Industrial Hygiene

Overview

Introduction

Industrial hygiene studies the environmental factors or stresses arising in or from the workplace, which may cause sickness, impaired health and well being, or significant discomfort among workers. In previous modules we discussed industrial hygiene hazards in an office environment. There are additional hazards in the industrial work environment that fall under the industrial hygienists purview.

Objectives

You will be able to:

- identify hazards relating to industrial hygiene, and
- describe control options.
-

In this module

In this module we will discuss the following topics:

- Occupational noise exposure and hearing conservation
- Temperature extremes
- Radiation hazards
- Confined spaces
- Ergonomics
- Bloodborne Pathogens

Occupational Noise Exposure

Introduction

Noise is usually defined as any unwanted sound. It is a by-product of many industrial processes within DLA. We are constantly surrounded by sound both on and off the job. Unfortunately, many of the sounds we hear are unpleasant or unwanted, whether it be pounding machinery or screeching traffic. In fact, millions of Americans are regularly exposed to loud, prolonged noise. Without proper controls, noise can damage the tiny hair cells inside our ears and may even lead to permanent hearing loss.

Hazards

Loud noises can cause hearing loss by damaging the delicate hair cells in the inner ear. Most of the time this damage happens gradually when prolonged exposure to loud sounds exhausts the hair cells. As noise levels increase, the tiny cilia at the top of the hair cells can be injured or broken off. Hair cells do not repair themselves. When enough hair cells are damaged, a hearing loss results.

Contributing factors

The extent of damage depends primarily on two factors:

- Intensity of the noise
- Duration of exposure

Noise-induced hearing loss can be temporary or permanent. Temporary hearing loss results from short-term exposures to noise, with normal hearing returning after a period of rest. Generally, prolonged exposure to high noise levels over a period of time gradually causes permanent damage.

Find a solution to noise pollution.

Occupational Noise Exposure, Continued

Acceptable noise levels

Sound is measured in decibels (dBA). Decibels measure the intensity of a sound, not its loudness. These are examples of common sound levels:

- Normal conversation—60 dBA
- Woodshop noise level—100 dBA
- Chain saw—110 dBA
- Jack hammer—120 to 125 dBA
- Jet plane—140 dBA

Note: Most experts consider noise levels above 85 dBA over an 8-hour shift to be hazardous.

Clues to look for

There are several clues that might indicate that a working environment could cause hearing loss:

- Must raise voice significantly for someone an arm's length away to hear me.
- Hearing a mild ringing or whooshing noise that goes away after an hour or two.
- Speech/music sounds muffled after work.
- Employees bring in their own hearing protection.

Noise control

Removing hazardous noise from the workplace through engineering controls is the most effective way to prevent noise-induced hearing loss. These are engineering controls:

- Mufflers
- Acoustical barriers
- Isolation
- Substitution

Administrative controls, such as alternate work schedules, may also be an effective method of noise control. As a last resort, personal protective hearing devices, i.e., earplugs and muffs, may be used.

Hearing Conservation Program

Introduction

Prevention of noise-induced hearing loss can be accomplished by instituting an effective hearing conservation program in accordance with 29 CFR 1910.95, Occupational Noise Exposure. Employers shall administer a continuing, effective hearing conservation program whenever employee noise exposures equal or exceed an 8-hour time-weighted average (TWA) sound level of 85 decibels. All noise measurement and analysis data will be maintained for the length of time required in DoD 6055.12, and will be used in development of a health hazard inventory. DLA will use host facility standards for determining worker exposures to hazardous noise.

Hazardous noise standards

The hazardous noise standards of DoDI 6055.12, DoD Hearing Conservation Program are adopted as the DLA Hazardous Noise Standards.

Monitoring

When information indicates that any employee's exposure may equal or exceed an 8-hour TWA of 85 decibels, the employer shall develop and implement a monitoring program. Monitoring shall be repeated whenever a change in production, process, equipment, or controls increases noise exposures.

Employee notification

The employer shall provide the results of monitoring to employees exposed at or above an 8-hour TWA of 85 decibels. The affected employee or their representative must be provided an opportunity to observe any noise monitoring.

Audiometric testing

The employer shall establish and maintain an audiometric testing program and make the audiometric testing available to all employees whose exposures equal or exceed an 8-hour TWA of 85 decibels.

Hearing protective devices

Hearing protective devices are those prescribed in 29 CFR 1910.95 and discussed in the Guidance. Basically, there are only two types of hearing protection—the earplug and the earmuff. Employers shall make hearing protectors available to all employees exposed to an 8-hour TWA of 85 decibels or greater, at no cost to the employees. Hearing protectors shall be replaced as necessary.

Training program

The employer shall institute a training program for all employees who are exposed to noise at or above an 8-hour TWA of 85 decibels and shall ensure that employees participate in this program. The training program shall be repeated annually.

