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Module 4: Personal Protective Equipment

Module Description

This module will provide employers and employees alike with knowledge concerning the proper selection, care, and use of Personal Protective Equipment (PPE). They also will be informed of the requirements for compliance with OSHA requirements.

Module Learning Objectives

At the conclusion of this module, you will be able to:

- Describe the role of PPE in controlling exposure to hazards in the workplace.
- Identify parts of the body most vulnerable to injury and name hazards associated with each.
- Describe the appropriate PPE to be worn for worker safety.

Lesson 1: Introduction to Personal Protective Equipment

Lesson Focus

This lesson focuses on the following topics:

- What is Personal Protective Equipment?
- Personal Protective Equipment Standards
- Employer Responsibilities
- Employee Responsibilities

Overview

What Is Personal Protective Equipment?

Personal Protective Equipment (PPE) means any type of device or clothing (i.e., head protection, eye/face protection, protective footwear, respiratory protection, etc.) worn for protection against biological, chemical, thermal, physical, or other hazards on the job.

All employees who are exposed to hazards like these, and others, may be required to wear appropriate PPE to reduce or eliminate their exposure to hazards.

Personal Protective Equipment Standard

What Is the Personal Protective Equipment Standard?

The Occupational Safety and Health Administration requires that, when necessary, employers establish and administer an effective Personal Protective Equipment (PPE) program for employees in order to reduce the effects of workplace hazard exposure and, as a result, the workplace accident rate in the U.S.

Engineering Controls

If . . .

The machine or work environment can be physically changed to prevent employee exposure to the potential hazard,

Then . . .

The hazard should be eliminated with an engineering control.

Payment for PPE

When PPE is required to protect employees, it must be provided by the employer at no cost to employees, except for specific items, such as:

- Safety-toe footwear not limited to the worksite
- Prescription safety eyewear
- Everyday clothing and weather-related gear and
- Logging boots

Employer Responsibilities

Hazard Assessment

The employer shall assess the workplace to determine if hazards are present, or likely to be present, which may necessitate the use of personal protective equipment. While an employer's first responsibility upon identification of a workplace hazard is to eliminate it through the use of engineering controls, PPE often is the final solution for remaining hazards.

Physical Hazards

Physical hazards include:

- Motion
- High and low temperatures
- Light radiation:
    - Welding
    - Brazing
    - Heat treating
    - High intensity lighting
- Falling objects
- Sharp objects
- Sources of rolling or pinching objects
- Electric hazards
- Hazardous floor conditions

Health Hazards

Health hazards include:

- Types of chemicals an employee could be exposed to
- Harmful dusts, fumes, and mists
- Nuclear radiation
- Noise

Selection of PPE

The selection of personal protective equipment depends on the hazard the worker needs to be protected against, the level of hazard present, and the availability of suitable equipment. Individual components of clothing and equipment should be assembled that both protects the worker from the specific hazard and minimizes the hazard and potential drawbacks of the PPE itself. PPE shall, wherever possible, be provided for the exclusive use of a single employee.

Periodic reevaluation of the selection is necessary in order to deal with changes in workplace conditions or wearer activities. The type of PPE selected is very important; different brands of PPE should be tried by workers to get the best possible protection. For example, using the wrong types of gloves to work with solvents can lead to ineffective protection.

Training

The employer shall provide training to each employee using PPE. Each employee shall be trained in at least the following:

- When and why PPE is necessary,
- What PPE is required for certain jobs.
- How to properly put on, take off, adjust, and wear PPE.
- The limitations of the PPE.
- The proper care, maintenance, useful life and disposal of PPE.
- How damaged, worn out, or defective PPE can be replaced.

Maintenance

All PPE should be inspected for tears, leaks, punctures, breaks, contamination, or signs of wear before use. Damaged or defective equipment should not be used.

PPE should be stored carefully and kept clean to prevent damage. Contaminated PPE that cannot be decontaminated should be disposed of properly.

