

# Personal Protective Equipment



# OSHAcademy Course 709 Study Guide

## Personal Protective Equipment

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Contact OSHAcademy to arrange for use as a training document.

This study guide is designed to be reviewed off-line as a tool for preparation to successfully complete OSHAcademy Course 709.

Read each module, answer the quiz questions, and submit the quiz questions online through the course webpage. You can print the post-quiz response screen which will contain the correct answers to the questions.

The final exam will consist of questions developed from the course content and module quizzes.

We hope you enjoy the course and if you have any questions, feel free to email or call:

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## Course Introduction

Hazards exist in every workplace in many different forms: sharp edges, falling objects, flying sparks, chemicals, noise and a myriad of other potentially dangerous situations. The Occupational Safety and Health Administration (OSHA) requires employers to protect their employees from workplace hazards that can cause injury.

Controlling a hazard at its source is the best way to protect employees. Depending on the hazard or workplace conditions, OSHA recommends the use of engineering or work practice controls to manage or eliminate hazards to the greatest extent possible. For example, building a barrier between the hazard and the employees is an engineering control; changing the way in which employees perform their work is a work practice control.

When elimination, substitution, engineering, and administrative controls are not feasible or do not provide sufficient protection, employers must provide personal protective equipment (PPE) to their employees and ensure its use. Personal protective equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to a variety of hazards. Examples of PPE include such items as gloves, foot and eye protection, protective hearing devices (i.e., earplugs, and muffs), hard hats, respirators, and full body suits. Remember, PPE is the last resort in hazard control, not the first choice. Some employers may mistakenly believe PPE is the end all to be all. They might do too much, not too little.

This course will help both employers and employees do the following:

- Understand the types of PPE.
- Know the basics of conducting a "hazard assessment" of the workplace.
- Select appropriate PPE for a variety of circumstances.
- Understand what kind of training is needed in the proper use and care of PPE.

### What is the purpose of this course?

The information in this course is general in nature and does not address all workplace hazards or PPE requirements. The information, methods and procedures in this course are based on the OSHA requirements for PPE as set forth in the Code of Federal Regulations (CFR) for general industry at:

- 29 CFR 1910.132 (General requirements)
- 29 CFR 1910.133 (Eye and face protection)
- 29 CFR 1910.135 (Head protection)



- 29 CFR 1910.136 (Foot protection)
- 29 CFR 1910.137 (Electrical protective equipment) and
- 29 CFR 1910.138 (Hand protection)

### The Requirement for PPE

To ensure the greatest possible protection for employees in the workplace, the cooperative efforts of both employers and employees will help in establishing and maintaining a safe and healthful work environment.

In general, employers are responsible for:

- performing a "hazard assessment" of the workplace to identify and control physical and health hazards
- identifying and providing appropriate PPE for employees
- training employees in the use and care of the PPE
- maintaining and replacing worn or damaged PPE
- periodically reviewing, updating and evaluating the effectiveness of the PPE program

In general, employees should be:

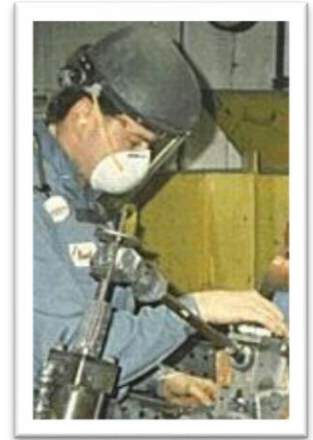
- properly wearing PPE
- attending training sessions on PPE
- caring for, cleaning and maintaining PPE
- informing a supervisor of the need to repair or replace PPE

Specific requirements for PPE are presented in many different OSHA standards, published in 29 CFR. Some standards require that employers provide PPE at no cost to the employee while others simply state that the employer must provide PPE.