Temperature Extremes of Heat

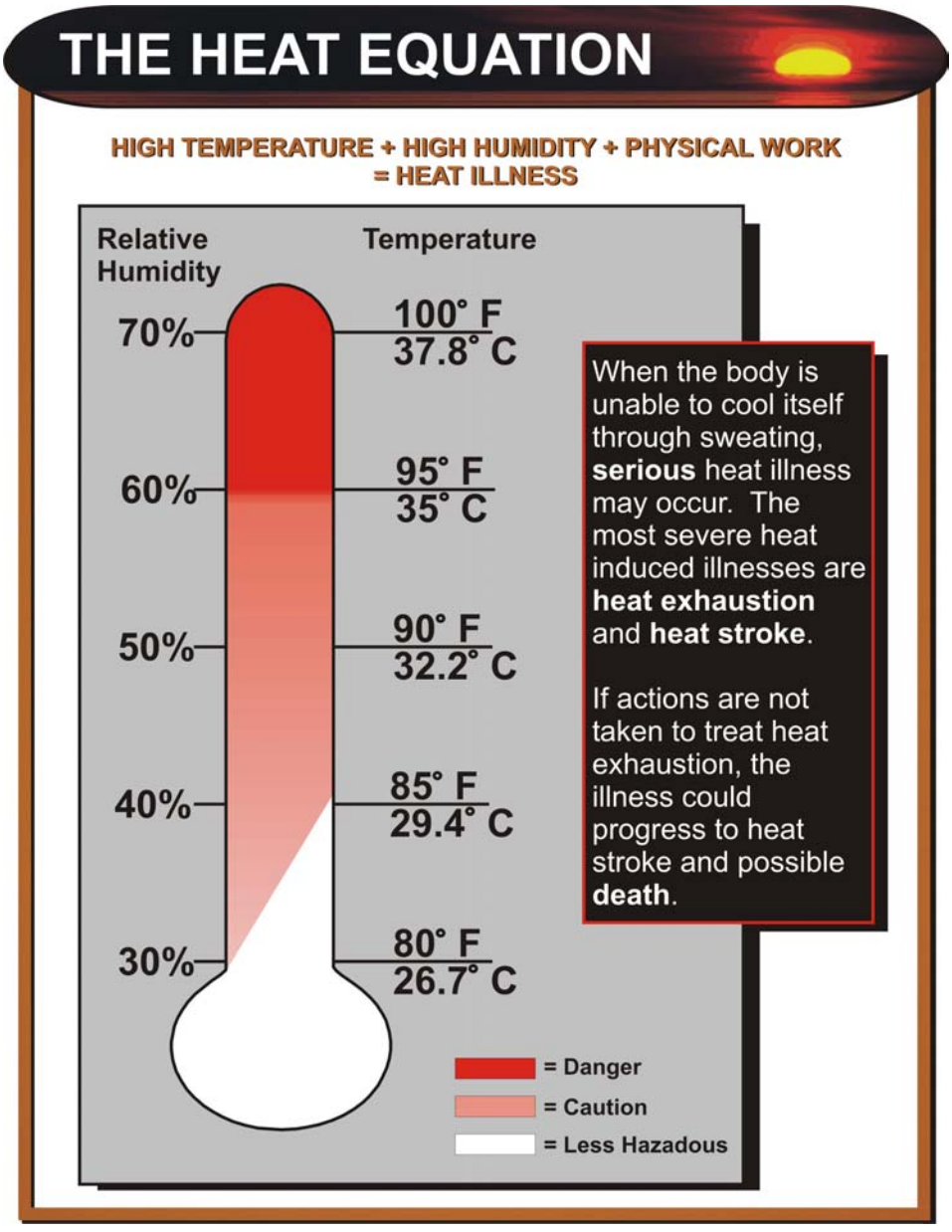
Introduction

Both very cold and very hot temperatures could be dangerous to your health. Excessive exposure to heat is referred to as heat stress and excessive exposure to cold is referred to as cold stress.

Heat stress

In a very hot environment, the most serious concern is heat stroke. In the absence of immediate medical attention, heat stroke could be fatal. Heat stroke fatalities do occur every summer. Heat exhaustion and fainting (syncope) are less serious illnesses that are not fatal, but interfere with a person's ability to work.

The following chart identifies the factors contributing to heat stress and associated illnesses.



Temperature Extremes of Heat, Continued

Warning signs of heat stroke

While symptoms can vary from person to person, the warning signs of heat stroke can include the following:

- Dry, pale skin (no sweating)
- Hot red skin (looks like a sunburn)
- Mood changes (irritable, confused/not making any sense)
- Seizures
- Collapsed/passed out (will not respond)

Response

If a coworker appears to be disorientated or confused (including euphoria), or has unaccountable irritability, malaise, or flu-like symptoms, move the worker to a cool location and seek medical advice.

Safety guidelines

Follow these guidelines for protecting workers from heat stress:

- Learn the signs and symptoms of heat-induced illnesses and what to do to help the worker.
- Train the workforce about heat-induced illnesses.
- Perform the heaviest work in the coolest part of the day.
- Slowly build up tolerance to the heat and the work activity (usually takes up to 2 weeks).
- Use the buddy system (work in pairs).
- Drink plenty of cool water (one small cup every 15–20 minutes)
- Wear light, loose-fitting, breathable (like cotton) clothing.
- Take frequent short breaks in cool shaded areas (allow your body to cool down).
- Avoid eating large meals before working in hot environments.
- Avoid caffeine and alcoholic beverages (these beverages make the body lose water and increase the risk for heat illnesses).

Exposure limits for working in hot environments

Two types of exposure limits are often used:

- Occupational exposure limits protect industrial workers from heat-related illness.
- Thermal comfort limits are for office work to ensure productivity and quality of work.

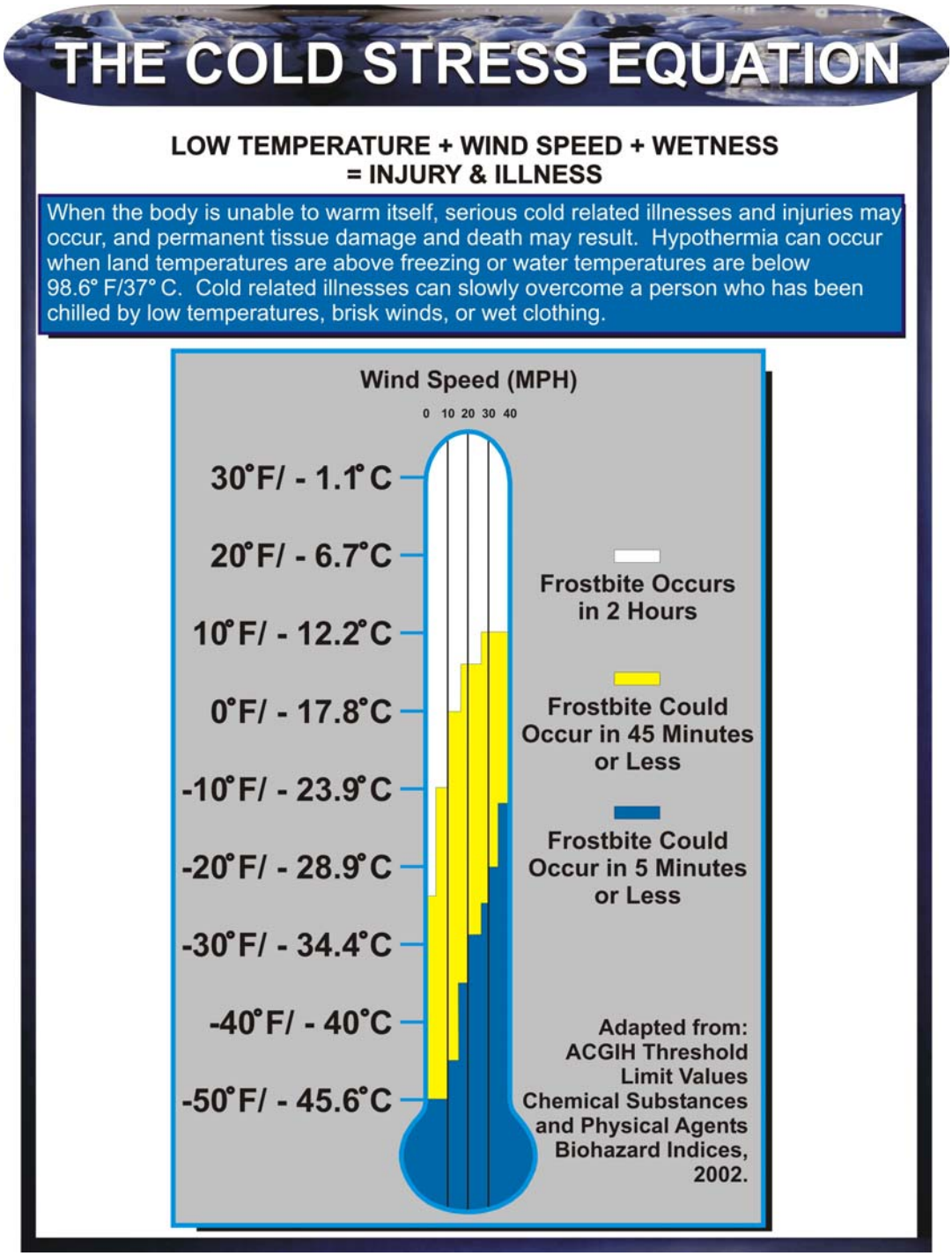
The American Conference of Governmental Industrial Hygienists (ACGIH) recommends Threshold Limit Values (TLVs) for working in hot environments. These limits are given in units of wet bulb globe temperature (WBGT) degrees Celsius (°C). The WBGT unit takes into account environmental factors, namely air temperature, humidity, and air movement, which contribute to perception of hotness by people.