Recordkeeping

The employer must maintain records of the workplace hazard assessment and employee training.

Employee Responsibilities

Employees are responsible to:

- Attend all required training sessions regarding PPE.
- Wear PPE as required and trained.
- Clean, maintain, and care for PPE as required.
- Report potential hazards they identify to their supervisors.
- Inform their supervisors or safety managers of the need to repair or replace PPE.
- Follow ALL warnings and precautions.
- Listen and follow the directions from supervisors or safety managers.

Case Study

This accident occurred in a cellophane-tape manufacturing factory during work to wash a drum that contained an adhesive.

The victim who was on the night shift was working with a group leader to monitor the machine that applies a coat of adhesive and to conduct sampling inspections. While they were taking turns working in thirty-minute shifts, the victim did not return to work after a break. When the group leader searched for the victim, he found him unconscious having fallen head first into an empty drum that previously contained adhesive.

Although the victim was immediately taken to the hospital for emergency treatment, he never regained consciousness.

Incidentally, a group leader on the day shift had washed the drum with toluene, before the task was transferred to the night shift workers at the time of the shift-change meeting.

What do you think some of the causes were?

- Ventilation was not used at a site where toluene was used.
- The victim bent forward to wash the inside of the drum that still contained toluene vapor.
- The victim did not use a respirator during the washing work.

Lesson Summary

Personal Protective Equipment (PPE) protects against biological, chemical, or physical hazards on the job. The employer will assess the workplace to determine if hazards are present, or likely to be present, which may necessitate the use of PPE. This protective equipment is often the final solution for hazards that cannot be eliminated through the use of engineering controls. Also, wherever possible, PPE will be provided for the exclusive use of a single employee.

Lesson 2: Eye, Face, and Respiratory Protection

Lesson Focus

This lesson focuses on the following topics:

- **Eye and Face Protection**
- **Respiratory Protection**

Eye and Face Protection

Every day an estimated 1,000 eye injuries occur in American workplaces.

The financial cost of these injuries is enormous—more than $300 million per year is lost in production time, medical expenses, and workers compensation. No dollar figure can adequately reflect the personal toll these accidents take on injured workers.

What contributes to eye injuries at work?

Take a moment to think about possible eye hazards at your workplace. The Labor Department's Bureau of Labor Statistics (BLS) survey of about 1,000 minor eye injuries reveals how and why many on-the-job accidents occur.

1. **Not Wearing Eye Protection.** The BLS reports that nearly three out of every five workers injured were not wearing eye protection at the time of their accidents.
2. **Wearing the Wrong Kind of Eye Protection for the Job.** About 40% of the injured workers were wearing some form of eye protection when the accident occurred, but often, it was not the correct eye protection for the job being done.

What causes eye injuries?

1. **Flying Particles:** The BLS found that almost 70% of the accidents studied resulted from flying or falling objects or sparks striking the eye. Injured workers estimated that nearly three-fifths of the objects were smaller than pin heads. Most of the particles were said to be traveling faster than hand-thrown objects when accidents occurred.
2. **Contact with Chemicals:** Chemicals caused one-fifth of the injuries.

3. **Other accidents:** Miscellaneous accidents were caused by objects swinging from a fixed or attached position—like tree limbs, ropes, chains, or tools pulled into an eye while a worker was using them.

Where do accidents occur most often?

Potential eye hazards can be found in nearly every industry, but BLS reported that more than 40% of injuries occurred among craft workers, like mechanics, repairers, carpenters, and plumbers.

Over a third of the 40% injured operated machinery, such as assemblers, sanders, and grinding machine operators. Laborers suffered about one-fifth of the eye injuries. Almost half the injured workers were employed in manufacturing; slightly more than 20% were in construction.

How can eye injuries be prevented?

