisions for the systematic identification, evaluation, and prevention or control of general workplace hazards, specific job hazards, and potential hazards that may arise from foreseeable conditions. The program may be written or verbal but it should reflect the unique characteristics of the job site.

To help contractors develop an effective safety and health program, in 1989, OSHA issued recommended guidelines for the effective management and protection of worker safety and health. The complete original text of the nonmandatory guidelines is found in the Federal Register [54 FR (18):3904-3916, January 26, 1989].

A copy of the guidelines can be obtained from the OSHA Publications Office, U.S. Department of Labor, 200 Constitution Avenue, N.W., Room N-3101, Washington, D.C. 20210, or from the nearest OSHA Regional Office.

To be sure safety policies are implemented effectively, there must be cooperation among supervisors, employee groups, including unions, and individual employees. Each supervisor must understand the degree of responsibility and authority he or she holds in a particular area. For effective labor support, affected unions should be notified of construction plans and asked to cooperate.

It is also important, before beginning work, for employers to provide employees who are exposed to public vehicular traffic with warning vests or other suitable garments marked with or made of reflectorized or high-visibility material and ensure that they wear them. Workers must also be instructed to remove or neutralize surface encumbrances that may create a hazard.

In addition, no employee should operate a piece of equipment without first being properly trained to handle it and fully alerted to its potential hazards.

In the training and in the site safety and health program, it also is important to incorporate procedures for fast notification and investigation of accidents.

On-the-Job Evaluation

The standard requires that a competent person inspect, on a daily basis, excavations and the adjacent areas for possible cave-ins, failures of protective systems and equipment, hazardous atmospheres, or other hazardous conditions. If these conditions are encountered, exposed employees must be removed from the hazardous area until the necessary safety precautions have been taken. Inspections are also required after natural (e.g., heavy rains) or man-made events such as blasting that may increase the potential for hazards.

Larger and more complex operations should have a full-time safety official who makes recommendations to improve the implementation of the safety plan. In a smaller operation, the safety official may be part-time and usually will be a supervisor.

Supervisors are the contractor's representatives on the job. Supervisors should conduct inspections, investigate accidents, and anticipate hazards. They should ensure that employees receive on-the-job safety and health training. They should also review and strengthen overall safety and health precautions to guard against potential hazards, get the necessary worker cooperation in safety matters, and make frequent reports to the contractor.

It is important that managers and supervisors set the example for safety at the job site. It is essential that when visiting the job site, all managers, regardless of status, wear the prescribed personal protective equipment such as safety shoes, safety glasses, hard hats, and other necessary gear (see CFR 1926.100 and 102).

Employees must also take an active role in job safety. The contractor and supervisor should make certain that workers have been properly trained in the use and fit of the prescribed protective gear and equipment, that they are wearing and using the equipment correctly, and that they are using safe work practices.

Cave-Ins and Protective Support Systems

Support Systems

Excavation workers are exposed to many hazards, but the chief hazard is danger of cave-ins. OSHA requires that in all excavations employees exposed to potential cave-ins must be protected by sloping, or benching the sides of the excavation; supporting the sides of the excavation, or placing a shield between the side of the excavation and the work area.

Designing a protective system can be complex because of the number of factors involved-soil classification, depth of cut, water content of soil, changes due to weather and climate, or other operations in the vicinity. The standard, however, provides several different methods and approaches (four for sloping and four for shoring, including the use of shields)(1) for designing protective systems that can be used to provide the required level of protection against cave-ins.

One method of ensuring the safety and health of workers in an excavation is to slope the sides to an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal). These slopes must be excavated to form configurations that are in accordance with those for Type C soil found in Appendix B of the standard. A slope of this gradation or less is considered safe for any type of soil.

All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½: 1.

A second design method, which can be applied for both sloping and shoring, involves using tabulated data, such as tables and charts, approved by a registered professional engineer. These data must be in writing and must include sufficient explanatory information to enable the user to make a selection, including the criteria for determining the selection and the limits on the use of the data.

At least one copy of the information, including the identity of the registered professional engineer who approved the data, must be kept at the worksite during construction of the protective system. Upon completion of the system, the data may be stored away from the job site, but a copy must be made available, upon request, to the Assistant Secretary of Labor for OSHA.

Contractors also may use a trench box or shield that is either designed or approved by a registered professional engineer or is based on tabulated data prepared or approved by a registered professional engineer. Timber, aluminum, or other suitable materials may also be used. OSHA standards permit the use of a trench shield (also known as a welder's hut) as long as the protection it provides is equal to or greater than the protection that would be provided by the appropriate shoring system.

The employer is free to choose the most practical design approach for any particular circumstance. Once an approach has been selected, however, the required performance criteria must be met by that system.

The standard does not require the installation and use of a protective system when an excavation (1) is made entirely in stable rock, or (2) is less than 5 feet deep and a competent person has examined the ground and found no indication of a potential cave-in.

Safety Precautions

The standard requires the employer to provide support systems such as shoring, bracing, or underpinning to ensure the stability of adjacent structures such as buildings, walls, sidewalks or pavements.

The standard prohibits excavation below the level of the base or footing of any foundation or retaining wall unless (1) a support system such as underpinning is provided, (2) the excavation is in stable rock, or (3) a registered professional engineer determines that the structure is sufficiently removed from the excavation and that excavation will not pose a hazard to employees.

Excavations under sidewalks and pavements are also prohibited unless an appropriately designed support system is provided or another effective method is used.

Installation and Removal of Protective Systems

The standard requires the following procedures for the protection of employees when installing support systems:

- Securely connect members of support systems,
- Safely install support systems,
- Never overload members of support systems, and
- Install other structural members to carry loads imposed on the support system when temporary removal of individual members is necessary.

In addition, the standard permits excavation of 2 feet or less below the bottom of the members of a support or shield system of a trench if (1) the system is designed to resist the forces calculated for the full depth of the trench, and (2) there are no indications, while the trench is open, of a possible cave-in below the bottom of the support system. Also, the installation of support systems must be closely coordinated with the excavation of trenches.

As soon as work is completed, the excavation should be back-filled as the protective system is dismantled. After the excavation has been cleared, workers should slowly remove the protective system from the bottom up, taking care to release members slowly.

Materials and Equipment

The employer is responsible for the safe condition of materials and equipment used for protective systems. Defective and damaged materials and equipment can result in the failure of a protective system and cause excavation hazards.

To avoid possible failure of a protective system, the employer must ensure that (1) materials and equipment are free from damage or defects, (2) manufactured materials and equipment are used and maintained in a manner consistent with the recommendations of the manufacturer and in a way that will prevent employee exposure to hazards, and (3) while in operation, damaged materials and equipment are examined by a competent person to determine if they are suitable for continued use. If materials and equipment are not safe for use, they must be removed from service. These materials cannot be returned to service without the evaluation and approval of a registered professional engineer.

Other Hazards *Falls and Equipment*

In addition to cave-in hazards and secondary hazards related to cave-ins, there are other hazards from which workers must be protected during excavation-related work. These hazards include exposure to falls, falling loads, and mobile equipment. To protect employees from these hazards, OSHA requires the employer to take the following precautions:

- Keep materials or equipment that might fall or roll into an excavation at least 2 feet from the edge of excavations, or have retaining devices, or both.
- Provide warning systems such as mobile equipment, barricades, hand or mechanical signals, or stop logs, to alert operators of the edge of an excavation. If possible, keep the grade away from the excavation.
- Provide scaling to remove loose rock or soil or install protective barricades and other equivalent protection to protect employees against falling rock, soil, or materials.
- Prohibit employees from working on faces of sloped or benched excavations at levels above other employees unless employees at lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.
- Prohibit employees under loads that are handled by lifting or digging equipment. To avoid being struck by any spillage or falling materials, require employees to stand away from vehicles being loaded or unloaded. If cabs of vehicles provide adequate protection from falling loads during loading and unloading operations, the operators may remain in them.

Water Accumulation

The standard prohibits employees from working in excavations where water has accumulated or is accumulating unless adequate protection has been taken. If water removal equipment is used to control or prevent water from accumulating, the equipment and operations of the equipment must be monitored by a competent person to ensure proper use.

OSHA standards also require that diversion ditches, dikes, or other suitable means be used to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Also, a competent person must inspect excavations subject to runoffs from heavy rains.

Hazardous Atmospheres

Under this provision, a competent person must test excavations greater than 4 feet in depth as well as ones where oxygen deficiency or a hazardous atmosphere exists or could reasonably be expected to exist, before an employee enters the excavation. If hazardous conditions exist, controls such as proper respiratory protection or ventilation must be provided. Also, controls used to reduce atmospheric contaminants to acceptable levels must be tested regularly.

Where adverse atmospheric conditions may exist or develop in an excavation, the employer also must provide and ensure that emergency rescue equipment, (e.g., breathing apparatus, a safety harness and line, basket stretcher, etc.) is readily available. This equipment must be attended when used.

When an employee enters bell-bottom pier holes and similar deep and confined footing excavations, the employee must wear a harness with a lifeline. The lifeline must be securely attached to the harness and must be separate from any line used to handle materials. Also, while the employee wearing the lifeline is in the excavation, an observer must be present to ensure that the lifeline is working properly and to maintain communication with the employee.

Access and Egress

Under the standard, the employer must provide safe access and egress to all excavations. According to OSHA regulations, when employees are required to be in trench excavations 4-feet deep or more, adequate means of exit, such as ladders, steps, ramps or other safe means of egress, must be provided and be within 25 feet of lateral travel. If structural ramps are used as a means of access or egress, they must be designed by a competent person if used for employee access or egress, or a competent person qualified in structural design if used by vehicles. Also, structural members used for ramps or runways must be uniform in thickness and joined in a manner to prevent tripping or displacement.

Summary

Trenching and excavation work presents serious risks to all workers involved. The greatest risk, and one of primary concern, is that of a cave-in. Furthermore, when cave-in accidents occur, they are much more likely to result in worker fatalities than other excavation-related accidents. Strict compliance, however, with all sections of the standard will prevent or greatly reduce the risk of cave-ins as well as other excavation-related accidents.

ANATOMY OF CONFINED SPACES IN CONSTRUCTION

The Issue

Fatalities and injuries constantly occur among construction workers who, during the course of their jobs, are required to enter confined spaces. In some circumstances, these workers are exposed to multiple hazards, any of which may cause bodily injury, illness, or death. Newspaper and magazine articles abound with stories of workers injured and killed from a variety of atmospheric factors and physical agents. Throughout the construction jobsite, contractors and workers encounter both inherent and induced hazards within confined workspaces.

Inherent Hazards

Inherent hazards, such as electrical, thermal, chemical, mechanical, etc., are associated with specific types of equipment and the interactions among them. Examples include high voltage (shock or corona discharge and the resulting burns), radiation generated by equipment, defective design, omission of protective features (no provision for grounding non-current-carrying conductive parts), high or low temperatures, high noise levels, and high-pressure vessels and lines (rupturing with resultant release of fragments, fluids, gases, etc.). Inherent hazards usually cannot be eliminated without degrading the system or equipment, or without making them inoperative. Therefore, emphasis must be placed on hazard control methods.

Induced Hazards

Induced hazards arise and are induced from a multitude of incorrect decisions and actions that occur during the actual construction process. Some examples are: omission of protective features, physical arrangements that may cause unintentional worker contact with electrical energy sources, oxygen-deficient atmospheres created at the bottom of pits or shafts, lack of safety factors in structural strength, and flammable atmospheres.

Examination of Typical Confined Spaces

Following are typical examples of confined workspaces in construction which contain both inherent and induced hazards.

Vaults

A variety of vaults are found on the construction jobsite. On various occasions, workers must enter these vaults to perform a number of functions. The restricted nature of vaults and their frequently below-grade location can create an assortment of safety and health problems.

Oxygen-Deficient Atmosphere

One of the major problems confronting construction workers while working in vaults is the ever-present possibility of an oxygen-deficient atmosphere.

Explosive or Toxic Gases, Vapors, or Fumes

While working in an electrical vault, workers may be exposed to the build-up of explosive gases such as those used for heating (propane). Welding and soldering produce toxic fumes which are confined in the limited atmosphere.

Electrical Shock

Electrical shock is often encountered from power tools, line cords, etc. In many instances, such electrical shock results from the fact that the contractor has not provided an approved grounding system or the protection afforded by ground-fault circuit interrupters or low-voltage systems.

Purging

In some instances, purging agents such as nitrogen and argon may enter the vault from areas adjacent to it. These agents may displace the oxygen in the vault to the extent that it will asphyxiate workers almost immediately.

Materials Falling In and On

A hazard normally considered a problem associated with confined spaces is material or equipment which may fall into the vault or onto workers as they enter and leave the vault. Vibration could cause the materials on top of the vault to roll off and strike workers. If the manhole covers were removed, or if they were not installed in the first place, materials could fall into the vault, causing injury to the workers inside.

Condenser Pits

A common confined space found in the construction of nuclear power plants is the condenser pit. Because of their large size, they are often overlooked as potentially hazardous confined spaces. These below-grade areas create large containment areas for the accumulation of toxic fumes, gases, and so forth, or for the creation of oxygen-deficient atmospheres when purging with argon, freon, and other inert gases. Other hazards will be created by workers above dropping equipment, tools, and materials into the pit.

Manholes

Throughout the construction site, manholes are commonplace. As means of entry into and exit from vaults, tanks, pits, and so forth, manholes perform a necessary function. However, these confined spaces may present serious hazards which could cause injuries and fatalities. A variety of hazards are associated with manholes. To begin with, the manhole could be a dangerous trap into which the worker could fall. Often covers are removed and not replaced, or else they are not provided in the first place.

Pipe Assemblies

One of the most frequently unrecognized types of confined spaces encountered throughout the construction site is the pipe assembly. Piping of sixteen to thirty-six inches in diameter is commonly used for a variety of purposes. For any number of reasons, workers will enter the pipe. Once inside, they are faced with potential oxygen-deficient atmospheres, often caused by purging with argon or another inert gas. Welding fumes generated by the worker in the pipe, or by other workers operating outside the pipe at either end, subject the worker to toxic atmospheres. The generally restricted dimensions of the pipe provide little room for the workers to move about and gain any degree of comfort while performing their tasks. Once inside the pipe, communication is extremely difficult. In situations where the pipe bends, communication and extrication become even more difficult. Electrical shock is another problem to which the worker is exposed. Ungrounded tools and equipment or inadequate line cords are some of the causes. As well, heat within the pipe run may cause the worker to suffer heat prostration.

Ventilation Ducts

Ventilation ducts, like pipe runs, are very common at the construction site. These sheet metal enclosures create a complex network which moves heated and cooled air and exhaust fumes to desired locations in the plant. Ventilation ducts may require that workers enter them to cut out access holes, install essential parts of the duct, etc. Depending on where these ducts are located, oxygen deficiency could exist. They usually possess many bends, which create difficult entry and exit and which also make it difficult for workers inside the duct to communicate with those outside it. Electrical shock hazards and heat stress are other problems associated with work inside ventilation ducts.

Tanks

Tanks are another type of confined workspace commonly found in construction. They are used for a variety of purposes, including the storage of water, chemicals, etc.

Tanks require entry for cleaning and repairs. Ventilation is always a problem. Oxygen-deficient atmospheres, along with toxic and explosive atmospheres created by the substances stored in the tanks, present hazards to workers. Heat, another problem in tanks, may cause heat prostration, particularly on a hot day. Since electrical line cords are often taken into the tank, the hazard of electrical shock is always present. The nature of the tank's structure often dictates that workers must climb ladders to reach high places on the walls of the tank.

