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Course Materials 

PERSONAL PROTECTION

AND LIFE SAVING EQUIPMENT IN CONSTRUCTION



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Personal Protective and Life Saving Equipment

In this Personal Protective Equipment Course, we'll cover.

- PPE and Life-Saving Devices including,
- Head Protection,
- Face and Eye Protection,
- Respiratory Protection,
- Hand Protection,
- Foot Protection,
- PPE for Working Over Water.
- Fall Protection, and
- Hearing Protection

Introduction to Personal Protective Equipment and Life Saving Devices

Numerous construction workers, such as you and I, face the daily risk of severe injuries while working on construction sites. Surprisingly, a significant number of these injuries can be attributed to the absence or improper use of personal protective equipment (PPE). However, ensuring that we wear the appropriate PPE is one of the easiest aspects of our job.

Most of us have been fortunate to experience few, if any, minor accidents, or mishaps, largely thanks to the PPE we utilize. PPE encompasses any gear or attire designed to safeguard us from potential harm. Examples include hard hats, gloves, safety boots, and protective eyewear. Nevertheless, for PPE to be effective, it must be specifically suited to the nature of our tasks, and regular maintenance is imperative.

PPE can range from basic items such as hard hats, high-visibility vests, safety glasses, to a simple pair of gloves. However, it is crucial that the PPE we choose aligns with the demands of the job, and it must be used and cared for appropriately. To maintain workplace safety, OSHA has established a set of standards for personal protective equipment, mandating that employers furnish suitable PPE to all employees and provide them with proper training in its use.

In addition to being trained on specific PPE, this training should include general training such as:

- Why do we need PPE?
- How does it work?
- How do workers use the PPE they'll be wearing?
- How do you put it on?
- How do you take it off?
- How do you adjust it?
- And how will it be maintained?
- What's my PPE's useful life?



Personal Protective and Life Saving Equipment

- And what about its disposal?

Today, our aim is to provide you with a comprehensive understanding of safety standards, your employer's responsibilities, your obligations in adhering to OSHA standards, and the crucial reasons behind wearing specific PPE.

While each type of Personal Protective Equipment (PPE) comes with its unique features and capabilities, certain standards are applicable to all PPE. Firstly, it is imperative to use PPE whenever you encounter hazardous conditions. These conditions may encompass risky tasks like electrical work, masonry, and trenching.

Additionally, consider the possibility of encountering radiological hazards, although they are relatively infrequent on construction sites but can be found on extensive healthcare and pharmaceutical projects. Mechanical irritants can pose a hazard in such scenarios. Mechanical irritants refer to objects that have the potential to puncture or cut your skin. Whenever any of these conditions are present, your employer is responsible for furnishing you with appropriate PPE that is tailored to your specific work conditions, well-maintained, and kept in a sanitary state.

In certain instances, you may prefer to use your own personal protective equipment instead of the PPE provided by your employer. Nonetheless, regardless of ownership, it is your employer's ultimate responsibility to ensure the suitability and proper maintenance of the equipment in use.

HEAD PROTECTION

Employees are required to wear hard hats when they are working in areas where there is a potential risk of head injury due to factors such as impacts, falling or flying objects, or exposure to electricity.

Hard hats serve as crucial protection against hazards like falling or airborne objects, chemical splashes, molten metal, and potential struck-by incidents from falling objects on the worksite. It's essential to note that hard hats come in various sizes and feature adjustable suspension systems to ensure a proper fit. An ill-fitting hard hat cannot provide the necessary protection.

In situations where you work near exposed electrical wires, your hard hat should be constructed from materials that can shield you from electrical shock hazards. Regardless of their design, all hard hats must adhere to OSHA regulations and comply with ANSI Z89.1 standards. These standards require industrial hard hats to absorb impact, insulate against electric shocks, resist water, and slow burning. They should also provide protection to the scalp, face, neck, and shoulders, which is achieved through rigorous testing.

