

# Some significant standards

Many OSHA standards apply to virtually all employers, because the regulated activity or condition is common to almost every work environment. Other standards are limited in their application, because the regulated activity or condition is not found in most employers' workplaces. A particular OSHA standard could apply only to a small subset of the employees or work operations at an employer's place of business, and have no relevance at all to the work of the majority.

## Basic standards applicable to most employers

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Important basic standards affecting most, if not all, industrial workplaces address general housekeeping, walking and working surfaces, both fixed and portable ladders, scaffolds, and prevention of falls through floor openings. Employers must keep the workplace aisles clear of obstructions, and floors clear of tripping and slipping hazards. When water on floors is likely, drainage systems are required to minimize the hazard. Also, the use of guardrails or other systems to prevent falls to a lower working surface are required. Similar general requirements for housekeeping apply to construction work environments, and a substantial portion of the OSHA construction standards are devoted to scaffolds and fall protection, as one might expect.

## Emergencies

All employers must plan for emergencies – for quick exit from the workplace and rapid notification of the proper response organizations. The standards mandate a written emergency plan for industrial employers with more than 10 employees. However, OSHA requires that all employers anticipate likely emergencies and plan for them by training employees, developing procedures, and delegating responsibilities. Industrial employers must ensure that exits are marked properly, and that these are not locked or blocked by accumulations of materials. In some cases, alarm systems are required. Other OSHA standards impose additional requirements when particular types of hazards create an elevated risk of fire, explosion, or other emergencies. Construction sites are covered by similar standards in the OSHA construction standards.

## Medical services and first aid

Medical services and first aid are related to planning for emergencies, and all industrial and construction employers must ensure their availability. There must be adequate first-aid supplies available in the workplace. If there is no nearby medical facility, then some employees must be delegated first-aid duties, for which they must be adequately trained

(see bloodborne pathogens discussion below). Required first-aid devices explicitly include eyewash stations and emergency showers, if either the eyes or the body of employee's workers could be splashed with "injurious corrosive materials."

## **Firefighting equipment**

If an employer's emergency plans call for the use of firefighting equipment by employees, then these devices must be properly selected, maintained, and positioned in the workplace. Such employers must ensure that the devices are inspected, and in some cases tested, at specified intervals. In addition, employees must receive appropriate training. The requirements are much more stringent if an employer organizes a formal "fire brigade" to respond to emergencies. The requirements concerning fire brigades include appropriate selection of respirators for use in conditions immediately dangerous to life and health.

## **Flammable and combustible liquids**

The safe storage of flammable and combustible liquids is an important part of fire prevention and fire protection, because these substances can create an initial blaze or enhance the severity of a fire that started elsewhere. OSHA requires that employers that store such materials classify them in accordance with technical safety criteria (flash point, boiling point, etc.) and adhere to complex rules regarding maximum inventory, storeroom configuration, and storage method. In addition, employers must avoid accumulation of static electricity – which can cause sparking – during transfers to containers. In addition, many technical requirements are imposed upon employers that store or transfer large quantities of flammable or combustible liquids.

## **Sanitation**

OSHA mandates minimal standards for sanitation in industrial and construction workplaces. The general requirements include the adequate provision of potable water from sources that cannot be confused with supplies of non-potable water. Such systems must be designed to ensure that non-potable water cannot be supplied by mistake for drinking, dishwashing, bathing, or other hygienic purposes. Drinking water may not be dipped from a container, even if it is covered between uses. The sanitation standards also specify the number of toilets required for workers of each sex, as well as the number of showers, if these are necessary.

## **Other standards**

The list of OSHA standards includes several other subparts with basic provisions affecting many employers – large and small. Personal protective equipment to guard against foot, eye, head, or other injury must be provided when necessary. Even if an employer does not use forklifts or cranes, some basic rules concerning "materials handling and storage" most likely will apply. Similarly, all dangerous machinery to which employees have access must be guarded, even if the machinery is not a type explicitly addressed by a standard (such as abrasive wheels). Other subparts with broadly applicable standards are those on power tools, welding, and electrical safety. Few

industrial workplaces can operate safely without attention to tool inspections, ground-fault protection, and other basic safety precautions.

## **Major standards applicable to many employers**

Several standards deserve special treatment because they impose compliance burdens that many employers do not normally anticipate. These standards normally require preparation of a document assessing the hazard and describing the employer's plans for compliance. In addition, OSHA almost invariably requires maintenance of numerous records on the operation of the employer's compliance program. Such records include those documenting training, medical monitoring, and workplace assessments, all of which normally are required. Workplace assessments could include technical measurements of the level of the regulated hazard in the employer's various work environments, or during various operations that occur there.