Sumps

Sumps are commonplace. They are used as collection places for water and other liquids. Workers entering sumps may encounter an oxygen-deficient atmosphere. Also, because of the wet nature of the sump, electrical shock hazards are present when power tools are used inside. Sumps are often poorly illuminated. Inadequate lighting may create an accident situation.

Containment Cavities

These large below-grade areas are characterized by little or no air movement. Ventilation is always a problem. In addition, the possibility of oxygen deficiency exists. As well, welding and other gases may easily collect in these areas, creating toxic atmospheres. As these structures near completion, more confined spaces will exist as rooms are built off the existing structure.

Electrical Transformers

Electrical transformers are located on the jobsite. They often contain a nitrogen purge or dry air. Before they are opened, they must be well vented by having air pumped in. Workers, particularly electricians and power plant operators, will enter these transformers through hatches on top for various work-related reasons. Testing for oxygen deficiency and for toxic atmospheres is mandatory.

Heat Sinks

These larger pit areas hold cooling water in the event that there is a problem with the pumps located at the water supply to the plant—normally a river or lake—which would prevent cooling water from reaching the reactor core. When in the pits, workers are exposed to welding fumes and electrical hazards, particularly because water accumulates in the bottom of the sink. Generally, it is difficult to communicate with workers in the heat sink, because the rebar in the walls of the structure deaden radio signals.

Unusual Conditions

Confined Space Within a Confined Space

By the very nature of construction, situations are created which illustrate one of the most hazardous confined spaces of all—a confined space within a confined space. This situation appears as tanks within pits, pipe assemblies or vessels within pits, etc. In this situation, not only do the potential hazards associated with the outer confined space require testing, monitoring, and control, but those of the inner space also require similar procedures. Often, only the outer space is evaluated. When workers enter the inner space, they are faced with potentially hazardous conditions. A good example of a confined space within a confined space is a vessel with a nitrogen purge inside a filtering water access pit. Workers entering the pit and/or the vessel should do so only after both spaces have been evaluated and proper control measures established.

Hazards In One Space Entering Another Space

During an examination of confined spaces in construction, one often encounters situations which are not always easy to evaluate or control. For instance, a room or area which classifies as a confined space may be relatively safe for work. However, access passages from other areas outside or adjacent to the room could, at some point, allow the transfer of hazardous agents into the "safe" one. One such instance would be a pipe coming through a wall into a containment room. Welding fumes and other toxic materials generated in one room may easily travel through the pipe into another area, causing it to change from a safe to an unsafe workplace. A serious problem with a situation such as this is that workers working in the "safe" area are not aware of the hazards leaking into their area. Thus, they are not prepared to take action to avoid or control it.

Conclusion

In this discussion, we have defined inherent and induced hazards in confined spaces. We have examined typical confined spaces on construction sites and we have described representative hazards within these confined spaces.

ELECTRICAL STANDARDS FOR CONSTRUCTION

Introduction

Electricity has long been recognized as a serious workplace hazard, exposing employees to such dangers as electric shock, electrocution, fires, and explosions.

Experts in electrical safety have traditionally looked toward the widely used National Electrical Code (NEC) for help in the practical safeguarding of persons from these hazards. The Occupational Safety and Health Administration (OSHA) recognized the important role of the NEC in defining basic requirements for safety in electrical installations by including the entire 1971 NEC by reference in Subpart K of 29 Code of Federal Regulations Part 1926 (Construction Safety and Health Standards).

In a final rule dated July 11, 1986, OSHA updated, simplified, and clarified Subpart K, 29 CFR 1926. The revisions serve these objectives:

- NEC requirements that directly affect employees in construction workplaces have been placed in the text of the OSHA standard, eliminating the need for the NEC to be incorporated by reference.
- Certain requirements that supplemented the NEC have been integrated in the new format.
- Performance language is utilized and superfluous specifications omitted and changes in technology accommodated.

In addition, the standard is easier for employers and employees to use and understand. Also, the OSHA revision of the electrical standards has been made more flexible, eliminating the need for constant revision to keep pace with the NEC, which is revised every three years.

Subpart K

The NEC provisions directly related to employee safety are included in the body of the standard itself—making it unnecessary to continue the adoption by reference of the NEC. Subpart K is divided into four major groups plus a general definitions section:

1. Installation Safety Requirements [29 CFR 1926.402 - 1926.415]
2. Safety-Related Work Practices [29 CFR 1926.416 - 1926.430]
3. Safety-Related Maintenance and Environmental Considerations [29 CFR 1926.431 - 1926.440]
4. Safety Requirements for Special Equipment [29 CFR 1926.441 - 1926.448]
5. Definitions [29 CFR 1926.449]

I. Installation Safety Requirements

Part I of the standard is very comprehensive. Only some of the major topics and brief summaries of these requirements are included in this discussion.

Sections 29 CFR 1926.402 through 1926.408 contain installation safety requirements for electrical equipment and installations used to provide electric power and light at the jobsite. These sections apply to installations, both temporary and permanent, used on the jobsite; but they do not apply to existing permanent installations that were in place before the construction activity commenced.

Approval

The electrical conductors and equipment used by the employer must be approved.

Examination, Installation, and Use of Equipment

The employer must ensure that electrical equipment is free from recognized hazards that are likely to cause death or serious physical harm to employees. Safety of equipment must be determined by the following:

- Suitability for installation and use in conformity with the provisions of the standard. Suitability of equipment for an identified purpose may be evidenced by a listing, by labeling, or by certification for that identified purpose.
- Mechanical strength and durability. For parts designed to enclose and protect other equipment, this includes the adequacy of the protection thus provided.
- Electrical insulation.
- Heating effects under conditions of use.
- Arcing effects.
- Classification by type, size, voltage, current capacity, and specific use.
- Other factors that contribute to the practical safeguarding of employees who use or are likely to come in contact with the equipment.

Guarding

Live parts of electric equipment operating at 50 volts or more must be guarded against accidental contact. Guarding of live parts must be accomplished as follows:

- Location in a cabinet, room, vault, or similar enclosure accessible only to qualified persons.
- Use of permanent, substantial partitions or screens to exclude unqualified persons.
- Location on a suitable balcony, gallery, or platform elevated and arranged to exclude unqualified persons.
- Elevation of eight feet or more above the floor.

Entrance to rooms and other guarded locations containing exposed live parts must be marked with conspicuous warning signs forbidding unqualified persons to enter.

Electric installations that are over 600 volts and that are open to unqualified persons must be made with metal-enclosed equipment or enclosed in a vault or area controlled by a lock. In addition, equipment must be marked with appropriate caution signs.

Overcurrent Protection

The following requirements apply to overcurrent protection of circuits rated 600 volts, nominal, or less.

- Conductors and equipment must be protected from overcurrent in accordance with their ability to safely conduct current and the conductors must have sufficient current-carrying capacity to carry the load.
- Overcurrent devices must not interrupt the continuity of the grounded conductor unless all conductors of the circuit are opened simultaneously, except for motor-running overload protection.
- Overcurrent devices must be readily accessible and not located where they could create an employee safety hazard by being exposed to physical damage or located in the vicinity of easily ignitable material.
- Fuses and circuit breakers must be so located or shielded that employees will not be burned or otherwise injured by their operation, e.g., arcing.

Grounding of Equipment Connected by Cord and Plug

Exposed noncurrent-carrying metal parts of cord- and plug-connected equipment that may become energized must be grounded in the following situations:

- When in a hazardous (classified) location.
- When operated at over 150 volts to ground, except for guarded motors and metal frames of electrically heated appliances if the appliance frames are permanently and effectively insulated from ground.
- When one of the types of equipment listed below. But see Item 6 for exemption.

Hand held motor-operated tools. Cord- and plug-connected equipment used in damp or wet locations or by employees standing on the ground or on metal floors or working inside metal tanks or boilers. Portable and mobile X-ray and associated equipment. Tools likely to be used in wet and/or conductive locations. Portable hand lamps. [Exemption] Tools likely to be used in wet and/or conductive locations need not be grounded if supplied through an isolating transformer with an ungrounded secondary of not over 50 volts. Listed or labeled portable tools and appliances protected by a system of double insulation, or its equivalent, need not be grounded. If such a system is employed, the equipment must be distinctively marked to indicate that the tool or appliance uses a system of double insulation.

II. Safety-Related Work Practices

Protection of Employees

The employer must not permit an employee to work near any part of an electric power circuit that the employee could contact in the course of work, unless the employee is protected against shock by de-energizing the circuit and grounding it or by guarding it effectively by insulation or other means.

Where the exact location of underground electric power lines is unknown, employees using jack hammers or hand tools that may contact a line must be provided with insulated protective gloves.

Even before work is begun, the employer must determine by inquiry, observation, or instruments where any part of an exposed or concealed energized electric power circuit is located. This is necessary because a person, tool or machine could come into physical or electrical contact with the electric power circuit.

The employer is required to advise employees of the location of such lines, the hazards involved, and protective measures to be taken as well as to post and maintain proper warning signs.

Passageways and Open Spaces

The employer must provide barriers or other means of guarding to ensure that workspace for electrical equipment will not be used as a passageway during the time when energized parts of electrical equipment are exposed. Walkways and similar working spaces must be kept clear of electric cords.

Other standards cover load ratings, fuses, cords, and cables.

Lockout and Tagging of Circuits

Tags must be placed on controls that are to be deactivated during the course of work on energized or de-energized equipment or circuits. Equipment or circuits that are de-energized must be rendered inoperative and have tags attached at all points where such equipment or circuits can be energized.

III. Safety-Related Maintenance and Environmental Considerations

Maintenance of Equipment

The employer must ensure that all wiring components and utilization equipment in hazardous locations are maintained in a dust-tight, dust-ignition-proof, or explosion-proof condition without loose or missing screws, gaskets, threaded connections, seals, or other impairments to a tight condition.

Environmental Deterioration of Equipment

Unless identified for use in the operating environment, no conductors or equipment can be located:

- In damp or wet locations.
- Where exposed to gases, fumes, vapors, liquids, or other agents having a deteriorating effect on the conductors or equipment.
- Where exposed to excessive temperatures.

Control equipment, utilization equipment, and busways approved for use in dry locations only must be protected against damage from the weather during building construction.

For protection against corrosion, metal raceways, cable armor, boxes, cable sheathing, cabinets, elbows, couplings, fittings, supports, and support hardware must be of materials appropriate for the environment in which they are installed.

IV. Safety Requirements for Special Equipment

Batteries

Batteries of the unsealed type must be located in enclosures with outside vents or in well-ventilated rooms arranged to prevent the escape of fumes, gases, or electrolyte spray into other areas. Other provisions include the following:

- Ventilation-to ensure diffusion of the gases from the battery and to prevent the accumulation of an explosive mixture.
- Racks and trays-treated to make them resistant to the electrolyte.
- Floors-acid-resistant construction unless protected from acid accumulations.
- Face shields, aprons, and rubber gloves-for workers handling acids or batteries.
- Facilities for quick drenching of the eyes and body-within 25 feet (7.62 m) of battery handling areas.
- Facilities-for flushing and neutralizing spilled electrolytes and for fire protection.

Battery Charging

Battery charging installations must be located in areas designated for that purpose. When batteries are being charged, vent caps must be maintained in functioning condition and kept in place to avoid electrolyte spray. Also, charging apparatus must be protected from damage by trucks.

PERSONAL PROTECTIVE AND LIFE SAVING EQUIPMENT

Criteria for Personal Protective Equipment – §1926.95

Application

Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

Employee-Owned Equipment

Where employees provide their own protective equipment, the employer shall be responsible to assure its adequacy, including proper maintenance, and sanitation of such equipment.

Design

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

Occupational Foot Protection – §1926.96

Safety-toe footwear for employees shall meet the requirements and specifications in American National Standard for Men's Safety—Toe Footwear, ANSI Z41.1-1967.

Head Protection – §1926.100

Employees working in areas where there is a possible danger of head injury from impact, or from falling or flying objects, or from electrical shock and burns shall be protected by protective helmets.

Helmets for the protection of employees against impact and penetration of falling and flying objects shall meet the specifications contained in American National Standards Institute, ANSI Z89.1-1969, Safety Requirements for Industrial Head Protection.

Helmets for the head protection of employees exposed to high voltage electrical shock and burns shall meet the specifications contained in American National Standards Institute, ANSI Z89.2-1971.

Hearing Protection – §1926.101

Wherever it is not feasible to reduce the noise levels or duration of exposures to those specified in Table D-2, Permissible Noise Exposures, in 1926.52, ear protective devices shall be provided and used.

Hearing protective devices inserted in the ear shall be fitted or determined individually by competent persons.

Plain cotton is not an acceptable protective device.

Eye and Face Protection – §1926.102

General

Employees shall be provided with eye and face protection equipment when machines or operations present potential eye or face injury from physical, chemical, or radiation agents.

Eye and face protection equipment required by this section shall meet the requirements specified in American National Standards Institute, ANSI Z87.1-1968, Practice for Occupational and Educational Eye and Face Protection.

Employees whose vision requires the use of corrective lenses in spectacles, when required by this regulation to wear eye protection, shall be protected by goggles or spectacles of one of the following types:

- Spectacles whose protective lenses provide optical correction;
- Goggles that can be worn over corrective spectacles without disturbing the adjustment of the spectacles; or
- Goggles that incorporate corrective lenses mounted behind the protective lenses.

Face and eye protection equipment shall be kept clean and in good repair. The use of this type equipment with structural or optical defects shall be prohibited.

Table E-1 in §1926.102 shall be used as a guide in the selection of face and eye protection for the hazards and operations noted.

Protectors shall meet the following minimum requirements:

- Provide adequate protection against the particular hazards for which they are designed
- Be reasonably comfortable when worn under the designated conditions
- Fit snugly and not unduly interfere with the movements of the wearer
- Be durable
- Be capable of being disinfected
- Be easily cleanable

Every protector shall be distinctly marked to facilitate identification only of the manufacturer.

When limitations or precautions are indicated by the manufacturer, they shall be transmitted to the user and care taken to see that such limitations and precautions are strictly observed.

Protection Against Radiant Energy

Table E-2 in §1926.102(b)(1) shall be used as a guide for the selection of the proper shade numbers of filter lenses or plates used in welding. Shades more dense than those listed may be used to suit the individual's needs.

Employees whose occupation or assignment requires exposure to laser beams shall be furnished suitable laser safety goggles which will protect for the specific wavelength of the laser and be of optical density (O.D.) adequate for the energy involved. Table E-3 in §1926.102(b)(2) lists the maximum power or energy density for which adequate protection is afforded by glasses of optical densities from 5 through 8.

All protective goggles shall bear a label identifying the following data:

- The laser wavelengths for which use is intended
- The optical density of those wavelengths
- The visible light transmission

Respiratory Protection – §1926.103

On October 5, 1998, OSHA's revised Respiratory Protection Standard took effect. It replaces the standards adopted in 1971 (29 CFR 1910.134 and 29 CFR 1926.103), and it applies to general industry, construction, shipyard, longshoring, and marine terminal workplaces.

For more information, see the Respiratory Protection Safety and Health Topics site.

Safety Belts, Lifelines, and Lanyards – §1926.104

Lifelines, safety belts, and lanyards shall be used only for employee safeguarding. Any lifeline, safety belt, or lanyard actually subjected to in-service loading, as distinguished from static load testing, shall be immediately removed from service and shall not be used again for employee safeguarding.

Lifelines shall be secured above the point of operation to an anchorage or structural member capable of supporting a minimum dead weight of 5,400 pounds.