Temperature Extremes of Cold

Cold stress

At very cold temperatures, the most serious concern is the risk of hypothermia or dangerous overcooling of the body. Another serious effect of cold exposure is frostbite or freezing of the exposed extremities such as fingers, toes, nose, and ear lobes. Hypothermia could be fatal in the absence of immediate medical attention.

The following chart identifies the factors contributing to cold stress and associated illnesses.



Temperature Extremes of Cold, Continued

Warning signs of hypothermia

Warning signs of hypothermia can include the following:

- Normal body temperature of 98.6°F/37°C drops to or below 95°F/35°C
- Fatigue or drowsiness
- Pain in extremities (hands, feet, ears, etc.)
- Uncontrolled shivering
- Cool bluish skin
- Slurred speech
- Irritable, irrational, or confused behavior

These signs indicate a medical emergency. Move workers to a heated shelter and seek medical advice.

Safety guidelines

Follow these guidelines for protecting workers from cold stress:

- Recognize the environmental and workplace conditions that lead to potential cold-induced illnesses and injuries.
- Learn the signs and symptoms of cold-induced illnesses and what to do to help the worker.
- Train the workforce about cold-induced illnesses and injuries.
- Select proper clothing for cold, wet, and windy conditions. Layer clothing to adjust to changing environmental temperatures. Wear a hat and gloves, in addition to underwear that will keep water away from the skin (polypropylene).
- Take frequent short breaks in warm dry shelters to allow the body to warm up.
- Perform work during the warmest part of the day.
- Avoid exhaustion or fatigue because energy is needed to keep muscles warm.
- Use the buddy system (work in pairs).
- Drink warm, sweet beverages (sugar water, sports-type drinks). Avoid drinks with caffeine (coffee, tea, or hot chocolate) and alcohol.
- Eat warm, high-calorie foods like hot pasta dishes.

Exposure limits for working in the cold

The ACGIH has adapted the guidelines for working outdoors in cold weather conditions. These guidelines recommend protective clothing and limits on exposure time. The recommended exposure times are based on the wind chill factor, a scale based on air temperature and wind speed. The work–break schedule applies to any 4-hour period with moderate or heavy activity.

Radio Frequency (RF) Radiation

RF and microwave radiation

Electromagnetic radiation consists of waves of electric and magnetic energy moving together (i.e., radiating) through space at the speed of light. Taken together, all forms of electromagnetic energy are referred to as the electromagnetic spectrum. Radio waves and microwaves emitted by transmitting antennas are one form of electromagnetic energy. They are collectively referred to as radio frequency or RF energy or radiation. Often the term electromagnetic field or radio frequency field may be used to indicate the presence of electromagnetic or RF energy.

Non-ionizing radiation and ionizing Radiation

Ionization is a process by which electrons are stripped from atoms and molecules. This process can produce molecular changes that can lead to damage in biological tissue, including effects on DNA, the genetic material. This process requires that live tissue interact with electromagnetic energy of very high frequency. Those types of electromagnetic radiation with enough energy to cause ionization in biological material include X-radiation and gamma radiation. Therefore, X-rays and gamma rays are examples of ionizing radiation. Other types of ionizing radiation include particles such as alpha, beta, and neutrons.

The energy levels associated with RF and microwave radiation, on the other hand, are not great enough to cause the ionization of atoms and molecules, and RF energy is, therefore, a type of non-ionizing radiation. Other types of non-ionizing radiation include visible light, infrared radiation, and other forms of electromagnetic radiation with relatively low frequencies. While RF radiation is not capable of causing ionization, it can still produce damage to living tissues by depositing large amounts of energy in it. An example of RF damage is sunburn caused by exposure to the ultraviolet and infrared rays of the Sun. Often the term radiation is used to apply to ionizing radiation such as that associated with nuclear power plants. Ionizing radiation should not be confused with the lower-energy, non-ionizing radiation with respect to possible biological effects, since the mechanisms of action are quite different.

Uses of RF energy

Probably the most important use for RF energy is in providing telecommunications services such as the following:

- Radio and television broadcasting
- Cellular telephones
- Personal communications services (PCS)
- Pagers
- Cordless telephones
- Radio communications for police and fire departments
- Amateur radio
- Microwave point-to-point links
- Satellite communications

Microwave ovens are a good example of a non-communication use of RF energy. RF radiation, especially at microwave frequencies, can transfer energy to water molecules. Other important non-communication uses of RF energy are for radar and for industrial heating and sealing. Radar is a valuable tool used in many applications from traffic enforcement to air traffic control and military applications.