## **Chemical hazard communication**

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Of special significance are OSHA requirements on the communication of chemical hazards to employees, which involves workplaces where employees are exposed to chemical hazards. This regulation, often called the "right-to-know" standard, mandates that an employer must maintain a material safety data sheet (MSDS) on every hazardous chemical located or used in the employer's work facility. This includes chemicals that present physical hazards (reactivity to water, flammability, high pressure, etc.) and chemical hazards (toxicity, irritation, elevated risk of cancer, etc.). Under most circumstances, an MSDS on an industrial chemical must be available for inspection by employees who work with the chemical. With few exceptions, containers holding industrial chemicals must be labeled.

An affected employer must review its use of chemicals and make an assessment of the hazards present. Training of employees upon initial employment, when conditions change, and periodically thereafter also is required. Employees must know the nature of the hazards, the steps necessary to work safely, and the employer's plan for compliance with the standard. The hazard assessment and the compliance plan must exist as a written hazard communication program, which must include a list of all chemicals covered by the standard.

## **Workplace exposure to noise**

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Long-term exposure to excessively noisy environments can produce gradual hearing loss, which can progress to the stage of profound disability. Employees in many industrial workplaces routinely are exposed to noise at levels high enough to trigger the requirements of the OSHA standard on occupational noise exposure.

The measurement of workplace noise levels for the purpose of OSHA compliance is complex. The standard limits workplace exposure to noise to an amount "equivalent" to an eight-hour exposure at a continuous sound level of 90 decibels (90 dBA) on the "A" scale. This is the permissible exposure limit (PEL) for unprotected employees. However, some people actually

may experience hearing loss after prolonged exposure to levels somewhat below the PEL. For this reason, OSHA requires that employers take certain actions if employees are exposed to levels above the “action level.” The action level is the equivalent of continuous exposure to 85 dBA for eight hours.

The standard requires that employers identify employees whose exposure to noise over the work shift is at or above the action level. (The determination can be done readily by several techniques. A competent industrial hygienist should be involved in the measurements.) Employees so identified must be included in a “hearing conservation program,” which involves initial and periodic audiograms to detect incipient hearing loss.

No employee may be exposed to sound levels above the PEL, unless appropriate protective earmuffs or earplugs are used. An employee identified as one experiencing incipient hearing loss must use hearing protection at levels above the “action level.” The length of a shift is a factor in this determination, because a 10-hour shift at the same equivalent sound level results in a total “dose” that is 25 percent higher than that received in an eight-hour shift. Thus, in a given situation, exposure to the conditions during an eight-hour shift might be just below 100 percent of the OSHA limit, while exposure over a 10-hour shift could be well above it.

Requirements for workplace assessment, training, and medical (audiometric) monitoring are extensive when employees’ exposures exceed the action level. In addition, OSHA requires that employers maintain records of every aspect of the compliance program. The standard also contains technical specifications on audiogram interpretation, hearing protector attenuation, and calibration of audiometric testing devices.

## Bloodborne pathogens

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The principal purpose of the standard on bloodborne pathogens is to protect employees from two diseases:

- HIV (AIDS)
- and
- hepatitis B.

It applies to “all occupational exposure to blood or other potentially infectious materials.” Affected employers are not just limited to those that provide medical and dental services. Employers in many industries have been cited for failure to comply, often because designated providers of first aid are not included in the required bloodborne pathogen program. Under the medical first-aid standard (discussed above), employers are required to designate an employee who is trained in first aid to provide such assistance where the employer’s facility is not in near proximity to a hospital or clinic.

The basic requirement is a written exposure control plan, which must provide a list of employees in jobs that involve exposure and a list of all tasks that present the potential for exposure. The document must detail the employer’s procedures for evaluating and minimizing such exposures to

blood, blood products, other body fluids, and other infectious materials. Required procedures for handling waste, disposal of needles, disinfection of work areas, and use of protective clothing, gloves, and devices must be described in the written plan.

Employers must offer a vaccination against hepatitis B at no cost to employees who desire to receive one, if the work involves exposure to this hazard. Employers are required to maintain a record of any vaccinations and refusals of such by employees. Also, employers must perform extensive follow-up investigations and evaluations when an exposure episode has occurred, and detailed, specified records of the event and its effect upon the exposed individual must be maintained.

Initial and annual training of covered employees is required, and the OSHA standard explicitly requires coverage of specified topics. Training records must be maintained by the employer. In addition, the standard requires various warning signs to communicate dangers and required work practices to employees.

## **The lockout/tagout standard**

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In many industrial workplaces, the hazard of “unexpected energization” can occur when employees perform maintenance on machines and other equipment. Serious injury can result if an employee inadvertently turns on equipment while another employee’s body or limb is within the zone of danger during operation. The lockout/tagout standard, requiring the “control of hazardous energy,” is designed to prevent this.