Despite the safety measures established by these standards, there have been instances of traumatic brain injuries, particularly in the construction industry, where fatalities occurred between 2003 and



Personal Protective and Life Saving Equipment

2010. Surprisingly, a survey by the Bureau of Labor Statistics revealed that 84 percent of workers who sustained head injuries were not wearing head protection.

To address this negligence and enhance safety, ANSI ISEA Z89.1-2014 offers user recommendations for added protection when wearing a hard hat, including scenarios like reverse wearing of helmets, which necessitate proper testing and marking.

OSHA regulations 29 CFR 1910.135(b)(1) and 29 CFR 1926.100(b)(1) stipulate that head protection must meet the 1997, 2003, or 2009 editions of ANSI Z89.1 or provide equivalent or superior protection. Employers are obligated to provide hard hats and ensure that employees wear them in situations where head injuries could result from impacts, falling or flying objects, or electrical shock.

This requirement applies when there's a risk of objects or debris falling from above and striking workers, when employees might collide with fixed objects like supports or equipment, and when there is a possibility of contact with electrical hazards. In all cases, hard hats must meet OSHA head protection requirements, which encompass different types and classes of hard hats designed for specific hazardous conditions. These hard hats must meet specific design and performance standards for impact, penetration, and electrical shock protection, with testing to ensure compliance with OSHA regulations.

While manufacturers typically test and certify their products, it is the responsibility of employers to verify that the hard hats used by their employees meet OSHA requirements. In cases where low head clearances are a concern, and protection is needed against scrapes, cuts, and light impacts, an alternative type of protective headgear known as a bump cap can be used. However, it's important to emphasize that bump caps should never be substituted for hard hats in hazardous conditions that require the latter's level of protection.

FACE AND EYE PROTECTION

Due to the vulnerability of your face and eyes, a variety of personal protective equipment (PPE) options are available for their protection. Among these, safety glasses are the most used. These glasses feature impact-resistant lenses that safeguard your eyes from potential frontal impacts and airborne particles.

When equipped with side shields, safety glasses also offer protection against side impacts. In today's market, many safety glasses come with built-in side shields, and if needed, detachable, clip-on, or slide-on side shields can be used if they meet OSHA standards.

Eye and face protection is essential to guard against physical, chemical, or radiation hazards. It's crucial that this protection is reasonably comfortable, fits securely, and does not excessively restrict the movement of employees.



Personal Protective and Life Saving Equipment

For those working near intense light sources like lasers or welding torches, safety glasses with special optical filter lenses are necessary. These lenses are categorized by shade numbers, indicating the type of light they protect against. Protection against radiant energy, such as UV light and other hazards, necessitates filter lens shades ranging from 2 to 4 for soldering and brazing, 7 to 9 for gas welding, and 9 to 12 for arc welding. Laser light protection must align with the specific wavelength of the energy source. It is vital to use glasses with shade numbers matching the light exposure to ensure effective protection.

In scenarios involving substantial quantities of dust or potential liquid splashes, safety glasses may not provide sufficient protection, and goggles become necessary. Goggles fit securely over your eyes, providing comprehensive protection from all angles. If you require goggles while wearing prescription glasses, they must fit over your glasses without compromising their proper positioning or the goggles themselves. Custom goggles are another option for workers who wear prescription glasses, as they can incorporate your vision prescription into the goggles.

Contact lens wearers should be aware of their employer's policies, as contacts may not always be suitable for work involving dust, liquids, or particles, as these substances could become trapped under the contacts.

In situations where there is a risk of chemical splashing or significant flying particles, more extensive eye and face protection is needed, typically in the form of a full-face shield. Workers engaged in welding or tasks involving intense light and sparks are required to use a welder's helmet for their safety.

RESPIRATORY PROTECTION

Certain work environments pose airborne hazards like dust, mist, fumes, and vapors that necessitate the use of a respirator for protection.