## Module 1: 1910.132 General Requirements

### What is required?

OSHA requires the use of personal protective equipment (PPE) to reduce employee exposure to hazards when engineering and administrative controls are not feasible or effective in reducing these exposures to acceptable levels. Employers are required to determine if PPE should be used to protect their workers and have an obligation to provide PPE, including personal protective equipment for eyes, face, head, and extremities, and protective clothing and barriers. Employers must also make sure employees use and maintain PPE in a sanitary and reliable condition.



### What is proper use?

Personal Protective Equipment must be worn and used in a manner which will make full use of its protective qualities.

Low rates of compliance in wearing PPE usually indicate the safety management system is failing in some way. Any one of the following root causes may result in general non-compliance:

- the employer does not provide quality PPE;
- the employer does not properly supervise the use of PPE;
- the employer fails to enforce the use of PPE; or
- the employer does not properly train employees on the use of PPE.

### What are the different categories of PPE?

Categories of PPE

- Face and eye protection
- Head protection
- Foot protection
- Hand protection
- Protective clothing
- Protective ointments
- Shields
- Barriers

- Restraints

### When and where is PPE required?

PPE is required wherever the conditions listed below are encountered that are capable of causing injury or impairment by being absorbed, inhaled, or physically contacted.

- hazards of processes
- environment hazards
- chemical hazards
- radiological hazards
- mechanical irritants

### Who pays for PPE?

With few exceptions, OSHA requires employers to pay for personal protective equipment used to comply with OSHA standards.

Employers cannot require workers to provide their own PPE and the worker's use of PPE they already own must be completely voluntary. Even when a worker provides his or her own PPE, the employer must ensure that the equipment is adequate to protect the worker from hazards at the workplace.

Employers must pay for the following:

- metatarsal foot protection
- rubber boots with steel toes
- non-prescription eye protection
- prescription eyewear inserts/lenses for full face respirators
- goggles and face shields
- firefighting PPE (helmet, gloves, boots, proximity suits, full gear)
- hard hats
- hearing protection
- welding PPE

### Payment Exceptions under the OSHA Rule

Employers are not required to pay for some PPE in certain circumstances:

- Non-specialty safety-toe protective footwear (including steel-toe shoes or boots) and non-specialty prescription safety eyewear provided that the employer permits such items to be worn off the job site. (OSHA based this decision on the fact that this type of equipment is very personal, is often used outside the workplace, and that it is taken by workers from jobsite to jobsite and employer to employer.)
- Everyday clothing, such as long-sleeve shirts, long pants, street shoes, and normal work boots.
- Ordinary clothing, skin creams, or other items, used solely for protection from weather, such as winter coats, jackets, gloves, parkas, rubber boots, hats, raincoats, ordinary sunglasses, and sunscreen.
- Items such as hair nets and gloves worn by food workers for consumer safety.
- Lifting belts because their value in protecting the back is questionable.
- When the employee has lost or intentionally damaged the PPE and it must be replaced.

## PPE Design

All personal protective equipment must be of safe design and construction for the work to be performed.

### What should not be worn?

The PPE rules require that rings, wristwatches, earrings, bracelets, and other jewelry must not be worn if it's possible for it to come into contact with power driven machinery or electric circuitry.

Why this rule? Read how this rule might have prevented some serious injuries:

De-gloving of a finger caused by a ring. From Bob F.

*The accident occurred when the individual was jumping off the side of an Army tow truck. He placed his hand on the railing of the bed and jumped off. The ring caught on the side of truck bed. Upon reaching the ground, the ring had removed all the skin from the finger, leaving the muscles, bone and fingernail exposed.*

*The individual was rushed to an emergency room where the finger was inserted into the wall of the stomach area. A pedicle graft was performed using the skin from the stomach area. After more than eight operations and over 100 plus days in the hospital the finger is semi-useable.*

Nothing but air? NOT! From Joan R.

*I took care of a man who got his ring caught on a basketball hoop as he made a dunk and pulled his whole finger off—skin, bone, and all at the knuckle. Not a pretty sight.*

### **What about back belts?**

It's important that you understand that back belts should not be considered personal protective equipment in that they physically "protect" you from back injuries.