The basic means of providing protection is the use of locks on manual switches, valves, etcetera controlling the energy supply to the dangerous machine, equipment or device. Only designated employees may apply and remove the locks, in accordance with strict OSHA requirements and the employer’s written program. If locks cannot be used, the employer must use tags to warn others against restoring power; however, locks are preferred. The employees exposed to the danger must be the ones who perform the lockout or tagout of the equipment.

Employers must assess the potential for accidents of this type during service, maintenance, or repair of machines and equipment. A written plan detailing protective measures required during work involving this hazard must be prepared for each facility. The employees must be trained in the proper work as well as lockout procedures, and only trained employees may do work requiring lockout/tagout or perform tasks required by the written program. Records of this initial and annual training must be maintained, as well as records of required inspections by the employer to ensure compliance.

## **Confined space entry**

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Entry into confined spaces is another job duty that can be extraordinarily dangerous in industrial or other work environments. The hazards are numerous and include: toxic, oxygen-deficient, and/or flammable atmospheres, as well as engulfment hazards (for example, from grain or the unanticipated release of feedstock chemicals). Also, an otherwise minor event could have fatal

consequences if a “dangerous internal configuration” hinders rescue or causes entrapment of an employee within the confined space.

This OSHA standard requires that employers identify all confined spaces in the workplace. In general, a confined space is one that can be entered for work through restricted or limited openings, and that is not intended by design or purpose for employee occupancy. Examples are vaults, pits, tanks and vessels.

Employers also must further determine which confined spaces are “permit spaces,” subject to stringent requirements, including the prohibition of unauthorized entry. A permit space is a confined space in which one of the recognized hazards discussed previously could occur – that is, the hazard is present or there is a risk that it could develop. Employers should note that the potential hazard associated with a confined space could be inherent in the space itself (for example, a sewer), or it could be a product of the work performed there (for example, welding).

The employer must develop a permit space program based upon a thorough assessment of the spaces and the likely hazards. The written document must include detailed work rules on all aspects of the anticipated entries, including testing of the atmosphere, supplying ventilation, stationing of attendants at the entry port, maintaining communication with employees inside, and ensuring effective rescue if necessary.

In addition, the written program must describe the employer’s permit system for authorizing work in confined spaces and assuring its safety. A permit for such work must show that the employer considered the likely hazards and specified the procedures to prevent harm to employees. The permit must apply to a specific entry on a specific date, and it must state the duration of the project and the personnel who will be present. A trained supervisor must sign the permit before entry, and the supervisor must cancel the permit when the specified work is completed or if any impermissible condition occurs.

The standard imposes stringent requirements regarding rescue because many people have died after entering confined spaces to aid others. Employers must plan both for retrieval from the space and for the provision of emergency services. For most situations, harnesses with retrieval lines attached to mechanical devices are required to effect rescue without entry of additional personnel.

Extensive training of employees is required under the standard. The training must prepare employees for various roles necessary for safe work – entrants, attendants, supervisors, and rescuers. Records of this training must be maintained. In addition, the employer must maintain canceled permits for one year to facilitate program evaluation.

## **Chemical hazards (including asbestos)**

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OSHA’s limits on airborne exposures to toxic chemicals are found in subpart Z, Toxic and Hazardous Substances. These permissible exposure limits (PELs) take several forms, depending upon the particular chemical regulated. For many employers, compliance with limits on chemical

exposures can become very complex, requiring the assistance of a professional industrial hygienist.

Several hundred chemicals are regulated only by means of their entries in the “Z” Tables, which are merely lists of chemicals and their respective PEL exposure limits. Subsequent standards deal with individual chemicals, including asbestos, benzene, lead, methylene chloride, ethylene oxide, and cotton dust, as well as several other chemicals that are considered to be potent carcinogens. These individual, substance-specific standards normally provide comprehensive regulation of the chemical and impose many requirements in addition to PELs.

The standards generally employ one of two units of contaminant concentration in air:

- parts per million (ppm) by volume
- milligrams per cubic meter ( $\text{mg}/\text{m}^3$ ).

The latter unit is used only for dusts, fumes, mists, and other suspensions of solid or liquid particles in air. If the contaminant is a gas or a vapor, either unit may be used. A simple formula can be used to convert ppm to  $\text{mg}/\text{m}^3$ , if the molecular weight of the gas or vapor is known. One exception to this is asbestos fibers, which are measured in  $\text{fibers}/\text{cm}^3$ .

Most OSHA PELs are limits on the average exposure over an eight-hour shift, which is called a time-weighted average (TWA). The employee’s level of exposure may vary greatly during the shift, but only the integrated exposure – the average over the shift – is compared with the OSHA PEL-TWA to assess compliance. A few OSHA limits are termed ceiling limits, which are levels of exposure that may not be exceeded even instantaneously. For such chemicals, the exposure profile is not relevant for the purpose of OSHA compliance. Rather, the PEL-ceiling is exceeded if the exposure level was above it for the briefest period in which it was possible to make an accurate measurement.