Employers are required to establish a written plan outlining procedures for the selection and utilization of respirators. It is essential to regularly clean, disinfect, store, and inspect respirators to ensure their effectiveness.

Users of respirators must undergo adequate training on selecting, using, and maintaining them. Proper fit is crucial. Only respirators approved by MSHA or NIOSH are permissible, and the supplied air must be of high purity.

There are three main types of respirators to choose from:

Disposable masks: These are the simplest and are crafted from fibers that trap airborne contaminants, preventing hazardous particles from entering your nose and lungs. They are often used in construction environments where nuisance dust is prevalent or during cleanup tasks.



Personal Protective and Life Saving Equipment

Air-purifying respirators (APRs): APRs are available in half-face and full-face models and employ disposable cartridges to trap airborne contaminants. These cartridges filter the air and capture impurities before inhalation. Different cartridges are available to capture specific substances or groups of substances. It's vital to select cartridges designed for the substances you are working with to ensure effective protection.

Air-supplying respirators (ASRs): ASRs utilize a compressor or compressed air cylinder to provide clean breathing air. These respirators are used in highly hazardous conditions or environments lacking sufficient oxygen. Proper training is essential for ASR use.

Employers must establish standard procedures for respirator selection, use, care, and emergency response. Respirators must be routinely cleaned, disinfected, stored correctly, and inspected. Users should receive proper training in selecting, using, and maintaining respirators, ensuring they fit correctly. Only respirators approved by MSHA or NIOSH are permitted, and the supplied air must meet high purity standards.

In atmospheres with toxic or oxygen-deficient conditions, additional workers must be present, and communication between all individuals must be maintained. In environments immediately dangerous to life or health, standby workers with rescue equipment are mandatory.

When airline respirators are used in such hazardous atmospheres, individuals must be equipped with safety harnesses and lines. Respirators must undergo frequent random inspections and be maintained through a comprehensive program covering inspection, cleaning, disinfection, repair, and proper storage. Inspection records for emergency-use respirators must be maintained, and gas mask canisters should be labeled and color-coded for easy identification.

HAND PROTECTION

Let's dive into the topic of hand protection because the condition of your hands is crucial for your ability to work effectively. Ensuring proper hand protection is vital, and we'll address it now. Gloves are often a necessary component of your protective gear.

Cloth gloves are suitable for lighter tasks, such as cleaning the project site. They provide protection against minor physical hazards like dust, dirt, and abrasions.

For tasks involving sharp edges on tools and materials, **metal mesh gloves** are specifically designed to shield your hands.

Disposable latex and similar gloves offer protection against biological or health hazards, such as blood and other bodily substances.



Personal Protective and Life Saving Equipment

Rubber and plastic gloves are essential for safeguarding your hands against various chemicals, including acids and corrosives. Some of these gloves also possess shock-resistant properties, which is particularly important as electricity poses a significant risk not only to your hands but to your life. To qualify as electrical personal protective equipment (PPE), rubber gloves and accompanying sleeves must effectively insulate against both AC and DC currents.

As with all PPE, proper maintenance is crucial for safety. Regularly inspect gloves and sleeves for signs of wear and tear, both at the start of each workday and immediately following any incident that could have compromised their integrity. Never use electrical PPE that exhibits holes, tears, punctures, cuts, or embedded foreign objects.

If you discover that Type 2 ozone-checking gloves you're using are damaged, remove them from service immediately. In fact, if there is any doubt about the insulating properties of electrical PPE, err on the side of caution and discontinue their use.

Regardless of the type of protective gloves you wear, they should fit correctly. Gloves that are too loose can catch on equipment or impede your ability to handle small objects, while overly tight gloves can restrict your hand movements and circulation. If you require assistance in selecting the appropriate hand protection for your specific task, don't hesitate to consult with your supervisor.