Radiofrequency (RF) Radiation, Continued

Biological hazards

Biological effects can result from animal or human exposure to RF energy. Biological effects that result from heating of tissue by RF energy are often referred to as thermal effects. It has been known for many years that exposure to very high levels of RF radiation can be harmful due to the ability of RF energy to heat biological tissue rapidly. This is the principle by which microwave ovens cook food. Exposure to very high RF intensities can result in heating of biological tissue and an increase in body temperature. Tissue damage in humans could occur during exposure to high RF levels because of the body's inability to cope with or dissipate the excessive heat that could be generated.

Controls

Various organizations and countries have developed exposure standards for RF energy. These standards recommend safe levels of exposure for both the general public and for workers. In the United States, the Federal Communications Commission (FCC) has adopted and used recognized safety guidelines for evaluating RF environmental exposure since 1985. Federal health and safety agencies, such as the EPA, NIOSH, and OSHA have also been involved in monitoring and investigating issues related to RF exposure.

DLA activities will follow DoDI 6055.11, Protection of DoD Personnel from Exposure to Radiofrequency Radiation and Military Exempt Lasers, and standards and procedures of the DoD component installation in protecting DLA personnel from hazards of RF radiation.

DoDI 6055.11 states that it is DoD policy to accomplish the following:

- Identify, and control by engineering design, protective equipment, administrative actions, or a combination thereof, hazardous RF EMF and other dangers associated with DoD electronic equipment.
- Limit personnel RF exposure to levels that are within permissible exposure limits (PELs).
- Define and control areas in which RF exposure to personnel could exceed the PEL.
- Ensure personnel are aware of potential RF exposures in their workplace and duty assignments, and the control measures imposed to limit their RF exposures.
- Investigate and document RF overexposure incidents.

Ionizing Radiation

Definition: ionizing radiation

Ionizing radiation exists in several forms: alpha particles, beta particles, neutron particles, gamma radiation, and X-radiation. Many ionizing radiation sources possess sufficient energy to produce damage to living cells. Radiation exposure may lead to diseases such as leukemia and other forms of cancer, and genetic defects in offspring.

Hazards

Ionizing radiation can cause changes in the chemical balance of cells. Some of those changes can result in cancer. In addition, by damaging the genetic material (DNA) contained in all cells of the body, ionizing radiation can cause harmful genetic mutations that can be passed on to future generations. Exposure to large amounts of radiation, a rare occurrence, can cause sickness in a few hours or days and death within 60 days of exposure. In extreme cases, it can cause death within a few hours of exposure.

Sources of exposure

The ionizing radiations of primary concern are alpha and beta particles, gamma rays, and X rays. Alpha and beta particles and gamma rays can come from natural sources or can be technologically produced. Most of the x-ray exposure people receive is technologically produced. Natural radiation comes from cosmic rays, naturally occurring radioactive elements found in the earth's crust (uranium, thorium, etc.), and radioactive decay products such as radon and its subsequent decay products. The latter group represents the majority of the radiation exposure of the general public.

In addition to these natural sources, radiation can come from such wide-ranging sources as hospitals, research institutions, nuclear reactors and their support facilities, certain manufacturing processes, and Federal facilities involved in nuclear weapons production.

Routes of exposure

Any release of radioactive material is a potential source of radiation exposure. In addition to exposure from external sources, radiation exposure can occur internally by ingesting, inhaling, injecting, or absorbing radioactive materials. Both external and internal sources may irradiate the whole body or a portion of the body. The amount of radiation exposure is usually expressed in a unit called millirem (mrem).

Controls

Each DLA organization that conducts operations or has employees in operations involving occupational exposure to ionizing radiation shall establish and maintain a comprehensive and effective written Ionizing Radiation Program that complies with DoD Instruction 6055.8, Occupational Radiation Protection Program.

DLA Occupational Radiation Program (ORP Program)

Introduction

DLA's ORP Program is designed to protect personnel who have occupational exposures to the hazards associated with ionizing radiation. If you have any questions concerning radiation or the ORP Program, contact your supporting Radiation Protection Officer (RPO).

Ionizing radiation protection policy

The ionizing radiation protection policy is to reduce occupational exposures to radiation within DLA operations to a level as low as reasonably achievable (ALARA):

- All exposures to radiation shall be kept ALARA consistent with operational requirements and technical and economic feasibility. Individual and collective exposures are considered.
- Do not adopt a practice or conduct an operation involving potential exposure to radiation without determining whether the use of radiation will produce a positive net benefit.
- Personnel dosimetry is required if there is a likelihood of exceeding 10 percent of the occupational exposure guides in DLAR 1000.28, paragraph 7a(1).
- Pregnant women are offered reassignment, during pregnancy, from specific tasks that are likely to result in a total dose to the unborn child of 0.5 rem or more.
- Field activities will obtain a Nuclear Regulatory Commission (NRC) license, if required, prior to procuring or using radioactive material within DLA in accordance with DLAR 4145.23.

Field activity SHM Occupational Radiation Protection Program

The field activity SHM administers the local ORP Program. An adequately trained and qualified RPO, who normally is a member of the Safety and Health Office staff, is designated at each PLFA. The RPO supervises the PLFA ORP Program. PLFAs without potential occupational radiation exposures are exempted from the ORP Program requirements.

RPO duties

Specific duties of the RPO include:

- Reviewing DLAR 1000.28, paragraph 5e(4), to determine if there is a need to designate a Radiation Control Committee and ensuring establishment of the Committee, if required.
- Ensuring all applicable ORP Program elements shown in the DLA Guidance are accomplished and providing advice on the degree of hazard associated with radiation sources used at the activity the effectiveness of measures used to control the hazards presented by these sources.
- Reviewing radiological operations and SOPs to determine compliance with all applicable regulations during all receiving, storing, and shipping operations.
- Assuring that radiation instruments are calibrated and are available to workers.
- Investigating radiation incidents.

Confined Spaces

Introduction

Many workplaces contain spaces that are "confined" because their configurations hinder the activities of any employees who must enter into, work in, and exit from them. In many instances, employees who work in confined spaces also face increased risk of exposure to serious physical injury from hazards such as entrapment, engulfment, and hazardous atmospheric conditions. Confinement itself may pose entrapment hazards, and work in confined spaces may keep employees closer to hazards, such as an asphyxiating atmosphere, than they would be otherwise. For example, confinement, limited access, and restricted airflow can result in hazardous conditions that would not arise in an open workplace.

OSHA rule 29 CFR Part 1910.146, Permit-Required Confined Spaces, protects all employees who must enter confined spaces as part of their job

Definition: confined space

A confined space

- has limited or restricted means of entry or exit
- is large enough for an employee to enter and perform assigned work, and
- is not designed for continuous occupancy by the employee.