OSHA also places, for a few chemicals, limits on the average concentration during short periods of relatively high exposure. Such limits, termed short-term exposure limits (STELs) normally apply to the average over a 15-minute interval. For example, in the case of benzene, an unprotected employee may be exposed to no more than one ppm as an average over an eight-hour day, but the exposure level may not exceed five ppm during any 15-minute interval of relatively high exposure. The PEL-TWA of benzene is one ppm, and the PEL-STEL is five ppm. An employee exposure to six ppm benzene for five minutes would mean that the standard had been violated, even if there was zero exposure for the other 475 minutes of the eight-hour shift.

Several aspects of the OSHA limits in subpart Z complicate their use. The definitions employed in Table Z-2 to limit exposure to the few chemicals listed therein differ from those discussed previously. For several chemicals, limits listed in the tables have been superseded by substance-specific standards that apply to most, but not all, industries. Also, there is some inconsistency in terminology with respect to short-term exposure limits, which occasionally are called “excursion limits.” In the case of asbestos, the excursion limit (EL) actually is a STEL applied to a 30-minute interval, rather than the usual 15-minute interval.

Employers whose employees are exposed to asbestos, benzene, lead, or several other airborne contaminants covered by single-substance standards must be concerned about the action level (AL). For a few substances, OSHA imposes regulatory requirements when employees' exposures are below the PEL, but above the AL. Exposure of employees at the low AL triggers certain required "actions" by employers, such as training, routine exposure measurements, and more frequent surveillance of conditions.

If an employee's exposure exceeds the PEL, then the employer is expected to use "engineering" or other controls to bring the exposure into compliance. When this cannot be done, then the employer may rely upon respiratory protection, if it does so in accordance with OSHA requirements.

## Respiratory protection

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Compliance with the OSHA standard on the use of respirators in the workplace presents significant technical, legal, and managerial challenges for many industrial employers. Employers must perform a formal "evaluation" of respiratory hazards, which must include "a reasonable estimate of employee exposures" and "an identification of the contaminant's chemical state and physical form." In most work environments, such a study would require the expertise of an experienced industrial hygienist or a similarly trained specialist.

Of course the employer must determine whether workplace atmospheres are "immediately dangerous to life and health" (IDLH), as a result of either a high concentration of a toxic contaminant or a low concentration of oxygen, or both. Work areas and operations in which IDLH atmospheres occur, or might occur under certain conditions, must be identified, and suitable respirators incorporating redundant safety features must be required.

In addition to the identities, physical forms, and concentrations of the various contaminants, the employer must identify "relevant workplace and user factors." These could include high humidity, which reduces the service life of respirator cartridges used against gases and vapors, or the presence of oil mist, which can diminish the effectiveness of filter cartridges used against solid and liquid aerosols (particles, mists, etc.). In fact, the presence or absence of any oil mists now is a critical factor in filter cartridge selection.

Employers also are required to evaluate the service lives of respirator cartridges. This is especially true in the case of cartridges used to remove gaseous and vaporous contaminants. The preferred option is an end-of-service-life indicator (ESLI) installed by the manufacturer, but these are not available in most cases. If there is no ESLI, then the employer must use some other method to establish service life under the conditions present in the workplace. This could involve the use of manufacturer's recommendations or other technical reports.

The employer's respiratory protection program must include many elements. First, the employer must make sure that the employee who will be required to use a respirator is physically able to do so. OSHA requires employers to provide a medical questionnaire conducted by a medical professional. The answers to the medical questionnaire may indicate the necessity for additional medical evaluation including pulmonary function history. The employer must perform annual fit

testing according to OSHA requirements, and ensure a good facepiece fit by maintaining a supply of respirators in a “sufficient number” of model/size combinations. The employer must provide the initial training of employees who use respirators and arrange the initial determinations of medical fitness to use the devices.

Employers may provide respirators to employees who request them even if air contaminants are present only in low concentrations (below OSHA limits) and oxygen concentration is adequate. However, this “voluntary respirator use” is permitted only if the employer determines that it will not “in itself create a hazard.” The standard imposes specific duties on employers who allow the use of respirators when they are not required.

OSHA requires detailed records of the administration of each aspect of the employer’s program. This includes training records, medical qualification statements, detailed information on each administered fit test, and other information.

There must be a formal, written respiratory protection program with sections specifically addressing the various workplace conditions for which different types of protective equipment are necessary. The written program must detail the employer’s procedures for ensuring that employees receive clean, properly fitting respirators, and that the employees are medically qualified and appropriately trained. There must be a stated provision on the employer’s ongoing procedure for evaluating the effectiveness of the respiratory protection program. The program must have a designated administrator “qualified by appropriate training or experience that is commensurate with the complexity of the program.”