FOOT PROTECTION

The workplace presents various hazards that can pose risks to your feet. Heavy objects like loaded pallets or tools have the potential to cause crushing injuries. Sharp objects such as nails or spikes can puncture the feet, and hot surfaces and molten metal can result in burns. Additionally, electrical shocks and sparks can be not only dangerous but sometimes catastrophic. To mitigate these risks, it's essential to understand the available types of foot and leg protection and how they function.

One of the most common forms of foot PPE is work boots equipped with steel toes, providing protection against crushing and other impacts. Some boots also feature puncture-resistant metal insoles to safeguard against sharp objects.

Boots with heat-resistant soles offer insulation against extreme temperatures, whether hot or cold. For those working around power lines or energized equipment, nonconductive boots are crucial to protect against electric shock.

Conductive footwear, on the other hand, is designed to prevent the buildup of static electricity. It should only be worn in situations involving explosive atmospheres or where spark prevention is critical.

Various other forms of foot and leg protection, such as toe guards, metal tarsal guards, foot and shin guards, and leggings, are designed to be worn over your regular shoes and legs.



Personal Protective and Life Saving Equipment

Regardless of the type of safety footwear you use, it's imperative to regularly inspect them for signs of damage like cracks, holes, tearing, broken buckles, or damaged laces. Before putting on foot protection, check the soles for any foreign objects, like pieces of metal or embedded items, which could create electrical or tripping hazards. If any issues are identified, promptly remove the footwear from service..

FALL PROTECTION

Falls constitute the primary cause of fatalities in the construction industry. Tragically, nearly every day, a construction worker loses their life due to a fall, with countless others sustaining injuries requiring hospitalization. Moreover, these numbers have been on the rise year by year.

Personal Fall Protection, also referred to as a fall arrest system, serves as the crucial PPE solution for addressing falls on construction sites.

A standard fall arrest system comprises several components, including a full-body harness, a lanyard, a lifeline, and an anchor point. Essentially, this system halts a fall by securely tethering the worker to the anchor point.

The anchor point is typically a part of a building or structure and must possess the strength and stability to support the worker's weight, absorbing the impact of a fall with a minimum load capacity of 5000 pounds. The body harness connects to the anchor point through a lifeline, a lanyard, or a combination of both.

A lanyard is a rope, wire, or strap that attaches either directly to the anchor point or to a lifeline securely fastened to the anchor point. There are two primary types of lifelines: horizontal lifelines, which stretch from one anchor point to another horizontally, and vertical lifelines, which hang down from a single anchor point.

When a fall arrest system comes into play, the full-body harness plays a critical role in injury prevention by evenly distributing the forces of the fall across the wearer's thighs, shoulders, chest, and pelvis.

Before utilizing a fall arrest system, a thorough inspection of each component is imperative to identify any signs of wear or damage. Any defective components should not be used and should be replaced promptly. Components that have been involved in arresting a fall must also be withdrawn from service until they have been inspected and deemed safe for reuse.

In instances where workplaces are situated more than 25 feet above the ground, and other safety equipment like ladders or scaffolds is not feasible, safety nets should be provided. Furthermore, for workers operating over or near water, life jackets or buoyant work vests are essential when there is a risk of drowning. These life-saving devices must be inspected for defects both before and after each use. Additionally, ring buoys should be positioned no more than 200 feet apart and made readily available



Personal Protective and Life Saving Equipment

for emergency rescue operations. A lifesaving skiff should also be on hand in areas where employees work over or near water.

HEARING PROTECTION

The use of hearing protection becomes imperative when noise levels cannot be effectively reduced through engineering or other means. Occupational hearing loss, often referred to as OHL, occurs when individuals are subjected to continuous exposure to noise levels of 85 decibels or higher or when they encounter ototoxic chemicals like solvents, asphyxiants, nitriles, and various compounds.

OHL can manifest in various forms, ranging from tinnitus to significant hearing loss, sometimes exceeding 50% or more. The damage caused by intermittent bursts of noise can accumulate over months or even years, often going unnoticed initially.