These spaces may include, but are not limited to, underground vaults, tanks, storage bins, pits and diked areas, vessels, and silos.

Definition: permit-required confined space

Under 29 CFR 1910.146, the term permit-required confined space, i.e., permit space, refers to those spaces that meet the definition of a confined space and pose health or safety hazards, thereby requiring a permit for entry.

A permit-required confined space is one that meets the definition of a confined space and has one or more of these characteristics:

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

Confined Space Hazards

Hazard elements

Hazards specific to a confined space are dictated by the

- material stored or used in the confined space
- activity carried out, or
- external environment.

The most hazardous kind of confined space is the type that combines limited access and mechanical devices.

General physical hazards

In addition to the above, an evaluation of a confined space should consider the following potential hazards:

- Temperature extremes: Extremely hot or cold temperatures can present problems for you.

- Engulfment hazards: Loose, granular material stored in bins and hoppers, such as grain, sand, coal, or similar material, can engulf and suffocate you. The loose material can crust or bridge over in a bin and break loose under your weight.

- Noise: Noise within a confined space can be amplified because of the design and acoustic properties of the space. Excessive noise not only can damage hearing, but also can affect communication, such as causing a shouted warning to go unheard.

- Slick/wet surfaces: Slips and falls can occur on a wet surface causing injury or death to workers. Also, a wet surface will increase the likelihood for and effect of electric shock in areas where electrical circuits, equipment, and tools are used.

- Falling objects: When in a confined space, you should be mindful of the possibility of falling objects, particularly in spaces which have topside openings for entry, and where work is being done above you.

Confined Space Safety Guidelines

Safety guidelines

Follow these guidelines for confined spaces.

Employers must evaluate the workplace to determine if spaces are permit-required confined spaces.

IF . . .	**THEN** the employer must . . .
there are permit spaces in the workplace	inform exposed employees of the existence, location, and danger posed by the spaces. This can be accomplished by posting danger signs or by another equally effective means.
employees are not to enter and work in permit spaces	take effective measures to prevent their employees from entering the permit spaces.
employees are to enter permit spaces	develop a written permit space program, which shall be made available to employees or their representatives.

Permit-Required Confined Spaces Program

Written permit space program

According to 29 CFR 1910.146, the employer who allows employee entry must develop and implement a written program for permit-required confined spaces.

The OSHA standard requires the employer's program to accomplish the following:

- Identify and evaluate permit space hazards before allowing employee entry.
- Test conditions in the permit space before entry operations and monitor the space during entry.
- Perform in the following sequence, appropriate testing for atmospheric hazards: oxygen, combustible gases or vapors, and toxic gases or vapors.
- Implement necessary measures to prevent unauthorized entry.
- Establish and implement the means, procedures and practices—such as specifying acceptable entry conditions; isolating the permit space; providing barriers; verifying acceptable entry conditions; purging, making inert, flushing, or ventilating the permit space—to eliminate or control hazards as necessary for safe permit-space entry operations.
- Identify employee job duties.
- Provide, maintain, and require, at no cost to the employee, the use of personal protective equipment and any other equipment necessary for safe entry (e.g., testing, monitoring, ventilating, communications, and lighting equipment; barriers, shields, and ladders).
- Ensure that at least one attendant is stationed outside the permit space for the duration of entry operations.
- Coordinate entry operations when employees of more than one employer are to be working in the permit space.
- Implement appropriate procedures for summoning rescue and emergency services.
- Establish, in writing, and implement a system for the preparation, issuance, use, and cancellation of entry permits.
- Review established entry operations and annually revise the permit-space entry program.
- When an attendant is required to monitor multiple spaces, implement the procedures to be followed during an emergency in one or more of the permit spaces being monitored.

Permit-Required Confined Spaces Program, Continued

Permit system

A permit, signed by the entry supervisor and verifying that pre-entry preparations have been completed and that the space is safe to enter, must be posted at entrances or otherwise made available to entrants before they enter a permit space.

The duration of entry permits must not exceed the time required to complete an assignment. Also, the entry supervisor must terminate entry and cancel permits when an assignment has been completed or when new conditions exist. New conditions must be noted on the canceled permit and used in revising the permit space program. The standard also requires the employer to keep all canceled entry permits for at least 1 year.

Training

Before initial work assignment begins, the employer must provide proper training for all workers who are required to work in permit spaces. Upon completing this training, employers must ensure that employees have acquired the understanding, knowledge, and skills necessary for the safe performance of their duties.

Additional training

Additional training is required when

- the job duties change
- there is a change in the permit-space program or the permit space operation presents a new hazard, and
- an employee's job performance shows deficiencies.

Certification

Employers must certify that training has been accomplished. Upon completion of training, employees must receive a certificate of training that includes the employee's name, signature or initials of trainer(s), and dates of training. Employees and their authorized representatives must make the certification available for inspection.

Ergonomics

Introduction

Although ergonomics is a relatively new science to most of us, it dates back to 1949. It was first used by the automotive industry in the early 1970s to design car interiors to be more functional and easier to use. Referred to as human engineering, ergonomics is concerned with helping people interact more comfortably and efficiently with their environment. While it is most often associated with the workplace these days, ergonomics can be applied elsewhere.

Yesterday vs. today

In the early 1980s, ergonomic principles were applied to the workplace when companies realized that designing workstations to fit people improved employee well-being, efficiency, and safety. Today, implementing ergonomics in the workplace is recognized as one of the best ways to minimize on-the-job stress and strain, and prevent work-related musculoskeletal disorders (WMSDs).

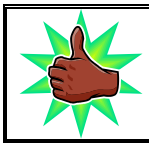
Why should I be concerned about ergonomics?

Preventing WMSDs not only protects the workforce, but it also makes good business sense. The production-related costs of an injured worker are at least 8 to 10 times more than their medical costs. Injured employees force units to deal with decreased output, replacement costs, retraining, increased errors, and an increased demand on the rest of the workforce.

Ergonomic program

Implementing and maintaining an effective ergonomics program at your facility means working smarter and safer. Facilities that have implemented successful programs have seen measurable results in terms of protecting the workforce, increasing productivity and quality, decreasing workers' compensation expenditures, increasing readiness, and reducing absenteeism and employee turnover.