Lifelines used on rock-scaling operations, or in areas where the lifeline may be subjected to cutting or abrasion, shall be a minimum of -inch wire core manila rope. For all other lifeline applications, a minimum of ¾-inch manila or equivalent, with a minimum breaking strength of 5,400 pounds, shall be used.

Safety belt lanyard shall be a minimum of ½-inch nylon, or equivalent, with a maximum length to provide for a fall of no greater than 6 feet. The rope shall have a nominal breaking strength of 5,400 pounds.

All safety belt and lanyard hardware shall be drop forged or pressed steel, cadmium plated in accordance with type 1, Class B plating specified in Federal Specification QQ-P-416. Surface shall be smooth and free of sharp edges.

All safety belt and lanyard hardware, except rivets, shall be capable of withstanding a tensile loading of 4,000 pounds without cracking, breaking, or taking a permanent deformation.

Safety Nets – §1926.105

Safety nets shall be provided when workplaces are more than 25 feet above the ground or water surface, or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, or safety belts is impractical.

Where safety net protection is required by this section, operations shall not be undertaken until the net is in place and has been tested.

Nets shall extend 8 feet beyond the edge of the work surface where employees are exposed and shall be installed as close under the work surface as practical but in no case more than 25 feet below such work surface. Nets shall be hung with sufficient clearance to prevent user's contact with the surfaces or structures below. Such clearances shall be determined by impact load testing.

It is intended that only one level of nets be required for bridge construction.

The mesh size of nets shall not exceed 6 inches by 6 inches. All new nets shall meet accepted performance standards of 17,500 foot-pounds minimum impact resistance as determined and certified by the manufacturers, and shall bear a label of proof test. Edge ropes shall provide a minimum breaking strength of 5,000 pounds.

Forged steel safety hooks or shackles shall be used to fasten the net to its supports.

Connections between net panels shall develop the full strength of the net.

Working Over or Near Water – §1926.106

Employees working over or near water, where the danger of drowning exists, shall be provided with U.S. Coast Guard-approved life jacket or buoyant work vests.

Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects which would alter their strength or buoyancy. Defective units shall not be used.

Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations. Distance between ring buoys shall not exceed 200 feet.

At least one lifesaving skiff shall be immediately available at locations where employees are working over or adjacent to water.

HAND AND POWER TOOLS

Hazard Recognition

Tools are such a common part of our lives that it is difficult to remember that they may pose hazards. All tools are manufactured with safety in mind but, tragically, a serious accident often occurs before steps are taken to search out and avoid or eliminate tool-related hazards.

In the process of removing or avoiding the hazards, workers must learn to recognize the hazards associated with the different types of tools and the safety precautions necessary to prevent those hazards.

Hand Tools

Hand tools are non-powered. They include anything from axes to wrenches. The greatest hazards posed by hand tools result from misuse and improper maintenance.

Some examples:

- Using a screwdriver as a chisel may cause the tip of the screwdriver to break and fly, hitting the user or other employees.
- If a wooden handle on a tool such as a hammer or an axe is loose, splintered, or cracked, the head of the tool may fly off and strike the user or another worker.
- A wrench must not be used if its jaws are sprung, because it might slip.
- Impact tools such as chisels, wedges, or drift pins are unsafe if they have mushroomed heads. The heads might shatter on impact, sending sharp fragments flying.

The employer is responsible for the safe condition of tools and equipment used by employees but the employees have the responsibility for properly using and maintaining tools.

Employers should caution employees that saw blades, knives, or other tools be directed away from aisle areas and other employees working in close proximity. Knives and scissors must be sharp. Dull tools can be more hazardous than sharp ones.

Appropriate personal protective equipment, e.g., safety goggles, gloves, etc., should be worn due to hazards that may be encountered while using portable power tools and hand tools.

Safety requires that floors be kept as clean and dry as possible to prevent accidental slips with or around dangerous hand tools.

Around flammable substances, sparks produced by iron and steel hand tools can be a dangerous ignition source. Where this hazard exists, spark-resistant tools made from brass, plastic, aluminum, or wood will provide for safety.

Power Tools Precautions

Power tools can be hazardous when improperly used. There are several types of power tools, based on the power source they use: electric, pneumatic, liquid fuel, hydraulic, and powder-actuated.

Employees should be trained in the use of all tools—not just power tools. They should understand the potential hazards as well as the safety precautions to prevent those hazards from occurring.

The following general precautions should be observed by power tool users:

- Never carry a tool by the cord or hose.
- Never yank the cord or the hose to disconnect it from the receptacle.
- Keep cords and hoses away from heat, oil, and sharp edges.
- Disconnect tools when not in use, before servicing, and when changing accessories such as blades, bits and cutters.
- All observers should be kept at a safe distance away from the work area.
- Secure work with clamps or a vise, freeing both hands to operate the tool.
- Avoid accidental starting. The worker should not hold a finger on the switch button while carrying a plugged-in tool.
- Tools should be maintained with care. They should be kept sharp and clean for the best performance. Follow instructions in the user's manual for lubricating and changing accessories.
- Be sure to keep good footing and maintain good balance.
- The proper apparel should be worn. Loose clothing, ties, or jewelry can become caught in moving parts.
- All portable electric tools that are damaged shall be removed from use and tagged "Do Not Use."

Guards

Hazardous moving parts of a power tool need to be safeguarded. For example, belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or moving parts of equipment must be guarded if such parts are exposed to contact by employees.

Guards, as necessary, should be provided to protect the operator and others from the following:

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

Safety guards must never be removed when a tool is being used. For example, portable circular saws must be equipped 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

The following hand-held powered tools must be equipped with a momentary contact "on-off" control switch: drills, tappers, fastener drivers, horizontal, vertical and angle grinders with wheels larger than 2 inches in diameter, disc and belt sanders, reciprocating saws, saber saws, and other similar tools. These tools also may be equipped with a lock-on control provided that turnoff can be accomplished by a single motion of the same finger or fingers that turn it on.

The following hand-held powered tools may be equipped with only a positive "on-off" control switch: platen sanders, disc sanders with discs 2 inches or less in diameter; grinders with wheels 2 inches or less in diameter; routers, planers, laminate trimmers, nibblers, shears, scroll saws and jigsaws with blade shanks <-inch wide or less.

Other hand-held powered tools such as circular saws having a blade diameter greater than 2 inches, chain saws, and percussion tools without positive accessory holding means must be equipped with a constant pressure switch that will shut off the power when the pressure is released.

Electric Tools

Employees using electric tools must be aware of several dangers; the most serious is the possibility of electrocution.

Among the chief hazards of electric-powered tools are burns and slight shocks which 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, be double insulated, or be powered by a low-voltage isolation transformer. Three-wire cords contain two current-carrying conductors and a grounding conductor. One end of the grounding conductor connects to the tool's metal housing. The other end is grounded through a prong on the plug. Anytime an adapter is used to accommodate a two-hole receptacle, the adapter wire must be attached to a known ground. The third prong should never be removed from the plug.

Double insulation is more convenient. The user and the tools are protected in two ways: by normal insulation on the wires inside, and by a housing that cannot conduct electricity to the operator in the event of a malfunction.

These general practices should be followed when using electric tools:

- Electric tools should be operated within their design limitations.
- Gloves and safety footwear are recommended during use of electric tools.
- When not in use, tools should be stored in a dry place.
- Electric tools should not be used in damp or wet locations.
- Work areas should be well lighted.

Powered Abrasive Wheel Tools

Powered abrasive grinding, cutting, polishing, and wire buffing wheels create special safety problems because they may throw off flying fragments.

Before an abrasive wheel is mounted, it should be inspected closely and sound- or ring-tested to be sure that it is free from cracks or defects. To test, wheels should be tapped gently with a light nonmetallic instrument. If they sound cracked or dead, they could fly apart in operation and so must not be used. A sound and undamaged wheel will give a clear metallic tone or "ring."

To prevent the wheel from cracking, the user should be sure it fits freely on the spindle. The spindle nut must be tightened enough to hold the wheel in place, without distorting the flange. Follow the manufacturer's recommendations. Care must be taken to assure that the spindle wheel will not exceed the abrasive wheel specifications.

Due to the possibility of a wheel disintegrating (exploding) during startup, the employee should never stand directly in front of the wheel as it accelerates to full operating speed.

Portable grinding tools need to be equipped with safety guards to protect workers not only from the moving wheel surface, but also from flying fragments in case of breakage.

In addition, when using a powered grinder:

- Always use eye protection.
- Turn off the power when not in use.
- Never clamp a hand-held grinder in a vise.

Pneumatic Tools

Pneumatic tools are powered by compressed air and include chippers, drills, hammers, and sanders.

There are several dangers encountered in the use of pneumatic tools. The main one is the danger of getting hit by one of the tool's attachments or by some kind of fastener the worker is using with the tool.

Eye protection is required and face protection is recommended for employees working with pneumatic tools.

Noise is another hazard. Working with noisy tools such as jackhammers requires proper, effective use of hearing protection.

When using pneumatic tools, employees must check to see that they are fastened securely to the hose to prevent them from becoming disconnected. A short wire or positive locking device attaching the air hose to the tool will serve as an added safeguard.

A safety clip or retainer must be installed to prevent attachments, such as chisels on a chipping hammer, from being unintentionally shot from the barrel.

Screens must be set up to protect nearby workers from being struck by flying fragments around chippers, riveting guns, staplers, or air drills.

Compressed air guns should never be pointed toward anyone. Users should never "dead-end" it against themselves or anyone else.

Powder-Actuated tools

Powder-actuated tools operate like a loaded gun and should be treated with the same respect and precautions. In fact, they are so dangerous that they must be operated only by specially trained employees.

Safety precautions to remember include the following:

- These tools should not be used in an explosive or flammable atmosphere.
- Before using the tool, the worker should inspect it to determine that it is clean, that all moving parts operate freely, and that the barrel is free from obstructions.
- The tool should never be pointed at anybody.
- The tool should not be loaded unless it is to be used immediately. A loaded tool should not be left unattended, especially where it would be available to unauthorized persons.
- Hands should be kept clear of the barrel end. To prevent the tool from firing accidentally, two separate motions are required for firing: one to bring the tool into position, and another to pull the trigger. The tools must not be able to operate until they are pressed against the work surface with a force of at least 5 pounds greater than the total weight of the tool.

If a powder-actuated tool misfires, the employee should wait at least 30 seconds, then try firing it again. If it still will not fire, the user should wait another 30 seconds so that the faulty cartridge is less likely to explode, than carefully remove the load. The bad cartridge should be put in water.

Suitable eye and face protection are essential when using a powder-actuated tool.

The muzzle end of the tool must have a protective shield or guard centered perpendicularly on the barrel to confine any flying fragments or particles that might otherwise create a hazard when the tool is fired. The tool must be designed so that it will not fire unless it has this kind of safety device.

All powder-actuated tools must be designed for varying powder charges so that the user can select a powder level necessary to do the work without excessive force.

If the tool develops a defect during use it should be tagged and taken out of service immediately until it is properly repaired.

Fasteners

When using powder-actuated tools to apply fasteners, there are some precautions to consider. Fasteners must not be fired into material that would let them pass through to the other side. The fastener must not be driven into materials like brick or concrete any closer than 3 inches to an edge or corner. In steel, the fastener must not come any closer than one-half inch from a corner or edge. Fasteners must not be driven into very hard or brittle materials which might chip or splatter, or make the fastener ricochet.

An alignment guide must be used when shooting a fastener into an existing hole. A fastener must not be driven into a spalled area caused by an unsatisfactory fastening.

Hydraulic Power Tools

The fluid used in hydraulic power tools must be an approved fire-resistant fluid and must retain its operating characteristics at the most extreme temperatures to which it will be exposed.

The manufacturer’s recommended safe operating pressure for hoses, valves, pipes, filters, and other fittings must not be exceeded.

Jacks

All jacks—lever and ratchet jacks, screw jacks, and hydraulic jacks—must have a device that stops them from jacking up too high. Also, the manufacturer’s load limit must be permanently marked in a prominent place on the jack and should not be exceeded.

A jack should never be used to support a lifted load. Once the load has been lifted, it must immediately be blocked up.

Use wooden blocking under the base if necessary to make the jack level and secure. If the lift surface is metal, place a 1-inch-thick hardwood block or equivalent between it and the metal jack head to reduce the danger of slippage.

To set up a jack, make certain of the following:

- The base rests on a firm level surface
- The jack is correctly centered
- The jack head bears against a level surface
- The lift force is applied evenly

Proper maintenance of jacks is essential for safety. All jacks must be inspected before each use and lubricated regularly. If a jack is subjected to an abnormal load or shock, it should be thoroughly examined to make sure it has not been damaged.

Hydraulic jacks exposed to freezing temperatures must be filled with an adequate antifreeze liquid.

General Safety Precautions

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 must be provided with the particular personal equipment necessary to protect them from the hazard.

All hazards involved in the use of power tools can be prevented 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, it should be brought to the attention of the proper individual immediately.

STAIRWAYS AND LADDERS

Introduction

Stairways and ladders are a major source of injuries and fatalities among construction workers.

OSHA estimates that there are 24,882 injuries and as many as 36 fatalities per year due to falls from stairways and ladders used in construction. Nearly half of these injuries are serious enough to require time off the job—11,570 lost workday injuries and 13,312 non-lost workday injuries occur annually due to falls from stairways and ladders used in construction. These data demonstrate that work on and around ladders and stairways is hazardous. More importantly, they show that compliance with OSHA's requirements for the safe use of ladders and stairways could have prevented many of these injuries.

This discussion serves as a quick and easy reference for use on job sites. The requirements of OSHA safety regulations for the safe use of ladders and stairs (Subpart X, Title 29 Code of Federal Regulations, Part 1926.1050 through 1926.1060) are explained in this discussion.

Scope and Application

The OSHA rules apply to all stairways and ladders used in construction, alteration, repair (including painting and decorating), and demolition of work sites covered by OSHA's construction safety and health standards. They also specify when stairways and ladders must be provided. They do not apply to ladders that are specifically manufactured for scaffold access and egress, but do apply to job-made and manufactured portable ladders intended for general purpose use and which are then used for scaffold access and egress.

General Requirements

- A stairway or ladder must be provided at all worker points of access where there is a break in elevation of 19 inches (48 cm) or more and no ramp, runway, embankment, or personnel hoist is provided.
- When there is only one point of access between levels, it must be kept clear to permit free passage by workers. If free passage becomes restricted, a second point of access must be provided and used.
- When there are more than two points of access between levels, at least one point of access must be kept clear.
- All stairway and ladder fall protection systems required by these rules must be installed and all duties required by the stairway and ladder rules must be performed before employees begin work that requires them to use stairways or ladders and their respective fall protection systems.

Stairways

The following general requirements apply to all stairways used during the process of construction, as indicated:

- Stairways that will not be a permanent part of the structure on which construction work is performed must have landings at least 30 inches deep and 22 inches wide (76 x 56 cm) at every 12 feet (3.7 m) or less of vertical rise.
- Stairways must be installed at least 30 degrees, and no more than 50 degrees, from the horizontal.
- Variations in riser height or stair tread depth must not exceed ¼ inch in any stairway system, including any foundation structure used as one or more treads of the stairs.

- Where doors or gates open directly onto a stairway, a platform must be provided that is at least 20 inches (51 cm) in width beyond the swing of the door.