Devices such as back belts are not recognized by OSHA as control measures to prevent back injury. While they may be accepted by individual workers because they feel as if they provide additional support, if used improperly, they may restrict the body's range of motion and possibly aggravate other ergonomic stressors in the job. Research indicates that the primary value in back belts, when used properly, is that they "remind" the employee to use proper lifting techniques. As a result, fewer back injuries occur. Thus, OSHA does not forbid the use of back belts and similar devices, nor does it endorse their use.

### **Work Clothing**

Clothing must be worn which is appropriate to the work performed and conditions encountered.

Loose sleeves, ties, lapels, cuffs, or other loose clothing must not be worn near moving machinery.

Make sure that you immediately remove clothing that becomes saturated or impregnated with flammable liquids, corrosive or toxic substances, irritants, or oxidizing agents. Don't wear it again until it's properly cleaned.

### **Defective and Damaged Equipment**

Of course, defective or damaged personal protective equipment must not be used. It's important to inspect PPE regularly, and before each use, to make sure it's capable of adequately protecting an employee from exposure to hazards. Remember, PPE that is defective is not PPE.

### **Hazard Assessment**

A first critical step in developing a comprehensive safety and health program is to identify physical and health hazards in the workplace. This process is known as a "hazard assessment."

Potential hazards may be physical or health-related and a comprehensive hazard assessment should identify hazards in both categories. Examples of physical hazards include moving objects, fluctuating temperatures, high intensity lighting, rolling or pinching objects, electrical connections and sharp edges. Examples of health hazards include overexposure to harmful dusts, chemicals or radiation. The hazard assessment should begin with a walk-through survey of the facility to develop a list of potential hazards in the basic hazard categories below.

- Impact
- Penetration
- Compression (roll-over)
- Chemical
- Heat/cold
- Harmful dust
- Light (optical) radiation
- Biological contaminants

In addition to noting the basic layout of the facility and reviewing any history of occupational illnesses or injuries, things to look for during the walk-through survey include:

- sources of electricity;
- sources of motion such as machines or processes where movement may exist that could result in an impact between personnel and equipment;
- sources of high temperatures that could result in burns, eye injuries or fire;
- types of chemicals used in the workplace;
- sources of harmful dusts;
- sources of light radiation, such as welding, brazing, cutting, furnaces, heat treating, high intensity lights, etc.;
- the potential for falling or dropping objects;
- sharp objects that could poke, cut, stab or puncture; and
- biological hazards such as blood or other potentially infectious material.

When the walk-through is complete, the employer should organize and analyze the data so that it may be efficiently used in determining the proper types of PPE required at the worksite. The employer should become aware of the different types of PPE available and the levels of protection offered. It is definitely a good idea to select PPE that will provide a level of protection greater than the minimum required to protect employees from hazards.

The workplace should be periodically be reassessed for any changes in conditions, equipment or operating procedures that could affect occupational hazards. This periodic reassessment should also include a review of injury and illness records to spot any trends or areas of concern and taking appropriate corrective action. The suitability of existing PPE, including an evaluation of its condition and age, should be included in the reassessment.

Documentation of the hazard assessment is required through a written certification that includes the following information:

- identification of the workplace evaluated;
- name of the person conducting the assessment;
- date of the assessment; and
- identification of the document certifying completion of the hazard assessment.

### PPE Assessment Form Sample

<b>PPE Hazard Assessment</b> (Example)			
<b>Department:</b> Building maintenance		<b>Job title:</b> Maintenance helper	
<b>Job duty location:</b> Plant-wide			
<b>Performed by:</b> John Black		<b>Date:</b> December 6, 2008	
Activity/Tools	Potential hazards	Body part(s)	PPE required
Replace glass	1,7	c,g,h	III,VII (cut resistant)
Remove trash	7	c	III
Replace light bulbs	1,4,7	c,h	III,VII (cloth/leather)
Welding	3,7,8	c,e,f,g,h	X (welding helmet/lens) IX (fume) X (welding vest) VII (welding gloves)
Hazard key		Body part key	PPE required
1. Cut 2. Abrasion 3. Burn 4. Fall 5. Flying object 6. Noise 7. Flying particles 8. Inhalation 9. Burn 10. Slip 11. Splash 12. Other		a. Head b. Face c. Eye(s) d. Ear(s) e. Respiratory f. Trunk g. Arm(s) h. Hand(s) i. Finger(s) j. Leg(s) k. Foot/feet l. Toe(s) m. Other	I. Hardhat II. Chemical goggles III. Safety glasses IV. Ear plugs V. Ear muffs VI. Body harness VII. Gloves (list type) VIII. Shoes/boots (list type) IX. Respirator X. Other
Source: Oregon OSHA			