As a supervisor, you do not have the technical expertise to control all ergonomic hazards. You should be able to understand what ergonomics is, recognize the risk factors, and know when to call in the experts. This section covers key concepts, risk factors, and the DLA Ergonomic Program.



A workplace at the wrong height will make a body sore and tight. Save your back from excess stress. Use the proper chair and desk.

Key Concepts

What is ergonomics?

Ergonomics is essentially fitting the workplace to the worker. It involves the application of knowledge about human capacities and limitations to the design of workplaces, jobs, tasks, tools, equipment, and the environment. In other words, adapting the job to fit the person, rather than forcing the person to fit the job.

The goal of ergonomics

The goal of ergonomics in the workplace is to achieve the following:

- Prevent WMSDs by reducing or eliminating exposure to occupational hazards.
- Reduce the potential for fatigue, error, or unsafe acts.
- Increase effective, efficient work.
- Design tasks, workstations, controls, displays, safety devices, tools, lighting, and equipment to fit the worker's physical capabilities and limitations.

What are WMSDs?

When there is a mismatch between the physical requirements of the job and the physical capacity of the worker, WMSDs can result. Many occupational injuries and illnesses can be attributed to poorly designed job tasks or equipment that lacked application of proper ergonomic principles in their design.

These ergonomic-related illnesses are commonly referred to as Work-Related Musculoskeletal Disorders. To understand WMSDs, consider the facts below.

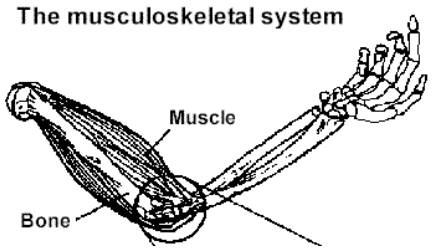


Photo provided by: WISHA, Dept of Labor and Industry

- Musculoskeletal disorders are disorders of the musculoskeletal system. That means that they are related to the muscles, nerves, tendons, ligaments, cartilage, and joints of the body.
- Typically, musculoskeletal disorders are not sudden injuries, but illnesses that develop gradually over time. This process can take weeks, months, or even years.
- Musculoskeletal disorders are commonly a result of repeated mechanical stresses on the body.
- Musculoskeletal disorders can result in losses of mobility and strength.
- "Work-related" means that the person's occupation played a role in development of the condition or made a preexisting condition worse.

Key Concepts, Continued

WMSDs definition

We can summarize the facts above into a definition of WMSDs: Disorders of the musculoskeletal system that have developed gradually over time, and which can be attributed, either completely or in part, to a person's occupation and related workplace conditions.

Common WMSDs

Keep in mind, WMSDs are not diagnoses; they are work-related disorders with similar characteristics. Common WMSDs include the following:

- Carpal tunnel syndrome
- Low back pain
- Tendonitis
- Tenosynovitis
- De Quervain's disease
- Trigger finger
- Lateral epicondylitis (tennis elbow)
- Medial epicondylitis (golfer's elbow)

Descriptions of each of the above conditions are listed below.

Descriptions of WMSDs

Carpal Tunnel Syndrome is a disorder involving the median nerve at the wrist joint. The disorder in the hand causes pain and loss of feeling, especially in the thumb and first three fingers. It is common among people using computers and word processors.

Low Back Pain is a condition caused by repeated bending, lifting, and twisting of the lower back, as well as sitting for long periods, standing on hard surfaces, or experiencing vibration over a long period of time, all of which result in cumulative microtrauma.

An aggravating event, even one that may seem minor, such as a slip, trip, fall, or awkward lift often causes an acute episode to occur. The episode occurs because a cumulative trauma reduces the tissues' ability to handle the physiologic stress of the aggravating event.

Tendonitis is a form of tendon inflammation that occurs when a muscle or tendon is repeatedly tensed from overuse or unaccustomed usage of the wrist and shoulder. Tendonitis is common among power press operators, welders, painters, and assembly line workers in the automobile, appliance, and electronic production industries.

Tenosynovitis is an irritation (inflammation) of the tendon and the lining of the smooth sheath surrounding the tendon, resulting from repeated movement of the tendon in the sheath.

De Quervain's Disease involves inflammation of the tendon sheath of the thumb. De Quervain's disease is attributed to excessive friction between two thumb tendons and their common sheath. Twisting and forceful gripping motions with the hands similar to a cloth-wringing movement, can place sufficient stress on the tendons to cause De Quervain's disease. Butchers, packers, housekeepers, seamstresses, and cutters frequently perform tasks involving these kinds of motions.

Key Concepts, Continued

Descriptions of WMSDs, continued

Trigger Finger, another tendon disorder, is attributed to the creation of a groove in the flexing tendon of the finger. If the tendon becomes locked in the sheath, attempts to move that finger will cause snapping and jerking movements. The palm side of the fingers is the usual site for trigger finger. This disorder is often associated with using tools having handles with hard or sharp edges.

Lateral epicondylitis (tennis elbow) is an irritation (inflammation) of the tendons attached on the outside of the elbow caused by activities that have jerky throwing motions or impact, e.g., turning a screw driver.

Medial epicondylitis (golfer's elbow) is an irritation (inflammation) of the tendon attachments on the inside of the elbow resulting from activities that require repeated or forceful rotation of the forearm and bending of the wrist at the same time.

Causes of WMSDs

WMSDs result from the cumulative effect of repeated traumas or microtraumas associated with specific workplace risk factors. Microtraumas are small, limited area tissue damage or tears. Cumulative trauma occurs when rest or overnight sleep fails to completely heal the microtrauma and residual trauma carries over to the next day, adding to the total system trauma. Prolonged exposure to the associated workplace ergonomic risk factors can eventually lead to permanent damage and disability.

Ergonomic Risk Factors

Introduction

Ergonomic risk factors are conditions that elevate the likelihood of WMSD development. There are several different factors that affect the human body, but not all factors affect the different parts of the body in the same fashion or to the same degree. It is also important to remember that although a risk factor may increase the chances of developing a WMSD, it does not necessarily mean that a WMSD will develop.

Factors contributing to WMSDs

Two types of factors contribute to WMSDs hazards:

- **Environmental hazards** are associated with stress resulting from demands on the body that exceed worker strength and endurance. Environmental hazards include heavy lifting, constant twisting, and repeated motions.

- **Biological hazards** are the physical characteristics of the worker that vary from human to human, including size, endurance, range of motion, strength, and other factors. When the job demand (or environmental hazard) exceeds the physical characteristics of the worker, an injury results.