- Metal pan landings and metal pan treads must be secured in place before filling.
- All stairway parts must be free of dangerous projections such as protruding nails.
- Slippery conditions on stairways must be corrected.
- Spiral stairways that will not be a permanent part of the structure may not be used by workers.

The following requirements apply to stairs in temporary service during construction:

- Except during construction of the actual stairway, stairways with metal pan landings and treads must not be used where the treads and/or landings have not been filled in with concrete or other material, unless the pans of the stairs and/or landings are temporarily filled in with wood or other material. All treads and landings must be replaced when worn below the top edge of the pan.
- Except during construction of the actual stairway, skeleton metal frame structures and steps must not be used (where treads and/or landings are to be installed at a later date) unless the stairs are fitted with secured temporary treads and landings.
- Temporary treads must be made of wood or other solid material and installed the full width and depth of the stair.

Stair rails and Handrails

The following general requirements apply to all stair rails and handrails:

- Stairways having four or more risers, or rising more than 30 inches (76 cm) in height, whichever is less, must have at least one handrail. A stair rail also must be installed along each unprotected side or edge. When the top edge of a stair rail system also serves as a handrail, the height of the top edge must not be more than 37 inches (94 cm) nor less than 36 inches (91.5 cm) from the upper surface of the stair rail to the surface of the tread.
- Winding or spiral stairways must be equipped with a handrail to prevent using areas where the tread width is less than 6 inches (15 cm).
- Stair rails installed after March 15, 1991, must not be less than 36 inches (91.5 cm) in height.
- Midrails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members must be provided between the top rail and stairway steps of the stairrail system.
- Midrails, when used, must be located midway between the top of the stairrail system and the stairway steps.
- Screens or mesh, when used, must extend from the top rail to the stairway step, and along the opening between top rail supports.
- Intermediate vertical members, such as balusters, when used, must not be more than 19 inches (48 cm) apart.
- Other intermediate structural members, when used, must be installed so that there are no openings of more than 19 inches (48 cm) wide.
- Handrails and the top rails of the stair rail systems must be capable of withstanding, without failure, at least 200 pounds (890 n) of weight applied within 2 inches (5 cm) of the top edge in any downward or outward direction, at any point along the top edge.

The height of handrails must not be more than 37 inches (94 cm) nor less than 30 inches (76 cm) from the upper surface of the handrail to the surface of the tread.

- The height of the top edge of a stair rail system used as a handrail must not be more than 37 inches (94 cm) nor less than 36 inches (91.5 cm)(1) from the upper surface of the stair rail system to the surface of the tread.

- Stairrail systems and handrails must be surfaced to prevent injuries such as punctures or lacerations and to keep clothing from snagging.
- Handrails must provide an adequate handhold for employees to grasp to prevent falls.
- The ends of stairrail systems and handrails must be constructed to prevent dangerous projections such as rails protruding beyond the end posts of the system.
- Temporary handrails must have a minimum clearance of 3 inches (8 cm) between the handrail and walls, stairrails systems, and other objects.
- Unprotected sides and edges of stairway landings must be provided with standard 42-inch (1.1 m) guardrail systems.

Ladders

The following general requirements apply to all ladders, including job-made ladders:

- A double-cleated ladder or two or more ladders must be provided when ladders are the only way to enter or exit a work area having 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.
- Rungs, cleats, and steps of portable and fixed ladders (except as provided below) must not be spaced less than 10 inches (25 cm) apart, nor more than 14 inches (36 cm) apart, along the ladder's side rails.
- Rungs, cleats, and steps of step stools must not be less than 8 inches (20 cm) apart, nor more than 12 inches (31 cm) apart, between center lines of the rungs, cleats, and steps.
- Rungs, cleats, and steps at the base section of extension trestle ladders must not be less than 8 inches (20 cm) nor more than 18 inches (46 cm) apart, between center lines of the rungs, cleats, and steps. The rung spacing on the extension section must not be less than 6 inches (15 cm) nor more than 12 inches (31 cm).
- Ladders must not be tied or fastened together to create longer sections unless they are specifically designed for such use.
- A metal spreader or locking device must be provided on each stepladder to hold the front and back sections in an open position when the ladder is being used.
- When splicing side rails, the resulting side rail must be equivalent in strength to a one-piece side rail made of the same material.
- Two or more separate ladders used to reach an elevated work area must be offset with a platform or landing between the ladders, except when portable ladders are used to gain access to fixed ladders.
- Ladder components must be surfaced to prevent injury from punctures or lacerations, and prevent snagging of clothing.
- Wood ladders must not be coated with any opaque covering, except for identification or warning labels which may be placed only on one face of a side rail.

Portable Ladders

- Non-self-supporting and self-supporting portable ladders must support at least four times the maximum intended load; extra heavy-duty type 1A metal or plastic ladders must sustain 3.3 times the maximum intended load. The ability of a self-supporting ladder to sustain loads must be determined by applying the load to the ladder in a downward vertical direction. The ability of a non-self-supporting ladder to sustain loads must be determined by applying the load in a downward vertical direction when the ladder is placed at a horizontal angle of 75.5 degrees.
- The minimum clear distance between side rails for all portable ladders must be 11.5 inches (29 cm).
- The rungs and steps of portable metal ladders must be corrugated, knurled, dimpled, coated with skid-resistant material, or treated to minimize slipping.

Fixed Ladders

- A fixed ladder must be capable of supporting at least two loads of 250 pounds (114 kg) each, concentrated between any two consecutive attachments. Fixed ladders also must support added anticipated loads caused by ice buildup, winds, rigging, and impact loads resulting from the use of ladder safety devices.
- Individual rung/step ladders must extend at least 42 inches (1.1 m) above an access level or landing platform either by the continuation of the rung spacings as horizontal grab bars or by providing vertical grab bars that must have the same lateral spacing as the vertical legs of the ladder rails.
- Each step or rung of a fixed ladder must be capable of supporting a load of at least 250 pounds (114 kg) applied in the middle of the step or rung.
- The minimum clear distance between the sides of individual rung/step ladders and between the side rails of other fixed ladders must be 16 inches (41 cm).
- The rungs of individual rung/step ladders must be shaped to prevent slipping off the end of the rungs.
- The rungs and steps of fixed metal ladders manufactured after January 14, 1991, must be corrugated, knurled, dimpled, coated with skid-resistant material, or treated to minimize slipping.
- The minimum perpendicular clearance between fixed ladder rungs, cleats, and steps, and any obstruction behind the ladder must be 7 inches (18 cm), except that the clearance for an elevator pit ladder must be 4.5 inches (11 cm).
- The minimum perpendicular clearance between the centerline of fixed ladder rungs, cleats, and steps, and any obstruction on the climbing side of the ladder must be 30 inches (76 cm). If obstructions are unavoidable, clearance may be reduced to 24 inches (61 cm), provided a deflection device is installed to guide workers around the obstruction.
- The step-across distance between the center of the steps or rungs of fixed ladders and the nearest edge of a landing area must be no less than 7 inches (18 cm) and no more than 12 inches (30 cm). A landing platform must be provided if the step-across distance exceeds 12 inches (30 cm).
- Fixed ladders without cages or wells must have at least a 15-inch (38 cm) clear width to the nearest permanent object on each side of the centerline of the ladder.
- Fixed ladders must be provided with cages, wells, ladder safety devices, or self-retracting lifelines where the length of climb is less than 24 feet (7.3 m) but the top of the ladder is at a distance greater than 24 feet (7.3 m) above lower levels.

- If the total length of a climb on a fixed ladder equals or exceeds 24 feet (7.3 m), the following requirements must be met: fixed ladders must be equipped with either (a) ladder safety devices; (b) self-retracting lifelines, and rest platforms at intervals not to exceed 150 feet (45.7 m); or (c) a cage or well, and multiple ladder sections, each ladder section not to exceed 50 feet (15.2 m) in length. These ladder sections must be offset from adjacent sections, and landing platforms must be provided at maximum intervals of 50 feet (15.2 m).
- The side rails of through or side-step fixed ladders must extend 42 inches (1.1 m) above the top level or landing platform served by the ladder. For a parapet ladder, the access level must be at the roof if the parapet is cut to permit passage through it; if the parapet is continuous, the access level is the top of the parapet.
- Steps or rungs for through-fixed-ladder extensions must be omitted from the extension; and the extension of side rails must be flared to provide between 24 inches (61 cm) and 30 inches (76 cm) clearance between side rails.
- When safety devices are provided, the maximum clearance between side rail extensions must not exceed 36 inches (91 cm).

Cages for Fixed Ladders

- Horizontal bands must be fastened to the side rails of rail ladders, or directly to the structure, building, or equipment for individual-rung ladders.
- Vertical bars must be on the inside of the horizontal bands and must be fastened to them.
- Cages must not extend less than 27 inches (68 cm), or more than 30 inches (76 cm) from the centerline of the step or rung, and must not be less than 27 inches (68 cm) wide.
- The inside of the cage must be clear of projections.
- Horizontal bands must be spaced at intervals not more than 4 feet (1.2 m) apart measured from centerline to centerline.
- Vertical bars must be spaced at intervals not more than 9.5 inches (24 cm) apart measured from centerline to centerline.
- The bottom of the cage must be between 7 feet (2.1 m) and 8 feet (2.4 m) above the point of access to the bottom of the ladder. The bottom of the cage must be flared not less than 4 inches (10 cm) between the bottom horizontal band and the next higher band.
- The top of the cage must be a minimum of 42 inches (1.1 m) above the top of the platform, or the point of access at the top of the ladder. Provisions must be made for access to the platform or other point of access.

Wells for Fixed Ladders

- Wells must completely encircle the ladder.
- Wells must be free of projections.
- The inside face of the well on the climbing side of the ladder must extend between 27 inches (68 cm) and 30 inches (76 cm) from the centerline of the step or rung.
- The inside width of the well must be at least 30 inches (76 cm).
- The bottom of the well above the point of access to the bottom of the ladder must be between 7 feet (2.1 m) and 8 feet (2.4 m).

Ladder Safety Devices and Related Support Systems for Fixed Ladders

- All safety devices must be capable of withstanding, without failure, a drop test consisting of a 500-pound weight (226 kg) dropping 18 inches (41 cm).
- All safety devices must permit the worker to ascend or descend without continually having to hold, push, or pull any part of the device, leaving both hands free for climbing.
- All safety devices must be activated within 2 feet (.61 m) after a fall occurs, and limit the descending velocity of an employee to 7 $^{ft}/_{second}$ (2.1 $^{m}/_{sec}$) or less.
- The connection between the carrier or lifeline and the point of attachment to the body belt or harness must not exceed 9 inches (23 cm) in length.

Mounting Ladder Safety Devices for Fixed Ladders

- Mountings for rigid carriers must be attached at each end of the carrier, with intermediate mountings, spaced along the entire length of the carrier, to provide the necessary strength to stop workers' falls.
- Mountings for flexible carriers must be attached at each end of the carrier. Cable guides for flexible carriers must be installed with a spacing between 25 feet (76 m) and 40 feet (12.2 m) along the entire length of the carrier, to prevent wind damage to the system.
- The design and installation of mountings and cable guides must not reduce the strength of the ladder.
- Side rails, and steps or rungs for side-step fixed ladders must be continuous in extension.

Use of All Ladders (Including Job-Made Ladders)

- When portable ladders are used for access to an upper landing surface, the side rails must extend at least 3 feet (.9 m) above the upper landing surface. When such an extension is not possible, the ladder must be secured, and a grasping device such as a grab rail must be provided to assist workers in mounting and dismounting the ladder. A ladder extension must not deflect under a load that would cause the ladder to slip off its support.
- Ladders must be maintained free of oil, grease, and other slipping hazards.
- Ladders must not be loaded beyond the maximum intended load for which they were built nor beyond their manufacturer's rated capacity.
- Ladders must be used only for the purpose for which they were designed.
- Non-self-supporting ladders must be used 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. Wood job-made ladders with spliced side rails must be used at an angle where the horizontal distance is one-eighth the working length of the ladder.
- Fixed ladders must be used at a pitch no greater than 90 degrees from the horizontal, measured from the back side of the ladder.
- Ladders must be used only on stable and level surfaces unless secured to prevent accidental movement.
- Ladders must not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental movement. Slip-resistant feet must not be used as a substitute for the care in placing, lashing, or holding a ladder upon slippery surfaces.

- Ladders placed in areas such as passageways, doorways, or driveways, or where they can be displaced by workplace activities or traffic must be secured to prevent accidental movement, or a barricade must be used to keep traffic or activities away from the ladder.
- The area around the top and bottom of the ladders must be kept clear.
- The top of a non-self-supporting ladder must be placed with two rails supported equally unless it is equipped with a single support attachment.
- Ladders must not be moved, shifted, or extended while in use.
- Ladders must have nonconductive siderails if they are used where the worker or the ladder could contact exposed energized electrical equipment.
- The top or top step of a stepladder must not be used as a step.
- Cross-bracing on the rear section of stepladders must not be used for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections.
- Ladders must be inspected by a competent person for visible defects on a periodic basis and after any incident that could affect their safe use.
- Single-rail ladders must not be used.
- When ascending or descending a ladder, the worker must face the ladder.
- Each worker must use at least one hand to grasp the ladder when moving up or down the ladder.
- A worker on a ladder must not carry any object or load that could cause the worker to lose balance and fall.

Structural Defects

- Portable ladders with structural defects-such as broken or missing rungs, cleats, or steps, broken or split rails, corroded components, or other faulty or defective components-must immediately be marked defective, or tagged with "Do Not Use" or similar language and withdrawn from service until repaired.
- Fixed ladders with structural defects—such as broken or missing rungs, cleats, or steps, broken or split rails, or corroded components—must be withdrawn from service until repaired.
- Defective fixed ladders are considered withdrawn from use when they are (a) immediately tagged with "Do Not Use" or similar language; (b) marked in a manner that identifies them as defective; or (c) blocked (such as with a plywood attachment that spans several rungs).
- Ladder repairs must restore the ladder to a condition meeting its original design criteria, before the ladder is returned to use.

Training Requirements

Under the provisions of the standard, employers must provide a training program for each employee using ladders and stairways. The program must enable each employee to recognize hazards related to ladders and stairways and to use proper procedures to minimize these hazards. For example, employers must ensure that each employee is trained by a competent person in the following areas, as applicable:

- The nature of fall hazards in the work area;
- The correct procedures for erecting, maintaining, and disassembling the fall protection systems to be used;

- The proper construction, use, placement, and care in handling of all stairways and ladders; and
- The maximum intended load-carrying capacities of ladders used. In addition, retraining must be provided for each employee, as necessary, so that the employee maintains the understanding and knowledge acquired through compliance with the standard.

GLOSSARY

Cleat – A ladder crosspiece of rectangular cross section placed on edge upon which a person may step while ascending or descending a ladder.

Double-Cleat ladder – A ladder with a center rail to allow simultaneous two-way traffic for employees ascending or descending.

Failure – Load refusal, breakage, or separation of components.

Fixed Ladder – A ladder that cannot be readily moved or carried because it is an integral part of a building or structure.

Handrail – A rail used to provide employees with a handhold for support.

Job-Made Ladder – A ladder that is fabricated by employees, typically at the construction site; not commercially manufactured.

Load Refusal – The point where the structural members lose their ability to carry the load.

Point of Access – All areas used by employees for work-related passage from one area or level to another.

Portable Ladder – A ladder that can be readily moved or carried.

Riser Heights – The vertical distance from the top of a tread or platform/landing to the top of the next higher tread or platform/landing.

Side-Step Fixed Ladder – A fixed ladder that requires a person to get off at the top to step to the side of the ladder side rails to reach the landing.