To address this issue, OSHA has established a set of requirements that employers must adhere to regarding hearing protection. Familiarizing oneself with OSHA's 29 CFR 1910.95 standard is not only essential for compliance with government regulations but also vital to ensure that employees receive the necessary protection.

There are two primary hearing risks associated with loud noise: sudden spikes in noise, such as gunshots or explosions, and extended exposure to noise levels significantly above the norm. Sudden loud noises can result in immediate hearing damage, often leaving individuals with little time to prepare unless the event is planned.

In work settings, these abrupt loud noises frequently emanate from machine presses utilized for shaping metal or other materials. Such extreme noise hazards can easily exceed 120 decibels, with proximity to the source determining the noise level. Facilities housing machines or equipment producing sudden loud noises should display signs reminding employees of the need for PPE.

Prolonged exposure to noise typically involves lower decibel levels but is equally perilous. Most manufacturing facilities have a constant background noise, making it difficult for employees to find relief. Even after a few minutes in this "normal" sound environment, most people become desensitized to the noise, barely registering it.

However, the absence of awareness does not signify the absence of harm. Individuals working in loud environments without adequate hearing protection are susceptible to permanent hearing loss, tinnitus, or other hearing-related issues that can affect them throughout their lives.

Surprisingly, prolonged noise exposure, even at lower levels, can be more hazardous compared to sudden bursts of loud noise. Consequently, facilities must identify all potential noise sources, assess the associated hazard levels, and implement safety measures to safeguard their employees.



Personal Protective and Life Saving Equipment

The extent of hearing damage resulting from noise exposure depends on the duration of exposure and the actual noise level. OSHA has established guidelines specifying the permissible duration of exposure to different sound levels without the need for hearing protection to ensure safety.

OSHA EXPOSURE LIMITS	
90 dB	Requires hearing protection if an employee is exposed for 8 or more hours.
92dB	Requires hearing protection if an employee is exposed for 6 or more hours.
95dB	Requires hearing protection if an employee is exposed for 4 or more hours.
97dB	Requires hearing protection if an employee is exposed for 3 or more hours
100dB	Requires hearing protection if an employee is exposed for 2 or more hours
102dB	Requires hearing protection if an employee is exposed for 1.5 or more hours.
102dB - 105dB	Requires hearing protection if an employee is exposed for 1 or more hours
110dB	Requires hearing protection if an employee is exposed for 30 minutes.
115dB	Noise at this volume is only safe for up to 15 minutes without protection

While OSHA sets specific limits for hearing protection, most facilities prioritize their employees' safety by providing proper hearing protection at lower noise levels and durations than those specified. It's a prudent approach to err on the side of caution. For instance, any noise exceeding 115 dB necessitates hearing protection, even for brief exposures. Placing earplugs or other hearing protection options at the entrances to noisy areas serves as an effective reminder for employees to take necessary precautions.

Before considering personal protective equipment (PPE) for hearing protection, employers can proactively reduce noise within their facilities using engineering and administrative controls. Below are some examples of engineering controls that can help contain or eliminate noise:

Noise Absorbing Panels: Installing these panels throughout the facility can significantly reduce overall noise levels.

Modernizing Machines: Upgrading to newer machines often results in quieter operation, making it worthwhile to replace or update older equipment to reduce noise.

Containment: Isolating particularly noisy equipment in soundproof rooms can effectively reduce noise in the rest of the facility. In some cases, these machines can even be operated from outside the soundproof room.



Personal Protective and Life Saving Equipment

Administrative controls also play a role in noise mitigation. These measures include limiting the duration of employee exposure to noisy equipment, scheduling noisy tasks during times when fewer people are present, and ensuring employees maintain a safe distance from noisy equipment when not in use.

Once noise control measures have been implemented, employers can then consider mandatory hearing protection for employees. Several options are available, including earplugs, earmuffs, or using a combination of both.