Task-related ergonomic risk factors

Task-related, workplace risk factors or hazards that contribute to WMSDs include the following:

- Posture
- Repetition
- Force
- Mechanical compression
- Duration
- Vibration
- Temperature

Posture

Awkward postures require increased muscle force; contribute to muscle fatigue, tendon fatigue, and joint soreness; and increase forces on the spine.

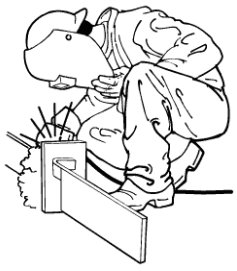


Photo provided by: WISHA, Dept of Labor and Industry

Repetition

Repeated motions or tasks increase fatigue and muscle-tendon strain. Highly repetitive tasks often prevent adequate tissue recovery time from the effects of awkward postures and force. The level of risk varies by body part.

Ergonomic Risk Factors, Continued

Force

Forceful exertions increase the physiologic stress to muscles, tendons, and joints. Muscles fatigue faster as the force exerted increases. The following factors can increase the force needed to perform a task:

- Object weight
- Load distribution characteristics (Shifting or bulky loads require more force exertion.)
- Object friction (Slippery objects require more force.)
- Awkward postures
- Vibration (Localized hand tool vibration increases grip forces.)
- Type of grip (A pinch grip places three to four times more force on tendons than power grip.)

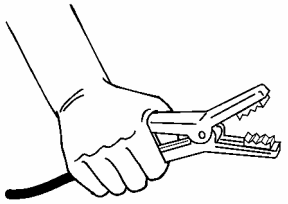


Photo provided by: WISHA, Dept of Labor and Industry

Mechanical compression or contact stress

Mechanical compression creates pressure over a small area and interferes with blood flow and nerve function. This compression can be caused by hard or sharp objects, the sharp edge of the desk, and small diameter handles.

Duration

Duration is the amount of time the worker is exposed to the risk factor. Prolonged exposure increases local and generalized fatigue and tissue stress. As the duration of exposure increases, the required recovery period increases proportionally.

Vibration

Localized vibration occurs when a part of the body contacts a vibrating object, e.g., pneumatic, electric, or impact hand tools.

Temperature

Prolonged contact between the bare hand and metal surfaces below 59 °F (15 °C) may impair dexterity, and contact with metal surfaces below 44.6 °F (7 °C) may induce numbness. Cold temperatures also decrease circulation and reduce tissues' ability to recover from physiologic stress. The time it takes to heal or recover from an injury is increased as well.

Preventing WMSDs

Engineering Controls

The best solution to ergonomic problems are those in which safe and healthful working conditions are a natural result of the job design and are independent of specific worker capabilities or work techniques. Therefore, Engineering Controls seek to improve the fit between the job and the person, i.e., to enhance the design of tools, equipment, workstations, and work methods to reduce job demands, and eliminate sources of ergonomic stress.

Engineering Controls can include changing or redesigning

- workstations
- tools
- facilities
- equipment
- materials, or
- processes.

Administrative Controls

Although Engineering Controls are always the preferred method of eliminating or reducing ergonomic hazards, there are situations when their use may be impeded by technical or cost constraints. In these cases, Administrative Controls may be used as a temporary measure to reduce WMSD risks. Administrative Controls are practices and policies that are set forth by management to reduce or prevent exposure to ergonomic risk factors. They generally attempt to reduce the effects of a known, unavoidable ergonomic risk by reducing the duration, frequency, magnitude, and severity of exposures.

Examples of Administrative Controls include the following:

- Reducing shift length and overtime
- Using job rotation schemes so that each worker performs several different tasks per day
- Adjusting the work pace to relieve repetitive motion risks
- Providing the worker with more control over the work process
- Scheduling more breaks
- Conducting morning stretching sessions
- Slowing the pace of work
- Increasing the number of employees assigned to a task
- Training the workforce to increase awareness of ergonomic risk factors
- Adding tasks to a worker's job requirements that use different muscle groups

Tips for Preventing WMSDs

Tips when using tools

Here are a few tips when using tools that will help to eliminate or reduce the occurrences of WMSDs:

- Use power tools if possible; they help minimize repetitive motion and excessive force.
- Wear gloves with power tools or choose tools with vibration dampening grips.
- Use tools with soft-cover grips. They reduce pressure points, protect hands from heat and cold, reduce vibration, and improve the grip.
- Select tools with properly designed handles to keep your wrist in a neutral position.
- Use a power grip by gripping the tool with your entire hand, allowing the thumb and index finger to overlap slightly.
- Put the item you are working on in a vise to minimize unnecessary grasping force.
- Know when to wear gloves and when not to. Gloves must fit properly and not be too large or thick. Gloves fitting too tightly may restrict circulation.

Standing

Standing for prolonged periods can cause back, neck, and knee strain. Here are a few suggestions:

- Place one foot on a low stool or like object.
- Change standing positions frequently.
- Wear comfortable shoes.

Sitting

Even sitting most of the day may cause problems with your back, neck, and shoulders. You can take the following measures to help relieve strain:

- Select a sturdy chair with a firm, padded back that adjusts vertically and horizontally.
- Use a swivel chair to avoid reaching.
- Adjust the chair height so that when seated with feet flat on the floor, your knees are as high as your hips.
- Sit close to your desk to avoid slouching while working.
- Use a headset to prevent neck strain if answering the phone is part of your job.
- Use a lumbar cushion or rolled towel if your chair does not support your lower back.

Tips for Preventing WMSDs, Continued

Computer operators

If your job requires you to sit at a computer terminal, even if it is only for a few hours of the day, there are ways you can minimize stress on the body.

- Make sure the computer monitor is eye level to prevent head and neck strain.
- Make sure the keyboard is placed elbow height and at a slight incline in order to keep your wrists relaxed.
- Use a hard copy holder to avoid eye and neck strain.
- Use a cushioned wrist pad to reduce wrist strain and pressure.
- Have a diffuser installed on light fixtures to reduce glare on your computer screen. You can also use a glare shield on your monitor, close nearby window blinds, or move your workstation away from direct sunlight.

DLA Ergonomic Program

Program overview

The Program requires each field activity to establish and maintain an ergonomics program. An effective program can

- prevent workplace injuries
- reduce costs associated with WMSDs
- protect the workforce through early detection and prevention, and
- improve productivity.