Single-Cleat Ladder – A ladder consisting of a pair of side rails connected together by cleats, rungs, or steps.

Stairrail System – A vertical barrier erected along the unprotected sides and edges of a stairway to prevent employees from falling to lower levels.

Temporary Service Stairway – A stairway where permanent treads and/or landings are to be filled in at a later date.

Through Fixed Ladder – A fixed ladder that requires a person getting off at the top to step between the side rails of the ladder to reach the landing.

Tread Depth – The horizontal distance from front to back of a tread, excluding nosing, if any. If installed before March 15, 1991, not less than 30 inches (76 cm).

CRANES

Cranes and Derricks – §1926.550

General Requirements

The employer shall comply with the manufacturer's specifications and limitations applicable to the operation of any and all cranes and derricks. Where manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a qualified engineer competent in this field and such determinations will be appropriately documented and recorded. Attachments used with cranes shall not exceed the capacity, rating, or scope recommended by the manufacturer.

Rated load capacities, and recommended operating speeds, special hazard warnings, or instruction, shall be conspicuously posted on all equipment. Instructions or warnings shall be visible to operators while they are at their control stations.

Hand signals to crane and derrick operators shall be those prescribed by the applicable ANSI standard for the type of crane in use. An illustration of the signals shall be posted at the job site.

The employer shall designate a competent person who shall inspect all machinery and equipment prior to each use, and during use, to make sure it is in safe operating condition. Any deficiencies shall be repaired, or defective parts replaced, before continued use.

A thorough, annual inspection of the hoisting machinery shall be made by a competent person, or by a government or private agency recognized by the U.S. Department of Labor. The employer shall maintain a record of the dates and results of inspections for each hoisting machine and piece of equipment.

Wire rope shall be taken out of service when any of the following conditions exist:

- In running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay;
- Wear of one-third the original diameter of outside individual wires. Kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure;
- Evidence of any heat damage from any cause;
- Reductions from nominal diameter of more than one-sixty-fourth inch for diameters up to and including five-sixteenths inch, one-thirty-second inch for diameters three-eighths inch to and including one-half inch, three-sixty-fourths inch for diameters nine-sixteenths inch to and including three-fourths inch, one-sixteenth inch for diameters seven-eighths inch to 1 inches inclusive, three-thirty-seconds inch for diameters 1¼ to 1½ inches inclusive;
- In standing ropes, more than two broken wires in one lay in sections beyond end connections or more than one broken wire at an end connection.
- Wire rope safety factors shall be in accordance with American National Standards Institute B30.5-1968 or SAE J959-1966.

Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or other moving parts or equipment shall be guarded if such parts are exposed to contact by employees, or otherwise create a hazard. Guarding shall meet the requirements of the American National Standards Institute B15.1-1958 Rev., Safety Code for Mechanical Power Transmission Apparatus.

Accessible areas within the swing radius of the rear of the rotating superstructure of the crane, either permanently or temporarily mounted, shall be barricaded in such a manner as to prevent an employee from being struck or crushed by the crane.

All exhaust pipes shall be guarded or insulated in areas where contact by employees is possible in the performance of normal duties.

Whenever internal combustion engine powered equipment exhausts in enclosed spaces, tests shall be made and recorded to see that employees are not exposed to unsafe concentrations of toxic gases or oxygen deficient atmospheres.

All windows in cabs shall be of safety glass, or equivalent, that introduces no visible distortion that will interfere with the safe operation of the machine.

Where necessary for rigging or service requirements, a ladder, or steps, shall be provided to give access to a cab roof. Guardrails, handholds, and steps shall be provided on cranes for easy access to the car and cab, conforming to American National Standards Institute B30.5.

Platforms and walkways shall have anti-skid surfaces.

Fuel tank filler pipe shall be located in such a position, or protected in such manner, as to not allow spill or overflow to run onto the engine, exhaust, or electrical equipment of any machine being fueled.

An accessible fire extinguisher of 5BC rating, or higher, shall be available at all operator stations or cabs of equipment.

All fuels shall be transported, stored, and handled to meet the rules of Subpart F, Fire Protection and Prevention. When fuel is transported by vehicles on public highways, Department of Transportation rules contained in 49 CFR Parts 177 and 393 concerning such vehicular transportation are considered applicable.

Except where electrical distribution and transmission lines have been deenergized and visibly grounded at point of work or where insulating barriers, not a part of or an attachment to the equipment or machinery, have been erected to prevent physical contact with the lines, equipment or machines shall be operated proximate to power lines only in accordance with the following:

- For lines rated 50 kV. or below, minimum clearance between the lines and any part of the crane or load shall be 10 feet;
- For lines rated over 50 kV., minimum clearance between the lines and any part of the crane or load shall be 10 feet plus 0.4 inch for each 1 kV. over 50 kV., or twice the length of the line insulator, but never less than 10 feet;
- In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltages less than 50 kV., and 10 feet for voltages over 50 kV., up to and including 345 kV., and 16 feet for voltages up to and including 750 kV.
- A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means;
- Cage-type boom guards, insulating links, or proximity warning devices may be used on cranes, but the use of such devices shall not alter the requirements of any other regulation of this part even if such device is required by law or regulation;
- Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded;

- Prior to work near transmitter towers where an electrical charge can be induced in the equipment or materials being handled, the transmitter shall be deenergized or tests shall be made to determine if electrical charge is induced on the crane. The following precautions shall be taken when necessary to dissipate induced voltages:
  - The equipment shall be provided with an electrical ground directly to the upper rotating structure supporting the boom; and
  - Ground jumper cables shall be attached to materials being handled by boom equipment when electrical charge is induced while working near energized transmitters. Crews shall be provided with nonconductive poles having large alligator clips or other similar protection to attach the ground cable to the load.
  - Combustible and flammable materials shall be removed from the immediate area prior to operations.

No modifications or additions which affect the capacity or safe operation of the equipment shall be made by the employer without the manufacturer's written approval. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals, shall be changed accordingly. In no case shall the original safety factor of the equipment be reduced.

The employer shall comply with Power Crane and Shovel Association Mobile Hydraulic Crane Standard No. 2.

Sideboom cranes mounted on wheel or crawler tractors shall meet the requirements of SAE J743a-1964.

All employees shall be kept clear of loads about to be lifted and of suspended loads.

Crawler, Locomotive, and Truck Cranes

All jibs shall have positive stops to prevent their movement of more than 5° above the straight line of the jib and boom on conventional type crane booms. The use of cable type belly slings does not constitute compliance with this rule. All crawler, truck, or locomotive cranes in use shall meet the applicable requirements for design, inspection, construction, testing, maintenance and operation as prescribed in the ANSI B30.5-1968, Safety Code for Crawler, Locomotive and Truck Cranes. However, the written, dated, and signed inspection reports and records of the monthly inspection of critical items prescribed in section 5-2.1.5 of the ANSI B30.5-1968 standard are not required. Instead, the employer shall prepare a certification record which includes the date the crane items were inspected; the signature of the person who inspected the crane items; and a serial number, or other identifier, for the crane inspected. The most recent certification record shall be maintained on file until a new one is prepared.

Hammerhead Tower Cranes

Adequate clearance shall be maintained between moving and rotating structures of the crane and fixed objects to allow the passage of employees without harm.

Each employee required to perform duties on the horizontal boom of hammerhead tower cranes shall be protected against falling by guardrails or by a personal fall arrest system in conformance with Subpart M, Fall Protection.

Buffers shall be provided at both ends of travel of the trolley.

Cranes mounted on rail tracks shall be equipped with limit switches limiting the travel of the crane on the track and stops or buffers at each end of the tracks.

All hammerhead tower cranes in use shall meet the applicable requirements for design, construction, installation, testing, maintenance, inspection, and operation as prescribed by the manufacturer.

Overhead and Gantry Cranes

The rated load of the crane shall be plainly marked on each side of the crane, and if the crane has more than one hoisting unit, each hoist shall have its rated load marked on it or its load block, and this marking shall be clearly legible from the ground or floor.

Bridge trucks shall be equipped with sweeps which extend below the top of the rail and project in front of the truck wheels.

Except for floor-operated cranes, a gong or other effective audible warning signal shall be provided for each crane equipped with a power traveling mechanism.

All overhead and gantry cranes in use shall meet the applicable requirements for design, construction, installation, testing, maintenance, inspection, and operation as prescribed in the ANSI B30.2.0-1967, Safety Code for Overhead and Gantry Cranes.

Derricks

All derricks in use shall meet the applicable requirements for design, construction, installation, inspection, testing, maintenance, and operation as prescribed in American National Standards Institute B30.6-1969, Safety Code for Derricks.

Floating Cranes and Derricks

Mobile Cranes Mounted on Barges

When a mobile crane is mounted on a barge, the rated load of the crane shall not exceed the original capacity specified by the manufacturer.

A load rating chart, with clearly legible letters and figures, shall be provided with each crane, and securely fixed at a location easily visible to the operator.

When load ratings are reduced to stay within the limits for list of the barge with a crane mounted on it, a new load rating chart shall be provided.

Mobile cranes on barges shall be positively secured.

Permanently Mounted Floating Cranes and Derricks

When cranes and derricks are permanently installed on a barge, the capacity and limitations of use shall be based on competent design criteria.

A load rating chart with clearly legible letters and figures shall be provided and securely fixed at a location easily visible to the operator.

Floating cranes and floating derricks in use shall meet the applicable requirements for design, construction, installation, testing, maintenance, and operation as prescribed by the manufacturer.

Protection of Employees Working on Barges

The employer shall comply with the applicable requirements for protection of employees working onboard marine vessels specified in §1926.605.

Crane or Derrick Suspended Personnel Platforms

This standard, §1926.550(g), is discussed in a separate document.

Helicopters – §1926.551

Helicopter Regulations

Helicopter cranes shall be expected to comply with any applicable regulations of the Federal Aviation Administration.

Briefing

Prior to each day's operation a briefing shall be conducted. This briefing shall set forth the plan of operation for the pilot and ground personnel.

Slings and Tag Lines

Load shall be properly slung. Tag lines shall be of a length that will not permit their being drawn up into rotors. Pressed sleeve, swedged eyes, or equivalent means shall be used for all freely suspended loads to prevent hand splices from spinning open or cable clamps from loosening.

Cargo Hooks

All electrically operated cargo hooks shall have the electrical activating device so designed and installed as to prevent inadvertent operation. In addition, these cargo hooks shall be equipped with an emergency mechanical control for releasing the load. The hooks shall be tested prior to each day's operation to determine that the release functions properly, both electrically and mechanically.

Personal Protective Equipment

Personal protective equipment for employees receiving the load shall consist of complete eye protection and hard hats secured by chin straps.

Loose-fitting clothing likely to flap in the downwash, and thus be snagged on hoist line, shall not be worn.

Loose Gear and Objects

Every practical precaution shall be taken to provide for the protection of the employees from flying objects in the rotor downwash. All loose gear within 100 feet of the place of lifting the load, depositing the load, and all other areas susceptible to rotor downwash shall be secured or removed.

Housekeeping

Good housekeeping shall be maintained in all helicopter loading and unloading areas.

Operator Responsibility

The helicopter operator shall be responsible for size, weight, and manner in which loads are connected to the helicopter. If, for any reason, the helicopter operator believes the lift cannot be made safely, the lift shall not be made.

Hooking and Unhooking Loads

When employees are required to perform work under hovering craft, a safe means of access shall be provided for employees to reach the hoist line hook and engage or disengage cargo slings. Employees shall not perform work under hovering craft except when necessary to hook or unhook loads.

Static Charge

Static charge on the suspended load shall be dissipated with a grounding device before ground personnel touch the suspended load, or protective rubber gloves shall be worn by all ground personnel touching the suspended load.

Weight Limitation
The weight of an external load shall not exceed the manufacturer's rating.

Ground Lines

Hoist wires or other gear, except for pulling lines or conductors that are allowed to "pay out" from a container or roll off a reel, shall not be attached to any fixed ground structure, or allowed to foul on any fixed structure.

Visibility
When visibility is reduced by dust or other conditions, ground personnel shall exercise special caution to keep clear of main and stabilizing rotors. Precautions shall also be taken by the employer to eliminate as far as practical reduced visibility.

Signal Systems
Signal systems between aircrew and ground personnel shall be understood and checked in advance of hoisting the load. This applies to either radio or hand signal systems.

Approach Distance
No unauthorized person shall be allowed to approach within 50 feet of the helicopter when the rotor blades are turning.

Approaching Helicopter
Whenever approaching or leaving a helicopter with blades rotating, all employees shall remain in full view of the pilot and keep in a crouched position. Employees shall avoid the area from the cockpit or cabin rearward unless authorized by the helicopter operator to work there.

Personnel

Sufficient ground personnel shall be provided when required for safe helicopter loading and unloading operations.

Communications

There shall be constant reliable communication between the pilot, and a designated employee of the ground crew who acts as a signalman during the period of loading and unloading. This signalman shall be distinctly recognizable from other ground personnel.

Fires

Open fires shall not be permitted in an area that could result in such fires being spread by the rotor downwash.

SLING SAFETY

Introduction

The ability to handle materials—to move them from one location to another, whether during transit or at the worksite—is vital to all segments of industry. Materials must be moved, for example, in order for industry to manufacture, sell, and utilize products. In short, without materials-handling capability, industry would cease to exist.

All employees in numerous workplaces take part in materials handling, to varying degrees. As a result, some employees are injured. In fact, the mishandling of materials is the single largest cause of accidents and injuries in the workplace. Most of these accidents and injuries, as well as the pain and loss of salary and productivity that often result, can be readily avoided. Whenever possible, mechanical means should be used to move materials in order to avoid employee injuries such as muscle pulls, strains, and sprains. In addition, many loads are too heavy and/or bulky to be safely moved manually. Therefore, various types of equipment have been designed specifically to aid in the movement of materials. They include: cranes, derricks, hoists, powered industrial trucks, and conveyors.

Because cranes, derricks, and hoists rely upon slings to hold their suspended loads, slings are the most commonly used piece of materials-handling apparatus. This discussion will offer information on the proper selection, maintenance, and use of slings.

Importance of the Operator

The operator must exercise intelligence, care, and common sense in the selection and use of slings. Slings must be selected in accordance with their intended use, based upon the size and type of load and the environmental conditions of the workplace. All slings must be visually inspected before use to ensure that there is no obvious damage.

A well-trained operator can prolong the service life of equipment and reduce costs by avoiding the potentially hazardous effects of overloading equipment, operating it at excessive speeds, taking up slack with a sudden jerk, and suddenly accelerating or decelerating equipment. The operator can look for causes and seek corrections whenever a danger exists. He or she should cooperate with co-workers and supervisors and become a leader in carrying out safety measures—not merely for the good of the equipment and the production schedule, but, more importantly, for the safety of everyone concerned.

Sling Types

The dominant characteristics of a sling are determined by the components of that sling. For example, the strengths and weaknesses of a wire rope sling are essentially the same as the strengths and weaknesses of the wire rope of which it is made.

Slings are generally one of six types: chain, wire rope, metal mesh, natural fiber rope, synthetic fiber rope, or synthetic web. In general, use and inspection procedures tend to place these slings into three groups: chain, wire rope and mesh, and fiber rope web. Each type has its own particular advantages and disadvantages. Factors that should be taken into consideration when choosing the best sling for the job include the size, weight, shape, temperature, and sensitivity of the material to be moved, as well as the environmental conditions under which the sling will be used.