1. **Always wear effective eye protection:** To be effective, eyewear must be appropriate for the hazard and also must be properly fitted. All eye-protective equipment provided by an employer must meet ANSI Z-87.1 standards. (American National Standards Institute)
2. **Better training and education:** The BLS reported that most workers were hurt while doing their regular jobs. Workers injured while not wearing protective eyewear most often said they believed it was not required by the situation. Even though the vast majority of employers furnished eye protection at no cost to employees, about 40% of the workers received no information on when and what kind of eyewear should be used.
3. **Maintenance:** Eye protection devices must be properly maintained. Scratched and dirty devices reduce vision, cause glare, and may contribute to accidents.

Eyewash Stations

Eyewash stations should be located within 10 seconds of a hazard area. If employees accidentally get something into their eyes, they must go directly to the eyewash station and flush their eyes with water for at least 15 minutes. The employee should hold the eyelids open and "look" directly into the water streams. They should NOT rub their eyes. Rubbing the eyes may scratch or embed particles. Employees should seek medical attention immediately.

Eye and Face Protectors

Face and eye protection includes:

1. **Goggles:** Goggles of soft, pliable body design provide adequate eye protection from many hazards. These goggles are available with clear or tinted lenses, perforated, port vented, or non-vented frames. Single lens goggles provide similar protection to spectacles and may be worn in combination with spectacles or corrective lenses to ensure protection along with proper vision.
2. **Face shields:** Face shields may be used in operations when the entire face needs protection and should be worn to protect eyes and face against flying particles and metal sparks. Specifically designed shields also provide protection from chemical and biological splash. Wearing a face shield does not necessarily protect from impact hazards.
3. **Welding shields:** Tinted shields will be provided to protect workers' eyes and face from infrared or radiant light burns, flying sparks, metal spatter, and slag chips encountered during welding, brazing, soldering, resistance welding, bare or shielded electric arc welding and oxyacetylene welding and cutting operations. Tinted lenses are available in varying shades or degrees of tinting, and it's the employer's responsibility to provide the appropriate lenses for the hazard to be encountered.

Safe Work Practices

As an employee works:

- He or she should read and follow all warnings and precautions that may be found on equipment and hazardous materials.
- He or she should avoid throwing tools or participating in horseplay.
- He or she should keep sharp or pointed objects away from his or her eyes.
- He or she should follow the supervisor's or safety manager's suggestions and recommendations for working safely.

Respiratory Protection

Health hazards in the workplace are a major concern for both employers and employees. Hazardous materials can enter our body in four ways:

1. Ingestion
2. Skin Absorption
3. Inhalation
4. Injection

Because many substances that are health hazards can become airborne, knowing how to protect ourselves is very important.

There are four basic methods of controlling inhalation hazards:

1. **Substitution** involves replacing the hazardous material or process with a non-hazardous or less hazardous one.
2. **Engineering controls** include enclosing the process so that contaminants do not get into the workspace, improving the ventilation, and changing the equipment or processes.
3. **Administrative controls** include restricting access to contaminated areas, limiting the total time workers are exposed, and establishing housekeeping procedures to control exposure.
4. **Personal protective equipment** includes the use of respirators. In some cases, however, respirators are the only means to protect workers.

What is a Respirator and When is it Needed?

A respirator is a protective device that covers the worker's nose and mouth or the entire face and head to keep airborne contaminants out of the worker's respiratory system and to provide a safe air supply.

There are two major categories of respirators:

1. **Air Purifying Respirators:** These types of respirators include:
    - Air Purifying Disposable Particulate Masks
    - Air Purifying Half Mask Respirators
    - Air Purifying Full Face Mask Respirators
    - Gas Masks
    - Powered Air Purifying Respirators
2. **Supplied Air Respirators:** These types of respirators include:
    - Airline Respirators
    - Emergency Escape Breathing Apparatus
    - Self-Contained Breathing Apparatus (SCBA)

Selecting the Correct Respirator

The first step in selecting the correct respirator is to determine the level of hazard that is posed by the environment in which one will be working. To do this, one must be able to answer five basic questions:

1. What type of contaminant is present?
2. What is the form of the contaminant?
3. How toxic is the contaminant?
4. What is the concentration of the contaminant?
5. What will be the length and duration of the exposure?