Responsibilities

Supervisors will

- observe work practices of employees
- routinely review work area, tasks, and equipment for risk factors
- support the program
- maintain effective schedules for facility, equipment, and tools
- hold personnel accountable for following safe work practices
- report to the safety office all symptoms of WMSDs or WMSD risk factors, and
- consult with the local Safety and Health office for additional information and support.

Employees will

- modify work practices, as recommended
- report any risk factors to the supervisor
- recognize and report symptoms early
- perform recommended conditioning activities, and
- routinely review work area, tasks, and tools for risk factors.

Employee representatives shall

- serve as members of the ergonomics committee, and
- encourage personnel to recognize and report WMSDs.

Program written plan

Each DLA FA has a written ergonomics plan. The plan focuses on the identification and control of improper workplace and work-process design to protect personnel from injury and illness due to exposure to occupational risk factors. The field activity Ergonomics Officer (EO) and the ergonomics committee develop the written plan based on the individual activities within the field activity. Critical program elements addressed in the plan include the following:

- Worksite analysis
- Hazard prevention and control
- Health care management
- Education and training
- Program evaluation

DLA Ergonomic Program, Continued

Worksite analysis

Surveillance of worksites may take one of two forms—active or passive.

Active surveillance involves efforts to gather information about WMSD hazards at work sites and to identify workers at risk of developing a cumulative trauma disorder—WMSD. Trained ergonomics personnel will perform active surveillance.

Passive surveillance consists of analyses of data provided by monthly reports, mishap reports, Federal Employees Compensation Act (FECA) claims, medical reports, workforce reports, and suggestions.

Hazard prevention and control

The primary method of preventing and controlling exposure to WMSD hazards is through effective design of a job or worksite. Intervention methods, in order of priority, include the following:

- Process elimination
- Engineering controls
- Substitution
- Work practices
- Administrative controls
- PPE

Education and training

Supervisors and ADSMs who provide assistance in recognizing WMSDs will receive basic ergonomics training. This training should include the following:

- Risks of WMSDs
- Possible causes and symptoms
- Recognizing symptoms and reporting WMSDs
- Means of prevention
- Sources of treatment

Personnel who are potentially exposed to WMSD hazards will receive formal instruction on hazards associated with their jobs and equipment. Personnel will receive training at their initial job orientation, and annually thereafter, until the hazard is eliminated.

Bloodborne Pathogens

Introduction

29 CFR Part 1910.1030 regulates bloodborne pathogens (BBPs). The regulation applies to those individuals who have occupational exposure to bloodborne pathogens, such as doctors, nurses, paramedics, and first responders. This section provides general awareness information including

- what bloodborne pathogens are
- how they are transmitted
- how you can protect yourself, and
- a brief description of CFR Part 1910.1030.

Key Concepts

What are bloodborne pathogens?

Bloodborne pathogens are microorganisms such as viruses or bacteria that are carried in blood and cause disease in people.

Types of BBP

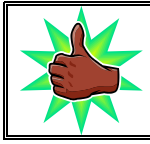
The most common types of bloodborne pathogens are:

- Hepatitis B Virus (HBV)
- Hepatitis C Virus (HCV)
- Human Immunodeficiency Virus (HIV)

How are they transmitted?

Bloodborne pathogens are transmitted through contact with infected human blood and other body fluids such as the following:

- Fluid around the brain and spinal cord (derebrospinal)
- Fluid from around the joints (synovial)
- Fluid from the lungs (pleural)
- Fluid around the heart (pericardial)
- Fluid from the abdomen (peritoneal)
- Vomit
- Urine
- Saliva
- Semen and vaginal secretions
- Any fluid you cannot identify



Protect the hands that feed you.

Key Concepts, Continued

How can I be exposed?

Unbroken skin forms a barrier, but, infected blood can enter your system through

- eyes
- nose
- mouth
- open sores
- cuts
- abrasions, and
- any broken skin.

Universal precautions

There is no way to determine if someone is infected without medical tests. Universal precautions include:

- Treat all human blood and fluids as dangerous and capable of spreading infection.
- Always wear Personal Protective Equipment (PPE), i.e., gloves, mask, goggles.
- Do not approach anyone or anything contaminated with blood or bodily fluids.

Leave emergency response to the professionals. Trained personnel should treat even first aid injuries. Do not attempt to clean up spills without the proper training and equipment.

Bloodborne Pathogen Hazards

Where do I find bloodborne pathogen hazards?

Bloodborne pathogens may exist anywhere there is blood or body fluids. Contact may be

- Direct—person to person, or
- Indirect—person to object to person.

The most common direct contact involves an injury. An employee is injured and you instinctively want to render assistance. Without the proper PPE, you could expose yourself to infection. Seek trained medical attention for the employee.

Indirect contact generally occurs in locations where employees may try to administer their own first aid (restrooms) and operations such as maintenance facilities. An employee injures himself or herself, cleans the wound in the restroom, but does not properly disinfect the faucets. The next employee to use the faucet could expose himself or herself to possible infection.

Regulatory Requirements

Introduction

OSHA's rule, Occupational Exposure to Bloodborne Pathogens (29 CFR 1910.1030), outlines specific employer responsibilities for industrial workers, including training. OSHA's rule is designed to provide a set of practices to follow when rendering first aid or cleaning up after an injury. The goal is to protect the worker against infections caused by bloodborne pathogens. In the past, you could come to the rescue of a coworker without giving much thought to your own safety. Today, you need to know how to protect yourself from diseases like HBV and HIV which causes AIDS.

Who is covered?

The bloodborne pathogens rule covers employees who, as a result of doing their job, could come in contact with blood or other potentially infectious material through the eyes, skin, mucous membrane, or under the skin by means of a needle stick, cut, or human bite. In addition, it covers those people who are trained in CPR and first aid.

Employer obligations

The employer obligations include:

- Development of an Exposure Control Plan (ECP)
- Implementation of engineering and work practice controls
- Enforcement of PPE use
- Offering a Hepatitis B vaccine and exposure evaluation and follow-up
- Implementation of the use of signs and labels to warn of potential hazards
- Providing training

Exposure control plan

DLA activities will develop a written plan identifying tasks and procedures, as well as job classifications where occupational exposure to blood occurs. The plan will also specify the procedure for evaluating circumstances surrounding exposure incidents. The plan must be accessible to employees and available to OSHA. Activities must review and update the plan at least annually.

Training

The training requirements are quite specific. Under Part 1910.1030(g)(2), all employees with occupational exposure to bloodborne pathogens, Hepatitis B, or other potentially infectious materials must be trained, at no cost to the employee, during working hours.