Chains

Chains are commonly used because of their strength and ability to adapt to the shape of the load. Care should be taken, however, when using alloy chain slings because they are subject to damage by sudden shocks. Misuse of chain slings could damage the sling, resulting in sling failure and possible injury to an employee.

Chain slings are your best choice for lifting materials that are very hot. They can be heated to temperatures of up to 1000° F; however, when alloy chain slings are consistently exposed to service temperatures in excess of 600° F, operators must reduce the working load limits in accordance with the manufacturer's recommendations.

All sling types must be visually inspected prior to use. When inspecting alloy steel chain slings, pay special attention to any stretching, wear in excess of the allowances made by the manufacturer, and nicks and gouges. These are all indications that the sling may be unsafe and is to be removed from service.

Wire Rope

A second type of sling is made of wire rope. Wire rope is composed of individual wires that have been twisted to form strands. The strands are then twisted to form a wire rope. When wire rope has a fiber core, it is usually more flexible but is less resistant to environmental damage. Conversely, a core that is made of a wire rope strand tends to have greater strength and is more resistant to heat damage.

Rope Lay

Wire rope may be further defined by the "lay." The lay of a wire rope can mean any of three things:

1. One complete wrap of a strand around the core: One rope lay is one complete wrap of a strand around the core.
2. The direction the strands are wound around the core: Wire rope is referred to as right lay or left lay. A right lay rope is one in which the strands are wound in a right-hand direction like a conventional screw thread. A left lay rope is just the opposite.
3. The direction the wires are wound in the strands in relation to the direction of the strands around the core: In regular lay rope, the wires in the strands are laid in one direction while the strands in the rope are laid in the opposite direction. In lang lay rope, the wires are twisted in the same direction as the strands.

In *regular lay* ropes, the wires in the strands are laid in one direction, while the strands in the rope are laid in the opposite direction. The result is that the wire crown runs approximately parallel to the longitudinal axis of the rope. These ropes have good resistance to kinking and twisting and are easy to handle. They are also able to withstand considerable crushing and distortion due to the short length of exposed wires. This type of rope has the widest range of applications.

Lang lay (where the wires are twisted in the same direction as the strands) is recommended for many excavating, construction, and mining applications, including draglines, hoist lines, dredgelines, and other similar lines.

Lang lay ropes are more flexible and have greater wearing surface per wire than regular lay ropes. In addition, since the outside wires in lang lay ropes lie at an angle to the rope axis, internal stress due to bending over sheaves and drums is reduced causing lang lay ropes to be more resistant to bending fatigue.

A *left lay* rope is one in which the strands form a left-hand helix similar to the threads of a left-hand screw thread. Left lay rope has its greatest usage in oil fields on rod and tubing lines, blast hole rigs, and spudders where rotation of right lay would loosen couplings. The rotation of a left lay rope tightens a standard coupling.

Wire Rope Sling Selection

When selecting a wire rope sling to give the best service, there are four characteristics to consider: strength, ability to bend without distortion, ability to withstand abrasive wear, and ability to withstand abuse.

1. Strength – The strength of a wire rope is a function of its size, grade, and construction. It must be sufficient to accommodate the maximum load that will be applied. The maximum load limit is determined by means of an appropriate multiplier. This multiplier is the number by which the ultimate strength of a wire rope is divided to determine the working load limit. Thus a wire rope sling with a strength of 10,000 pounds and a total working load of 2,000 pounds has a design factor (multiplier) of 5. New wire rope slings have a design factor of 5. As a sling suffers from the rigors of continued service, however, both the design factor and the sling's ultimate strength are proportionately reduced. If a sling is loaded beyond its ultimate strength, it will fail. For this reason, older slings must be more rigorously inspected to ensure that rope conditions adversely affecting the strength of the sling are considered in determining whether or not a wire rope sling should be allowed to continue in service.
2. Fatigue – A wire rope must have the ability to withstand repeated bending without the failure of the wires from fatigue. Fatigue failure of the wires in a wire rope is the result of the development of small cracks under repeated applications of bending loads. It occurs when ropes make small radius bends. The best means of preventing fatigue failure of wire rope slings is to use blocking or padding to increase the radius of the bend.
3. Abrasive Wear – The ability of a wire rope to withstand abrasion is determined by the size, number of wires, and construction of the rope. Smaller wires bend more readily and therefore offer greater flexibility but are less able to withstand abrasive wear. Conversely, the larger wires of less flexible ropes are better able to withstand abrasion than smaller wires of the more flexible ropes.
4. Abuse – All other factors being equal, misuse or abuse of wire rope will cause a wire rope sling to become unsafe long before any other factor. Abusing a wire rope sling can cause serious structural damage to the wire rope, such as kinking or bird caging which reduces the strength of the wire rope. (In bird caging, the wire rope strands are forcibly untwisted and become spread outward.) Therefore, in order to prolong the life of the sling and protect the lives of employees, the manufacturer's suggestion for safe and proper use of wire rope slings must be strictly adhered to.

Wire Rope Life

Many operating conditions affect wire rope life. They are bending, stresses, loading conditions, speed of load application (jerking), abrasion, corrosion, sling design, materials handled, environmental conditions, and history of previous usage.

In addition to the above operating conditions, the weight, size, and shape of the loads to be handled also affect the service life of a wire rope sling. Flexibility is also a factor. Generally, more flexible ropes are selected when smaller radius bending is required. Less flexible ropes should be used when the rope must move through or over abrasive materials.

Wire Rope Sling Inspection

Wire rope slings must be visually inspected before each use. The operator should check the twists or lay of the sling. If ten randomly distributed wires in one lay are broken, or five wires in one strand of a rope lay are damaged, the sling must not be used. It is not sufficient, however, to check only the condition of the wire rope. End fittings and other components should also be inspected for any damage that could make the sling unsafe.

To ensure safe sling usage between scheduled inspections, all workers must participate in a safety awareness program. Each operator must keep a close watch on those slings he or she is using. If any accident involving the movement of materials occurs, the operator must immediately shut down the equipment and report the accident to a supervisor. The cause of the accident must be determined and corrected before resuming operations.

Field Lubrication

Although every rope sling is lubricated during manufacture, to lengthen its useful service life it must also be lubricated "in the field." There is no set rule on how much or how often this should be done. It depends on the conditions under which the sling is used. The heavier the loads, the greater the number of bends, or the more adverse the conditions under which the sling operates, the more frequently lubrication will be required.

Storage

Wire rope slings should be stored in a well ventilated, dry building or shed. Never store them on the ground or allow them to be continuously exposed to the elements because this will make them vulnerable to corrosion and rust. And, if it is necessary to store wire rope slings outside, make sure that they are set off the ground and protected.

Note: Using the sling several times a week, even at a light load, is a good practice. Records show that slings that are used frequently or continuously give useful service far longer than those that are idle.

Discarding Slings

Wire rope slings can provide a margin of safety by showing early signs of failure. Factors requiring that a wire sling be discarded include the following:

- Severe corrosion
- Localized wear (shiny worn spots) on the outside
- A one-third reduction in outer wire diameter
- Damage or displacement of end fittings—hooks, rings, links, or collars—by overload or misapplication
- Distortion, kinking, bird caging, or other evidence of damage to the wire rope structure, or
- Excessive broken wires.

Fiber Rope and Synthetic Web

Fiber rope and synthetic web slings are used primarily for temporary work, such as construction and painting jobs, and in marine operations. They are also the best choice for use on expensive loads, highly finished parts, fragile parts, and delicate equipment.

Fiber Rope

Fiber rope slings are preferred for some applications because they are pliant, they grip the load well and they do not mar the surface of the load. They should be used only on light loads, however, and must not be used on objects that have sharp edges capable of cutting the rope or in applications where the sling will be exposed to high temperatures, severe abrasion or acids.

The choice of rope type and size will depend upon the application, the weight to be lifted and the sling angle. Before lifting any load with a fiber rope sling be sure to inspect the sling carefully because they deteriorate far more rapidly than wire rope slings and their actual strength is very difficult to estimate.

When inspecting a fiber rope sling prior to using it, look first at its surface. Look for dry, brittle, scorched, or discolored fibers. If any of these conditions are found, the supervisor must be notified and a determination made regarding the safety of the sling. If the sling is found to be unsafe, it must be discarded.

Next, check the interior of the sling. It should be as clean as when the rope was new. A build-up of powder-like sawdust on the inside of the fiber rope indicates excessive internal wear and is an indication that the sling is unsafe.

Finally, scratch the fibers with a fingernail. If the fibers come apart easily, the fiber sling has suffered some kind of chemical damage and must be discarded.

Synthetic Web Slings

Synthetic web slings offer a number of advantages for rigging purposes. The most commonly used synthetic web slings are made of nylon, dacron, and polyester. They have the following properties in common:

- Strength – Can handle load of up to 300,000 lbs.
- Convenience – Can conform to any shape.
- Safety – Will adjust to the load contour and hold it with a tight, nonslip grip.
- Load protection – Will not mar, deface, or scratch highly polished or delicate surfaces.
- Long life – Are unaffected by mildew, rot, or bacteria; resist some chemical action; and have excellent abrasion resistance.
- Economy – Have low initial cost plus long service life.
- Shock absorbency – Can absorb heavy shocks without damage.
- Temperature resistance – Are unaffected by temperatures up to 180° F.

Each synthetic material has its own unique properties. Nylon must be used wherever alkaline or greasy conditions exist. It is also preferable when neutral conditions prevail and when resistance to chemicals and solvents is important. Dacron must be used where high concentrations of acid solutions—such as sulfuric, hydrochloric, nitric, and formic acids—and where high-temperature bleach solutions are prevalent. (Nylon will deteriorate under these conditions.) Do not use dacron in alkaline conditions because it will deteriorate; use nylon or polypropylene instead. Polyester must be used where acids or bleaching agents are present and is also ideal for applications where a minimum of stretching is important.

Possible Defects

Synthetic web slings must be removed from service if any of the following defects exist:

- Acid or caustic burns,
- Melting or charring of any part of the surface,
- Snags, punctures, tears, or cuts,
- Broken or worn stitches,
- Wear or elongation exceeding the amount recommended by the manufacturer
- Distortion of fittings.

Safe Lifting Practices

Now that the sling has been selected (based upon the characteristics of the load and the environmental conditions surrounding the lift) and inspected prior to use, the next step is learning how to use it safely. There are four primary factors to take into consideration when safely lifting a load. They are (1) the size, weight, and center of gravity of the load; (2) the number of legs and the angle the sling makes with the horizontal line; (3) the rated capacity of the sling; and (4) the history of the care and usage of the sling.

Size, Weight, and Center of Gravity of the Load

The center of gravity of an object is that point at which the entire weight may be considered as concentrated. In order to make a level lift, the crane hook must be directly above this point. While slight variations are usually permissible, if the crane hook is too far to one side of the center of gravity, dangerous tilting will result causing unequal stresses in the different sling legs. This imbalance must be compensated for at once.

Number of Legs and Angle with the Horizontal

As the angle formed by the sling leg and the horizontal line decreases, the rated capacity of the sling also decreases. In other words, the smaller the angle between the sling leg and the horizontal, the greater the stress on the sling leg and the smaller (lighter) the load the sling can safely support. Larger (heavier) loads can be safely moved if the weight of the load is distributed among more sling legs.

Rated Capacity of the Sling

The rated capacity of a sling varies depending upon the type of sling, the size of the sling, and the type of hitch. Operators must know the capacity of the sling. Charts or tables that contain this information generally are available from sling manufacturers. The values given are for new slings. Older slings must be used with additional caution. Under no circumstances shall a sling's rated capacity be exceeded.

History of Care and Usage

The mishandling and misuse of slings are the leading causes of accidents involving their use. The majority of injuries and accidents, however, can be avoided by becoming familiar with the essentials of proper sling care and usage.

Proper care and usage are essential for maximum service and safety. Slings must be protected from sharp bends and cutting edges by means of cover saddles, burlap padding, or wood blocking, as well as from unsafe lifting procedures such as overloading.

Before making a lift, check to be certain that the sling is properly secured around the load and that the weight and balance of the load have been accurately determined. If the load is on the ground, do not allow the load to drag along the ground. This could damage the sling. If the load is already resting on the sling, ensure that there is no sling damage prior to making the lift.

Next, position the hook directly over the load and seat the sling squarely within the hook bowl. This gives the operator maximum lifting efficiency without bending the hook or overstressing the sling.

Wire rope slings are also subject to damage resulting from contact with sharp edges of the loads being lifted. These edges can be blocked or padded to minimize damage to the sling.

After the sling is properly attached to the load, there are a number of good lifting techniques that are common to all slings:

- Make sure that the load is not lagged, clamped, or bolted to the floor.
- Guard against shock loading by taking up the slack in the sling slowly. Apply power cautiously so as to prevent jerking at the beginning of the lift, and accelerate or decelerate slowly.

- Check the tension on the sling. Raise the load a few inches, stop, and check for proper balance and that all items are clear of the path of travel. Never allow anyone to ride on the hood or load.
- Keep all personnel clear while the load is being raised, moved, or lowered. Crane or hoist operators should watch the load at all times when it is in motion.
- Finally, obey the following "nevers:"

Never allow more than one person to control a lift or give signals to a crane or hoist operator except to warn of a hazardous situation. Never raise the load more than necessary. Never leave the load suspended in the air. Never work under a suspended load or allow anyone else to.

Once the lift has been completed, clean the sling, check it for damage, and store it in a clean, dry airy place. It is best to hang it on a rack or wall.

Remember, damaged slings cannot lift as much as new or well-cared for older slings. Safe and proper use and storage of slings will increase their service life.

Maintenance of Slings

Chains

Chain slings must be cleaned prior to each inspection, as dirt or oil may hide damage. The operator must be certain to inspect the total length of the sling, periodically looking for stretching, binding, wear, or nicks and gouges. If a sling has stretched so that it is now more than three percent longer than it was when new, it is unsafe and must be discarded.

Binding is the term used to describe the condition that exists when a sling has become deformed to the extent that its individual links cannot move within each other freely. It is also an indication that the sling is unsafe. Generally, wear occurs on the load-bearing inside ends of the links. Pushing links together so that the inside surface becomes clearly visible is the best way to check for this type of wear. Wear may also occur, however, on the outside of links when the chain is dragged along abrasive surfaces or pulled out from under heavy loads. Either type of wear weakens slings and makes accidents more likely.

Heavy nicks and/or gouges must be filed smooth, measured with calipers, then compared with the manufacturer's minimum allowable safe dimensions. When in doubt, or in borderline situations, do not use the sling. In addition, never attempt to repair the welded components on a sling. If the sling needs repair of this nature, the supervisor must be notified.

Wire Rope

Wire rope slings, like chain slings, must be cleaned prior to each inspection because they are also subject to damage hidden by dirt or oil. In addition, they must be lubricated according to manufacturer's instructions. Lubrication prevents or reduces corrosion and wear due to friction and abrasion. Before applying any lubricant, however, the sling user should make certain that the sling is dry. Applying lubricant to a wet or damp sling traps moisture against the metal and hastens corrosion.

Corrosion deteriorates wire rope. It may be indicated by pitting, but it is sometimes hard to detect. Therefore, if a wire rope sling shows any sign of significant deterioration, that sling must be removed until it can be examined by a person who is qualified to determine the extent of the damage.

By following the above guidelines to proper sling use and maintenance, and by the avoidance of kinking, it is possible to greatly extend a wire rope sling's useful service life.

Fiber Ropes and Synthetic Webs

Fiber ropes and synthetic webs are generally discarded rather than serviced or repaired. Operators must always follow manufacturer's recommendations.