Employees should always work with their supervisor or safety professional to determine the correct answers to these questions. Without the technical knowledge to make correct decisions, it's best to consult with an industrial hygienist or safety professional who is trained to provide professional guidance on proper respirator selection and use.

It should be noted that before an employer provides any employee with a respirator to use in a workplace, the employer must create a formal written respiratory protection program and have every employee who will wear a respirator medically evaluated by a licensed healthcare professional.

Inspection before Use

Every time an employee uses a respirator, he or she must first inspect it. To properly inspect a respirator before using it, one should look for:

- Chips or cracks in the faceplate
- Cracks or holes in the breathing tube or airlines
- Worn or frayed straps
- Worn or damaged fittings
- Bent or corroded buckles
- Dirty or improperly seated valves

If you find anything wrong with your respirator, do not use it. Have it repaired or replaced immediately.

Donning (putting on) a Respirator

Each respirator should be donned making certain to follow the manufacturer's instructions carefully. You must be able to demonstrate proper donning of the respirator to your supervisor or safety professional.

Case Study

This accident occurred during work to lift a drain pump through a manhole in a sewerage construction worksite.

The work was to replace the pipes for rainwater. As another drain pump became necessary, it was decided to use the drain pump in another manhole for which work was almost completed. Accordingly, two workers opened the cover of the manhole and entered, using a ladder.

After a short while, a colleague who was going to the material shed spotted the two workers lying at the bottom when he looked into the manhole and raised an alarm with other workers. One of the workers who ran to the spot entered the manhole and called out to them but received no answer. Immediately after this, this worker also collapsed.

Although the three were taken to a hospital by a rescue team, the two workers died, and the would-be rescuer was hospitalized with brain damage caused by hypoxia (a lack of oxygen).

The two fatalities were attributed to anoxia (meaning, without oxygen).

What do you think were some of the causes?

- Although survey results had been provided by the client, neither the general contractor nor the subcontractor assessed the worksite as presenting the hazard of anoxia.
- The employer and supervisor failed to measure the oxygen content of the hole and to carry out ventilation measures before allowing any employee to enter.

- The project should have been declared a Permit Required, Confined Space, and all elements of OSHA's standard for PRCS should have been implemented.
- Neither special education nor rescue training concerning work at sites with the danger of anoxia was provided to workers.

Lesson Summary

To be effective, eyewear must be appropriate for the encountered hazard and also be fitted properly. All eye-protective equipment provided by an employer must meet ANSI standards.

Not wearing eye protection and wearing the wrong kind of eye protection for the job are common factors in eye injuries on the job. Causes of eye injuries include flying particles, contact with chemicals, and objects swinging from a fixed or attached position.

Eye injuries be prevented with:

- Effective eye protection
- Better training and education
- Maintenance

Face and eye protection includes:

- Goggles
- Face shields
- Welding shields

Because many substances that are health hazards can become airborne, knowing how to protect ourselves is very important. A respirator is a protective device that covers the worker's nose and mouth or the entire face and head to keep airborne contaminants out of the worker's respiratory system and to provide a safe air supply. There are two major categories of respirators air purifying respirators and supplied air respirators.

Every time an employee uses a respirator, he or she must first inspect it.

When necessary, workers must be able to demonstrate proper donning and doffing of respirators. If you find anything wrong with a respirator, do not use it; instead, have it repaired or replaced immediately.

Lesson 3: Head, Hand, Face, and Foot Protection

Lesson Focus

This lesson focuses on the following topics:

- Why Head Protection Is Important
- Potential Hazards
- Occupational Noise
- Why Hand Protection Is Important
- Foot Protection Is Important

Why Head Protection Is Important

Your head is a very delicate part of the human body.

Injuries to the head may be very serious. For this reason, head protection and safety are very important.