Earmuffs are designed to cover the entire ear by fitting over or around the head, rather than inserting into the ear canal. Properly fitted earmuffs provide substantial protection by preventing sound from entering the ear altogether. Some advanced earmuff designs incorporate external microphones and small speakers. These earmuffs can detect and transmit environmental sounds at a safe volume to the wearer, effectively reducing noise exposure. This innovation allows individuals to communicate freely in noisy environments without risking hearing loss.

Earplugs represent one of the earliest forms of hearing protection, yet they remain highly effective. They are suitable for environments with relatively low decibel levels where hearing protection is essential. This type of hearing protection is remarkably cost-effective and often disposable. Employers can readily provide large containers of earplugs for employees to use when entering noisy environments, and employees can conveniently discard them upon leaving. Utilizing earplugs is not only practical but also an economical means of complying with OSHA's hearing protection requirements.

However, employee fit testing for hearing protection presents a more complex challenge compared to respirator fit testing, as it primarily relies on the user's correct application of earplugs or earmuffs. To address this, employees are instructed on the proper insertion of earplugs or the use of earmuffs, and their effectiveness is evaluated through a personal attenuation rating. This assessment often involves audiometric testing for individual users. It's important to note that the level of protection observed during testing may not necessarily reflect the actual protection as employees adjust and readjust their hearing protection throughout the day. Consistent reminders and instructions to employees regarding the proper use of hearing protection are crucial, as there is no guarantee of complete safety without them.

Implementing OSHA's hearing conservation program is a mandatory requirement for any business with noise pollution within its facility. This comprehensive program encompasses various aspects, including noise level monitoring, individual audiometric testing, provision of hearing protection, employee training, and maintaining records of these activities.

In summary, hearing protection is essential to safeguard employees' health. Hearing loss has been associated with an increased risk of cognitive decline, mental health issues, and chronic pain related to



Personal Protective and Life Saving Equipment

heightened stress levels. Prioritizing hearing protection is not only a regulatory obligation but also a fundamental aspect of preserving overall employee well-being.

FALL PROTECTION

Falls are the main reason construction workers lose their lives. Almost every day, someone working in construction dies because they fall. And for each person who dies this way, many more get hurt and have to go to the hospital. These accidents are happening more often every year.

To prevent falls in construction, workers use something called Personal Fall Protection, or a fall arrest system.

A basic fall arrest system has four main parts: a full body harness, a lanyard, a lifeline, and an anchor point. The system works by keeping you connected to a strong and secure anchor point to stop you from falling.

The anchor point is usually a part of the building or structure you're working on. It needs to be able to hold not just your weight but also handle the force of a fall, which can be as much as 5000 pounds. You attach your body harness to the anchor point using a lifeline, a lanyard, or both.

A lanyard is like a rope, wire, or strap that connects either directly to the anchor point or to a lifeline that's attached to the anchor point.

There are two kinds of lifelines: horizontal ones that stretch from one anchor point to another side to side, and vertical ones that hang down from a single anchor point.

When the fall arrest system stops a fall, the full body harness spreads out the impact evenly across your thighs, shoulders, chest, and pelvis to prevent injury.

Before you use a fall arrest system, you must check each part to make sure it's not worn out or damaged. If anything is wrong with a part, you must replace it.

If any parts of the system have been used to stop a fall, they can't be used again until they've been checked and confirmed to be safe.

If safety belts, lifelines, and lanyards have been used to catch someone during a fall, they can't be used again for regular work until they've been checked.

If you're working more than 25 feet above the ground and can't use ladders, scaffolds, or other safety gear, you need to have safety nets to catch you if you fall.



Personal Protective and Life Saving Equipment

FALLS WHEN WORKING ON OR NEAR WATER

For workers over or near water, life jackets or buoyant work vests must be provided to employees where the danger of drowning exists.

These must be inspected for defects before and after each use. Ring buoys must be no more than 200 feet apart and available for emergency rescue operations.

A lifesaving skiff must also be available where employees work over or near water.