Summary

There are good practices to follow to protect yourself while using slings to move materials. First, learn as much as you can about the materials with which you will be working. Slings come in many different types, one of which is right for your purpose. Second, analyze the load to be moved—in terms of size, weight, shape, temperature, and sensitivity—then choose the sling which best meets those needs. Third, always inspect all the equipment before and after a move. Always be sure to give equipment whatever "in service" maintenance it may need. Fourth, use safe lifting practices. Use the proper lifting technique for the type of sling and the type of load.

MATERIALS HANDLING AND STORAGE

Potential Hazards

Handling and storing materials involves diverse operations such as hoisting tons of steel with a crane, driving a truck loaded with concrete blocks, manually carrying bags and material, and stacking drums, barrels, kegs, lumber, or loose bricks.

The efficient handling and storing of materials is vital to industry. These operations provide a continuous flow of raw materials, parts, and assemblies through the workplace, and ensure that materials are available when needed. Yet, the improper handling and storing of materials can cause costly injuries.

Workers frequently cite the weight and bulkiness of objects being lifted as major contributing factors to their injuries. In 1990, back injuries resulted in 400,000 workplace accidents. The second factor frequently cited by workers as contributing to their injuries was body movement. Bending, followed by twisting and turning, were the more commonly cited movements that caused back injuries. Back injuries accounted for more than 20 percent of all occupational illnesses, according to data from the National Safety Council(1).

In addition, workers can be injured by falling objects, improperly stacked materials, or by various types of equipment. When manually moving materials, however, workers should be aware of potential injuries, including the following:

- Strains and sprains from improperly lifting loads, or from carrying loads that are either too large or too heavy.
- Fractures and bruises caused by being struck by materials, or by being caught in pinch points; and
- Cuts and bruises caused by falling materials that have been improperly stored, or by incorrectly cutting ties or other securing devices.

Since numerous injuries can result from improperly handling and storing materials, it is important to be aware of accidents that may occur from unsafe or improperly handled equipment and improper work practices, and to recognize the methods for eliminating, or at least minimizing, the occurrence of those accidents. Consequently, employers and employees can and should examine their workplaces to detect any unsafe or unhealthful conditions, practices, or equipment and take the necessary steps to correct them.

Methods of Prevention

General safety principles can help reduce workplace accidents. These include work practices, ergonomic principles, and training and education. Whether moving materials manually or mechanically, employees should be aware of the potential hazards associated with the task at hand and know how to exercise control over their workplaces to minimize the danger.

Moving, Handling and Storing Materials

When manually moving materials, employees should seek help when a load is so bulky it cannot be properly grasped or lifted, when they cannot see around or over it, or when a load cannot be safely handled.

When an employee is placing blocks under raised loads, the employee should ensure that the load is not released until his or her hands are clearly removed from the load. Blocking materials and timbers should be large and strong enough to support the load safely. Materials with evidence of cracks, rounded corners, splintered pieces, or dry rot should not be used for blocking.

Handles and holders should be attached to loads to reduce the chances of getting fingers pinched or smashed. Workers also should use appropriate protective equipment. For loads with sharp or rough edges, wear gloves or other hand and forearm protection. To avoid injuries to the hands and eyes, use gloves and eye protection. When the loads are heavy or bulky, the mover should also wear steel-toed safety shoes or boots to prevent foot injuries if the worker slips or accidentally drops a load.

When mechanically moving materials, avoid overloading the equipment by letting the weight, size, and shape of the material being moved dictate the type of equipment used for transporting it. All materials handling equipment has rated capacities that determine the maximum weight the equipment can safely handle and the conditions under which it can handle those weights. The equipment-rated capacities must be displayed on each piece of equipment and must not be exceeded except for load testing. When picking up items with a powered industrial truck, the load must be centered on the forks and as close to the mast as possible to minimize the potential for the truck tipping or the load falling. A lift truck must never be overloaded because it would be hard to control and could easily tip over. Extra weight must not be placed on the rear of a counterbalanced forklift to offset an overload. The load must be at the lowest position for traveling, and the truck manufacturer's operational requirements must be followed. All stacked loads must be correctly piled and cross-tiered, where possible. Precautions also should be taken when stacking and storing material.

Stored materials must not create a hazard. Storage areas must be kept free from accumulated materials that may cause tripping, fires, or explosions, or that may contribute to the harboring of rats and other pests. When stacking and piling materials, it is important to be aware of such factors as the materials' height and weight, how accessible the stored materials are to the user, and the condition of the containers where the materials are being stored.

All bound material should be stacked, placed on racks, blocked, interlocked, or otherwise secured to prevent it from sliding, falling, or collapsing. A load greater than that approved by a building official may not be placed on any floor of a building or other structure. Where applicable, load limits approved by the building inspector should be conspicuously posted in all storage areas.

When stacking materials, height limitations should be observed. For example, lumber must be stacked no more than 16 feet high if it is handled manually; 20 feet is the maximum stacking height if a forklift is used. For quick reference, walls or posts may be painted with stripes to indicate maximum stacking heights.

Used lumber must have all nails removed before stacking. Lumber must be stacked and leveled on solidly supported bracing. The stacks must be stable and self-supporting. Stacks of loose bricks should not be more than 7 feet in height. When these stacks reach a height of 4 feet, they should be tapered back 2 inches for every foot of height above the 4-foot level. When masonry blocks are stacked higher than 6 feet, the stacks should be tapered back one-half block for each tier above the 6-foot level.

Bags and bundles must be stacked in interlocking rows to remain secure. Bagged material must be stacked by stepping back the layers and cross-keying the bags at least every ten layers. To remove bags from the stack, start from the top row first. Baled paper and rags stored inside a building must not be closer than 18 inches to the walls, partitions, or sprinkler heads. Boxed materials must be banded or held in place using cross-ties or shrink plastic fiber.

Drums, barrels, and kegs must be stacked symmetrically. If stored on their sides, the bottom tiers must be blocked to keep them from rolling. When stacked on end, put planks, sheets of plywood dunnage, or pallets between each tier to make a firm, flat, stacking surface. When stacking materials two or more tiers high, the bottom tier must be chocked on each side to prevent shifting in either direction.

When stacking, consider the need for availability of the material. Material that cannot be stacked due to size, shape, or fragility can be safety stored on shelves or in bins. Structural steel, bar stock, poles, and

other cylindrical materials, unless in racks, must be stacked and blocked to prevent spreading or tilting. Pipes and bars should not be stored in racks that face main aisles; this could create a hazard to passersby when supplies are being removed.

Using Materials Handling Equipment

To reduce potential accidents associated with workplace equipment, employees need to be trained in the proper use and limitations of the equipment they operate. This includes knowing how to effectively use equipment such as conveyors, cranes, and slings.

Conveyors

When using conveyors, workers' hands may be caught in nip points where the conveyor runs over support members or rollers; workers may be struck by material falling off the conveyor; or they may become caught on or in the conveyor, thereby being drawn into the conveyor path.

To reduce the severity of an injury, an emergency button or pull cord designed to stop the conveyor must be installed at the employee's work station. Continuously accessible conveyor belts should have an emergency stop cable that extends the entire length of the conveyor belt so that the cable can be accessed from any location along the belt. The emergency stop switch must be designed to be reset before the conveyor can be restarted. Before restarting a conveyor that has stopped due to an overload, appropriate personnel must inspect the conveyor and clear the stoppage before restarting. Employees must never ride on a materials handling conveyor. Where a conveyor passes over work areas or aisles, guards must be provided to keep employees from being struck by falling material. If the crossover is low enough for workers to run into, it must be guarded to protect employees and either marked with a warning sign or painted a bright color.

Screw conveyors must be completely covered except at loading and discharging points. At those points, guards must protect employees against contacting the moving screw; the guards are movable, and they must be interlocked to prevent conveyor movement when not in place.

Cranes

Only thoroughly trained and competent persons are permitted to operate cranes. Operators should know what they are lifting and what it weighs. The rated capacity of mobile cranes varies with the length of the boom and the boom radius. When a crane has a telescoping boom, a load may be safe to lift at a short boom length and/or a short boom radius, but may overload the crane when the boom is extended and the radius increases.

All movable cranes must be equipped with a boom angle indicator; those cranes with telescoping booms must be equipped with some means to determine the boom length, unless the load rating is independent of the boom length. Load rating charts must be posted in the cab of cab-operated cranes. All mobile cranes do not have uniform capacities for the same boom length and radius in all directions around the chassis of the vehicle.

Always check the crane's load chart to ensure that the crane is not going to be overloaded for the conditions under which it will operate. Plan lifts before starting them to ensure that they are safe. Take additional precautions and exercise extra care when operating around power lines.

Some mobile cranes cannot operate with outriggers in the traveling position. When used, the outriggers must rest on firm ground, on timbers, or be sufficiently cribbed to spread the weight of the crane and the load over a large enough area. This will prevent the crane from tipping during use. Hoisting chains and ropes must always be free of kinks or twists and must never be wrapped around a load. Loads should be attached to the load hook by slings, fixtures, or other devices that have the capacity to support the load on

the hook. Sharp edges of loads should be padded to prevent cutting slings. Proper sling angles shall be maintained so that slings are not loaded in excess of their capacity.

All cranes must be inspected frequently by persons thoroughly familiar with the crane, the methods of inspecting the crane, and what can make the crane unserviceable. Crane activity, the severity of use, and environmental conditions should determine inspection schedules. Critical parts, such as crane operating mechanisms, hooks, air or hydraulic system components and other load-carrying components, should be inspected daily for any maladjustment, deterioration, leakage, deformation, or other damage.

Slings

When working with slings, employers must ensure that they are visually inspected before use and during operation, especially if used under heavy stress. Riggers or other knowledgeable employees should conduct or assist in the inspection because they are aware of how the sling is used and what makes a sling unserviceable. A damaged or defective sling must be removed from service.

Slings must not be shortened with knots or bolts or other makeshift devices, sling legs that have been kinked must not be used. Slings must not be loaded beyond their rated capacity, according to the manufacturer's instructions. Suspended loads must be kept clear of all obstructions, and crane operators should avoid sudden starts and stops when moving suspended loads. Employees also must remain clear of loads about to be lifted and suspended. All shock loading is prohibited.

Powered Industrial Trucks

The OSHA standard for Powered Industrial Truck Operator Training was revised March 1, 1999. Training information which follows relates to the previous standard, and while it still has practical applications, the reader should refer to the current standard for compliance.

See Powered Industrial Trucks (Forklifts) Safety and Health Topics site.

Workers who must handle and store materials often use fork trucks, platform lift trucks, motorized hand trucks, and other specialized industrial trucks powered by electrical motors or internal combustion engines. Affected workers, therefore, should be aware of the safety requirements pertaining to fire protection, and the design, maintenance, and use of these trucks.

All new powered industrial trucks, except vehicles intended primarily for earth moving or over-the-road hauling, shall meet the design and construction requirements for powered industrial trucks established in the American National Standard for Powered Industrial Trucks, Part ll, ANSI B56.1-1969. Approved trucks shall also bear a label or some other identifying mark indicating acceptance by a nationally recognized testing laboratory.

Modifications and additions that affect capacity and safe operation of the trucks shall not be performed by an owner or user without the manufacturer's prior written approval. In these cases, capacity, operation, and maintenance instruction plates and tags or decals must be changed to reflect the new information. If the truck is equipped with front-end attachments that are not factory installed, the user should request that the truck be marked to identify these attachments and show the truck's approximate weight, including the installed attachment, when it is at maximum elevation with its load laterally centered.

There are 11 different types of industrial trucks or tractors, some having greater safeguards than others. There are also designated conditions and locations under which the vast range of industrial-powered trucks can be used. In some instances, powered industrial trucks cannot be used, and in others, they can only be used if approved by a nationally recognized testing laboratory for fire safety. For example, powered industrial trucks must not be used in atmospheres containing hazardous concentrations of the following substances:

- Acetylene
- Butadiene
- Ethylene oxide
- Hydrogen (or gases or vapors equivalent in hazard to hydrogen, such as manufactured gas).
- Propylene oxide
- Acetaldehyde
- Cyclopropane
- Dimethyl ether
- Ethylene
- Isoprene, and
- Unsymmetrical dimethyl hydrazine.

These trucks are not to be used in atmospheres containing hazardous concentrations of metal dust, including aluminum, magnesium, and other metals of similarly hazardous characteristics or in atmospheres containing carbon black, coal, or coke dust. Where dust of magnesium, aluminum, or aluminum bronze dusts may be present, the fuses, switches, motor controllers, and circuit breakers of trucks must be enclosed with enclosures approved for these substances.

There also are powered industrial trucks or tractors that are designed, constructed, and assembled for use in atmospheres containing flammable vapors or dusts. These include industrial-powered trucks equipped with additional safeguards to their exhaust, fuel, and electrical systems; with no electrical equipment, including the ignition; with temperature limitation features; and with electric motors and all other electrical equipment completely enclosed.

These specially designed powered industrial trucks may be used in locations where volatile flammable liquids or flammable gases are handled, processed, or used. The liquids, vapors, or gases should, among other things, be confined within closed containers or closed systems from which they cannot escape.

Some other conditions and/or locations in which specifically designed powered industrial trucks may be used include the following:

- Only powered industrial trucks that do not have any electrical equipment, including the ignition, and have their electrical motors or other electrical equipment completely enclosed should be used in atmospheres containing flammable vapors or dust.
- Powered industrial trucks that are either powered electrically by liquefied petroleum gas or by a gasoline or diesel engine are used on piers and wharves that handle general cargo.

Safety precautions the user can observe when operating or maintaining powered industrial trucks include:

- That high lift rider trucks be fitted with an overhead guard, unless operating conditions do not permit.
- That fork trucks be equipped with a vertical load backrest extension according to manufacturers' specifications, if the load presents a hazard.
- That battery charging installations be located in areas designated for that purpose.
- That facilities be provided for flushing and neutralizing spilled electrolytes when changing or recharging a battery to prevent fires, to protect the charging apparatus from being damaged by the trucks, and to adequately ventilate fumes in the charging area from gassing batteries.

- That conveyor, overhead hoist, or equivalent materials handling equipment be provided for handling batteries.
- That auxiliary directional lighting be provided on the truck where general lighting is less than 2 lumens per square foot.
- That arms and legs not be placed between the uprights of the mast or outside the running lines of the truck.
- That brakes be set and wheel blocks or other adequate protection be in place to prevent movement of trucks, trailers, or railroad cars when using trucks to load or unload materials onto train boxcars.
- That sufficient headroom be provided under overhead installations, lights, pipes, and sprinkler systems.
- That personnel on the loading platform have the means to shut off power to the truck.
- That dockboards or bridgeplates be properly secured, so they won't move when equipment moves over them.
- That only stable or safely arranged loads be handled, and caution be exercised when handling loads.
- That trucks whose electrical systems are in need of repair have the battery disconnected prior to such repairs.
- That replacement parts of any industrial truck be equivalent in safety to the original ones.

Ergonomic Safety and Health Principles

Ergonomics is defined as the study of work and is based on the principle that the job should be adapted to fit the person, rather than forcing the person to fit the job. Ergonomics focuses on the work environment and items such as design and function of workstations, controls, displays, safety devices, tools, and lighting to fit the employees' physical requirements and to ensure their health and well being.

Ergonomics includes restructuring or changing workplace conditions to make the job easier and reducing/ stressors that cause cumulative trauma disorders and repetitive motion injuries. In the area of materials handling and storing, ergonomic principles may require controls such as reducing the size or weight of the objects lifted, installing a mechanical lifting aid, or changing the height of a pallet or shelf.