Potential Hazards

Impact to the head

Falling or flying objects are a common cause of head injuries. Also, falling or walking into hard objects can cause head injuries. These injuries include neck sprains, concussions, and skull fractures.

Electrical Shocks

Accidents involving electricity result in electrical shocks and burns.

How Hard Hats Protect an Employee's Head

Hard hats protect an employee's head by providing the following features:

- A rigid shell that resists and deflects blows to the head and a suspension system inside the hat that acts as a shock absorber.
- Some hats serve as insulators against electrical shocks.

- Hard hats may shield the scalp, face, neck, and shoulders against splashes, spills, and drips.
- Some hard hats are constructed so that face shields, goggles, hoods, or hearing protection can be added.

When necessary, employers must provide hard hats that meet the appropriate ANSI standards.

> **Note:** OSHA does not specify when an employer must provide hard hats. It's up to each employer to make that determination based on the hazards of the workplace and through the required completion of a proper hazard assessment.

Occupational Noise

Noise is a common problem found in many workplaces. Research has shown that high levels of noise will damage your hearing. Losing your hearing is typically a gradual process, and is less noticeable than other types of workplace injuries. It is, however, a permanent handicap for those who are affected.

Remember the four "P"s of hearing loss: It's Painless, Permanent, Progressive and usually, Preventable.

When an employer determines the "Action Level" of 85 dBs has been reached, they must create a formal written hearing conservation program.

Types of Hearing Protection Devices

Many types of hearing protection devices are available. Popular types of hearing protection devices are the following:

- Foam Earplugs
- PVC Earplugs
- Earmuffs

Caring for Hearing Protection Devices

Foam Earplugs

When not using your foam earplugs, store them in a clean, cool, dry place. If your foam earplugs become soiled, torn or stiff, discard them and ask your supervisor or safety manager for a new pair.

PVC Earplugs

When not using your PVC earplugs, store them in a clean, cool, dry place. If your PVC earplugs become soiled, you can clean them according to the manufacturer's guidelines. If your PVC earplugs become torn or brittle, discard them and ask your supervisor or safety manager for a new pair.

Earmuffs

When not using your earmuffs, store them in a clean, cool, dry place. Always inspect your earmuffs for cracks around the foam cups. If your earmuffs are damaged, have them repaired immediately or ask your supervisor or safety manager for a new pair.

Why Hand Protection Is Important

Take a moment to hold your hands out in front of you. Look at them. They are the only two hands you will ever have.

A number of disabling accidents on the job involve the hands. Without your fingers or hands, your ability to work would be greatly reduced.

Human hands are unique. No other creature in the world has hands that can grasp, hold, move, and manipulate objects like human hands. They are one of your greatest assets and, as such, must be protected and cared for.

Potential Hazards to the Hand

Traumatic Injuries

An employee can suffer a traumatic injury to his or her hands in many ways:

- Tools and machines with sharp edges can cut hands.
- Staples, screwdrivers, nails, chisels and stiff wire can puncture hands.

- Getting your hands caught in machinery can sprain, crush or remove your hands and fingers.

Contact Injuries

Coming into contact with caustic or toxic chemicals, biological substances, electrical sources or extremely cold or hot objects can irritate or burn one's hands.

Toxic substances are poisonous substances, some of which can be absorbed through one's skin and enter the body.

Repetitive Motion Injuries

Whenever you repeat the same hand movement over a long period of time, you run the risk of repetitive motion problems. Repetitive motion problems can appear as a numb or tingling sensation, chronic or acute pain, loss of gripping power in your hands, or in many other ways.

Preventative Measures

Poorly maintained machinery, tools, sloppy work areas, and cluttered aisles all contribute to hand injuries.

Good hygiene includes hand washing. Proper washing helps remove germs and dirt from your hands. Clean hands are less susceptible to infection and other skin problems such as contact dermatitis.