Although no approach has been found for totally eliminating back injuries resulting from lifting materials, a substantial number of lifting injuries can be prevented by implementing an effective ergonomics program and by training employees in appropriate lifting techniques.

In addition to using ergonomic controls, there are some basic safety principles that can be employed to reduce injuries resulting from handling and storing materials. These include taking general fire safety precautions and keeping aisles and passageways clear.

In adhering to fire safety precautions, employees should note that flammable and combustible materials must be stored according to their fire characteristics. Flammable liquids, for example, must be separated from other material by a fire wall. Also, other combustibles must be stored in an area where smoking and using an open flame or a spark-producing device is prohibited. Dissimilar materials that are dangerous when they come into contact with each other must be stored apart.

When using aisles and passageways to move materials mechanically, sufficient clearance must be allowed for aisles at loading docks, through doorways, wherever turns must be made, and in other parts of the workplace. Providing sufficient clearance for mechanically moved materials will prevent workers from being pinned between the equipment and fixtures in the workplace, such as walls, racks, posts, or other machines. Sufficient clearance also will prevent the load from striking an obstruction and falling on an employee.

All passageways used by employees should be kept clear of obstructions and tripping hazards. Materials in excess of supplies needed for immediate operations should not be stored in aisles or passageways, and permanent aisles and passageways must be marked appropriately.

Training and Education

OSHA recommends using a formal training program to reduce materials handling hazards. Instructors should be well-versed in matters that pertain to safety engineering and materials handling and storing. The content of the training should emphasize those factors that will contribute to reducing workplace hazards including the following:

- Alerting the employee to the dangers of lifting without proper training.
- Showing the employee how to avoid unnecessary physical stress and strain.
- Teaching workers to become aware of what they can comfortably handle without undue strain.
- Instructing workers on the proper use of equipment.
- Teaching workers to recognize potential hazards and how to prevent or correct them.

Because of the high incidence of back injuries, safe lifting techniques for manual lifting should be demonstrated and practiced at the work site by supervisors as well as by employees.

A training program to teach proper lifting techniques should cover the following topics:

- Awareness of the health risks to improper lifting—citing organizational case histories.
- Knowledge of the basic anatomy of the spine, the muscles, and the joints of the trunk, and the contributions of intra-abdominal pressure while lifting.
- Awareness of individual body strengths and weaknesses-determining one's own lifting capacity.
- Recognition of the physical factors that might contribute to an accident, and how to avoid the unexpected.
- Use of safe lifting postures and timing for smooth, easy lifting and the ability to minimize the load-moment effects.
- Use of handling aids such as stages, platforms, or steps, trestles, shoulder pads, handles, and wheels.
- Knowledge of body responses—warning signals—to be aware of when lifting.

A campaign using posters to draw attention to the need to do something about potential accidents, including lifting and back injuries, is one way to increase awareness of safe work practices and techniques. The plant medical staff and a team of instructors should conduct regular tours of the site to look for potential hazards and allow input from workers.

Safety and Health Program Management Guidelines

To have an effective materials handling and storing safety and health program, managers must take an active role in its development. First-line supervisors must be convinced of the importance of controlling hazards associated with materials handling and storing and must be held accountable for employee training. An on-going safety and health program should be used to motivate employees to continue to use necessary protective gear and to observe proper job procedures.

OSHA's recommended "Safety and Health Program Management Guidelines" issued in 1989 can provide a blueprint for employers who are seeking guidance on how to effectively manage and protect worker

safety and health. The four main elements of an effective occupational safety and health program are (a) management commitment and employee involvement, (b) worksite analysis, (c) hazard prevention and control, and (d) safety and health training. These elements encompass principles such as establishing and communicating clear goals of a safety and health management program; conducting worksite examinations to identify existing hazards and the conditions under which changes might occur; effectively designing the job site or job to prevent hazards; and providing essential training to address the safety and health responsibilities of both management and employees.

Instituting these practices, along with providing the correct materials handling equipment, can add a large measure of worker safety and health in the area of materials handling and storing.

SIGNIFICANT ISSUES IN THE NEW ASBESTOS STANDARD FOR CONSTRUCTION 29 CFR 1926.1101

This discussion is designed to acquaint interested persons with significant changes to OSHA's new Asbestos Standard for Construction, 29 CFR 1926.1101. It is not intended to be a comprehensive review of the entire standard. Persons who wish to learn more about the specific provisions of the standard should consult the preamble and regulatory text of the standard as published in the Federal Register.

The issues that are discussed here are the Permissible Exposure Limit (PEL); duties of building/facility owners; duties and training of the competent person; aspects of exposure monitoring; and control measures, especially for the 4 classes of asbestos work defined by the standard. Basic definitions that are important to understanding these issues are presented.

Definitions

Asbestos-Containing Material (ACM) – means any material containing more than one percent asbestos.

Presumed Asbestos-Containing Material (PACM) – means thermal system insulation and surfacing material found in buildings constructed no later than 1980. The designation of a material as "PACM" may be rebutted following procedures specified in the standard.

Surfacing ACM – means material that is sprayed, troweled-on or otherwise applied to surfaces (such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, and other purposes) and that contains more than 1% asbestos.

Thermal System Insulation (TSI) ACM – means ACM applied to pipes, fittings, boilers, breeching, tanks, ducts or other structural components to prevent heat loss or gain and that contains more than 1% asbestos.

Class I Asbestos Work – means activities involving the removal of TSI and surfacing ACM and PACM.

Class II Asbestos Work – means activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.

Class III Asbestos Work – means repair and maintenance operations, where "ACM," including TSI and surfacing ACM and PACM, may be disturbed.

Class IV Asbestos Work – means maintenance and custodial construction activities during which employees contact but do not disturb ACM or PACM and activities to clean up dust, waste and debris resulting from Class I, II and III activities.

NOTES:

1. The removal of intact cements, coatings, mastics, and flashings during roofing work is not covered by the class system.
2. The installation of asbestos-containing products is covered by the standard but does not fall into any of the four classes.

Building/Facility Owner – means the legal entity, including a lessee, which exercises control over management and recordkeeping functions relating to a building and/or facility in which activities covered by this standard take place.

Permissible Exposure Limit (PEL)

The time-weighted average (TWA) permissible exposure limit has been reduced to 0.1 fibers per cubic centimeter. The Excursion Limit remains at 1.0 fibers per cubic centimeter averaged over 30 minutes. Both of these values are considered PELs.

There is no established action level in the new standard because the sampling and analytical method is not reliable below the time-weighted average limit of 0.1 fibers per cubic centimeter.

Requirements for Building/Facility Owners

Most asbestos-related construction activities involve previously installed building materials. Building owners often are the only and/or best sources of information concerning them. Therefore they are assigned specific information conveying and retention duties under the new asbestos standard. Where a building/facility owner also is an employer with employees who may be exposed to asbestos-containing materials, the duties of employers also apply.

The following materials must be treated as asbestos-containing, unless specified procedures are followed to determine otherwise:

- TSI and surfacing materials in buildings or substrates constructed no later than 1980
- Asphalt and vinyl flooring material installed not later than 1980
- Any other materials that the building owner has actual knowledge that it is, or should have known it to be, asbestos-containing

Notification Requirements

Before work is begun, building/facility owners must identify the presence, location, and quantity of ACM/ PACM and notify the following persons:

- Prospective employers applying for or bidding for work whose employees reasonably can be expected to work in or adjacent to areas containing such material
- Employees of the owner who will work in or adjacent to areas containing such material
- On multi-employer worksites, all employers of employees who will be performing work within or adjacent to areas containing such materials
- Tenants who will occupy areas containing such materials

Notification may be in writing or by personal communication to the affected person(s) or their authorized representatives.

Note: When materials labeled as containing asbestos according to the requirements of this standard are installed on nonresidential roofs, the contractor must notify the building owner of the presence and location of such asbestos-containing materials. This facilitates the owner's future notification requirements.

Signs and Labels

Building/facility owners must post signs at the entrance to mechanical rooms/areas in which employees reasonably can be expected to enter and which contain TSI and surfacing ACM/PACM. The signs must identify the material which is present, its location, and appropriate work practices that will ensure ACM/ PACM will not be disturbed.

Previously installed PACM/ACM that is identified by a building owner or employer must be labeled in areas where the label will clearly be noticed. Posting of signs may be used as an alternative to labels.

The wording for labels is:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

Labels must also contain a warning statement against breathing asbestos fibers.

Records Retention

Where a building/facility owner has communicated and/or received notification concerning the identification, location, and quantity of ACM/PACM, written records of such notifications and their content must be maintained by the building owner for the duration of ownership and transferred to successive owners.

Where a building/facility owner has relied on data to demonstrate that PACM is not asbestos-containing, such data must be maintained for as long as they are relied upon to rebut the presumption.

Competent Person

The new standard requires that a competent person be designated for all worksites covered by the standard. The competent person must have the qualifications and authority required by 29 CFR 1926.20-32, the basic construction requirements.

The standard specifies additional duties and training for the competent person on asbestos worksites.

Duties

The competent person must make frequent and regular inspections of the job site, materials, and equipment. On jobsites where Class I or II work is being performed, the competent person must perform or supervise the following duties:

- Set-up the regulated area, enclosure, or other containment
- Ensure (by on-site inspection) the integrity of the enclosure or containment
- Set up procedures to control entry to and exit from the enclosure and/or area
- Supervise all employee exposure monitoring
- Ensure that employees working within the enclosure and/or using glove bags wear protective clothing and respirators
- Ensure through on-site supervision, that employees set up and remove engineering controls, use work practices and personal protective equipment in compliance with all requirements
- Ensure that employees use the hygiene facilities and observe the decontamination procedures
- Ensure through on-site inspection that engineering controls are functioning properly and employers are using proper work practices
- Ensure that notification requirements are met

For Class I jobs, on-site inspections must be made at least once during each work shift, and at any time at employee request.

For Class II and III jobs, on-site inspections must be made frequently enough to assess whether conditions have changed, as well as at any reasonable time at employee request.

Training

For Class I and II asbestos work, training of the competent person must include all aspects of asbestos removal and handling, including

- Abatement, installation, removal, and handling
- Contents of the standard
- Identification of asbestos
- Other practices for reducing the hazard

This training will be obtained in a comprehensive course for supervisors that meets the criteria of EPA's Model Accreditation Plan (40 CFR Part 763), or a course equivalent in stringency, content, and length.

For Class III and IV, training of the competent person must include aspects of asbestos handling appropriate to the work, including

- Procedures for setting up glove bags and mini-enclosures
- Use of wet methods
- Contents of the standard
- Identification of asbestos

Training must include successful completion of a course meeting EPA requirements for training local education agency maintenance and custodial staff [40 CFR 763.92(a)(2)], or its equivalent in stringency, content, and length.

Training required for Class I and II competent persons also satisfies the requirements for Class III and IV.

Exposure Monitoring

Initial Exposure Assessment

A competent person must make an "initial exposure assessment" before or at the initiation of all covered operations to determine expected exposures. An initial exposure assessment is not the same as initial exposure monitoring. Initial employee exposure monitoring cannot adequately predict all future exposures on construction jobs. First-day exposures may reflect set-up activities and thus be lower than later exposures. In addition, results of monitoring are not instantaneously available. Therefore, the initial exposure assessment will identify jobs likely to exceed the PEL in time for employers to install and implement the extra controls required to reduce exposures.

The bases for the initial exposure assessment are

1. Employee exposure monitoring, if feasible, and
2. All observations, information, or calculations that indicate employee exposure to asbestos; this includes any previous monitoring conducted in the workplace, or of the operations of the employer that indicate the levels of airborne asbestos likely to be encountered on the job.

For Class I jobs, exposures are to be assumed to exceed the PELs until and unless the employer is able to make a "negative exposure assessment."

If a "negative exposure assessment" has been made, the "initial exposure assessment" is not required.

Negative Initial Exposure Assessment

A "negative initial exposure assessment" is a demonstration by the employer that employee exposure during an operation is expected to be consistently below the PELs.

The determination of a "negative exposure assessment" is job-specific. It can apply only to jobs performed by trained employees.

An employer may demonstrate that exposure will be below the PELs by data conforming to the following criteria:

1. ***Objective data*** – demonstrating that the product or material containing asbestos minerals or the activity involving such product or material cannot release airborne fibers in concentrations in excess of the PELs (TWA or Excursion Limit) under those work conditions having the greatest potential for releasing asbestos (the worst case), or
2. ***Prior exposure monitoring results*** – for both PELs; within the previous 12 months; using the sampling and analytical methods of the asbestos standard in effect; work operations closely resemble current or projected operations in terms of processes, types of material, control methods, work practices, environmental conditions, and employee training; results indicate that employee exposures will not exceed PELs, or
3. ***Results of initial exposure monitoring of the current job*** – cover operations that are most likely during the performance of the entire asbestos job to result in exposures over the PELs.

Periodic Monitoring

Daily monitoring is required for Class I and II operations unless the employer has made a negative exposure assessment for the entire operation.

For Class I work, daily monitoring may be dispensed with only if all employees are equipped with supplied-air respirators operated in the pressure demand mode (or other positive pressure mode respirator) and only control methods listed in the standard are used.

For Class II work, daily monitoring may be dispensed with if all employees are equipped with supplied-air respirators operated in the positive-pressure mode.

All work operations, other than Class I and II work, where exposures are expected to exceed a PEL, must be monitored at intervals sufficient to document the validity of the exposure prediction.

Methods of Compliance

Some methods of compliance specified in the new standard apply to all covered asbestos jobs. Others are Class-specific.

Requirements Applying to All Jobs

Controls and practices that must always be used, regardless of the level of exposure, are:

1. Vacuum cleaners with HEPA filters to collect asbestos-containing debris and dust
2. Wet methods or wetting agents during handling, mixing, removal, cutting, application, and cleanup (unless infeasible or creates a greater hazard)

3. Prompt cleanup and disposal of wastes and debris contaminated with asbestos in leak-tight containers

Controls and work practices that may never be used, regardless of the level of exposure, are:

1. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air
2. Compressed air to remove asbestos-containing materials, unless used in conjunction with an enclosed ventilation system to capture the dust cloud
3. Dry sweeping, shoveling or other dry cleanup of dust and debris containing ACM and PACM
4. Employee rotation to reduce employee exposure

For all work covered by the standard, one or more of the following controls must be used, as necessary, to achieve compliance with the PELs:

- Local exhaust ventilation equipped with HEPA filter dust collection systems
- Enclosure or isolation of processes producing asbestos dust
- Ventilation of the regulated area to move contaminated air away from the employee's breathing zone toa filtration or collection device equipped with a HEPA filter
- Other work practices and engineering controls that the Assistant Secretary for OSHA can show to be feasible.

Note: Where the above controls are not sufficient to achieve compliance with the PELs, they must still be used and then supplemented with respiratory protection.

Requirements Applying to Specific Classes of Asbestos Work

Requirements for controls and work practices that apply to a specific Class or type of asbestos work are found in the sections of the Standard as indicated in the following table:

Class or Type of Asbestos Work	**Paragraph of the Standard**
Class I Requirements	(g)(4); (g)(5); (g)(6)
Class II Requirements	(g)(7); (g)(8)
Class III Requirements	(g)(9)
Class IV Requirements	(g)(10)
Installing, removing, repairing, or maintaining intact roof cements, mastics, coatings, or flashings which contain asbestos fibers encapsulated or coated by bituminous or resinous compounds	(g)(11)

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