Instructions for the Safe Removal of Contaminated Gloves

When removing contaminated gloves, remember to:

1. Pull one glove near your wrist towards your fingertips until the glove folds over.
2. Carefully grab the fold and pull towards your fingertips. As you pull you are turning the inside of the glove outwards.
3. Pull the fold until the glove is almost off.
4. To avoid contamination of your environment, continue to hold the removed glove. Completely remove your hand from the glove.
5. Slide your finger from your glove-free hand under the remaining glove. Continue to slide your finger towards your fingertips until almost half of your finger is under the glove.

6. Turn you finger 180 degrees and pull the glove outwards and towards your fingertips. As you do this, the first glove will be encased in the second glove. The inside of the second glove will also be turned outwards.
7. Grab the gloves firmly, by the uncontaminated surface (the side that was originally touching your hand). Release your grasp of the first glove you removed. Pull your second hand free from its glove. Dispose of the gloves properly.

Foot Protection Is Important

Scientists and engineers for centuries have marveled at the design and structure of the human foot. The human foot is rigid enough to support the weight of your entire body, and yet flexible enough to allow you to run, dance, play sports, and take you anywhere you want to go. Without your feet and toes, your ability to work at your job would be greatly reduced.

Potential Hazards to the Foot

Impact Injuries

If you have ever stubbed your toe, you know that impact injuries can hurt. At work, heavy objects can fall on your feet. If you work around sharp objects, you might step on something sharp and puncture your foot.

Injuries from Spills and Splashes

Liquids such as acids, caustics, and molten metals can spill onto your shoes and boots. These hazardous materials can cause chemical and heat burns.

Compression Injuries

Heavy machinery, equipment, and other objects can roll over your feet. The result of these types of accidents is often broken or crushed bones.

Electrical Shocks

Accidents involving electricity can cause severe shocks and burns.

Extremes in Cold, Heat, and Moisture

If not protected, your feet can suffer from frostbite if you must work in an extremely cold environment. Extreme heat, on the other hand, can blister and burn your feet. Finally, extreme moisture in your shoes or boots can lead to fungal infections.

Slipping

Oil, water, soaps, wax, and other chemicals can cause you to slip and fall.

Preventative Measures for Foot Safety

Housekeeping

Poorly maintained machinery, tools, sloppy work areas, and cluttered aisles all contribute to foot injuries.

Wearing and Using Safety Footwear

Select and use the right kind of footwear for the job you are going to be performing. Footwear should meet or exceed the standards set by ANSI (ANSI Z41-1991) or the newer ASTM F 2413 Specifications for Performance Requirements for Protective Footwear.

Avoid footwear made of leather or cloth if you work around acids or caustics. These chemicals quickly eat through the leather or cloth and can injure your feet.

Remember to:

- Select footwear that fits properly.
- Inspect your footwear before you use it. Look for holes and cracks that might leak.
- Replace footwear that is worn or torn.
- After working with chemicals, cleanse your footwear appropriately to rinse away any chemicals or dirt before removing footwear.
- Avoid borrowing footwear; footwear is personal protective equipment.
- Store footwear in a clean, cool, dry, ventilated area.

Lesson Summary

Head injuries may include neck sprains, concussions, and skull fractures, or electrical shocks and burns. OSHA does not dictate specifically when an employer must provide hard hats; rather it is up to each employer to make that determination based on the hazards of the workplace.

When employers determine that noise levels in excess of the "Action Level" of 85 dBs has been reached, they must create a formal written hearing conservation program.

Liquids such as acids, caustics, and molten metals can spill onto your shoes and boots. These hazardous materials can cause chemical and heat burns, and extreme moisture in your shoes or boots can lead to fungal infections.

Because poorly maintained machinery, tools, sloppy work areas, and cluttered aisles all contribute to foot injuries, footwear should meet or exceed the standards formerly set by ANSI and now set by ASTM F2413. Avoid borrowing footwear; footwear is personal protective equipment.

Revision #1
Created 2023-02-24 00:34:24 UTC by Nicole Blum
Updated 2023-02-24 00:35:42 UTC by Nicole Blum