If the person conducting the hazard assessment discovers that hazards requiring PPE are present, or likely to be present, then management must:

- select, and have each affected employee use, the types of PPE that will protect the affected employee from the hazard identified in the hazard assessment;
- communicate selection decisions to each affected employee; and,
- select PPE that properly fits each affected employee.

### **PPE Selection - One does not fit all.**

All PPE clothing and equipment should be of safe design and construction, and should be maintained in a clean and reliable fashion. Employers should take the fit and comfort of PPE into consideration when selecting appropriate items for their workplace. PPE that fits well and is comfortable to wear will encourage employee use of PPE. Most protective devices are available in multiple sizes and care should be taken to select the proper size for each employee. If several different types of PPE are worn together, make sure they are compatible. If PPE does not fit properly, it can make the difference between being safely covered or dangerously exposed. It may not provide the level of protection desired and may discourage employee use.

OSHA requires that many categories of PPE meet or be equivalent to standards developed by the American National Standards Institute (ANSI). ANSI has been preparing safety standards since the 1920s, when the first safety standard was approved to protect the heads and eyes of industrial workers. Employers who need to provide PPE in the categories listed below must make certain that any new equipment procured meets the cited ANSI standard. Existing PPE stocks must meet the ANSI standard in effect at the time of its manufacture or provide protection equivalent to PPE manufactured to the ANSI criteria. Employers should inform employees who provide their own PPE of the employer's selection decisions and ensure that any employee-owned PPE used in the workplace conforms to the employer's criteria, based on the hazard assessment, OSHA requirements and ANSI standards. OSHA requires PPE to meet the ANSI standards listed below.

- Eye and Face Protection: [ANSI](#) Z87.1-2010 (USA Standard for Occupational and Educational Eye and Face Protection).
- Head Protection: [ANSI](#) Z89.1-2009.
- Foot Protection: [ANSI](#) Z41.1-1999.

For hand protection, there is no ANSI standard for gloves but OSHA recommends that selection be based upon the tasks to be performed and the performance and construction characteristics



of the glove material. For protection against chemicals, glove selection must be based on the chemicals encountered, the chemical resistance and the physical properties of the glove material.

## Controlling Hazards

To control hazards, a hierarchy of controls has been used as a means of determining how to implement feasible and effective controls. [ANSI Z10-2005, Occupational Health and Safety Management Systems](#), encourages employers to employ the hierarchy of hazard control strategies listed below.

- Elimination
- Substitution
- Engineering controls
- Administrative controls
- Personal protective equipment

The idea behind this hierarchy is that the control methods at the top of the list are potentially more effective and protective than those at the bottom. Following the hierarchy normally leads to the implementation of inherently safer systems, ones where the risk of illness or injury has been substantially reduced. Let's take a closer look at the hierarchy of control strategies.

### Elimination and Substitution

Elimination and substitution, while most effective at reducing hazards, also tend to be the most difficult to implement in an existing process. If the process is still at the design or development stage, elimination and substitution of hazards may be inexpensive and simple to implement. For an existing process, major changes in equipment and procedures may be required to eliminate or substitute for a hazard.

These strategies are considered first because they have the potential to completely eliminate the hazard, thus greatly reducing the probability of an accident. Redesigning or replacing equipment or machinery may be expensive, but remember that, according to the National Safety Council, the average direct and indirect cost of a lost work time injury is \$34,000 and \$1,115,000 to close a fatality claim.

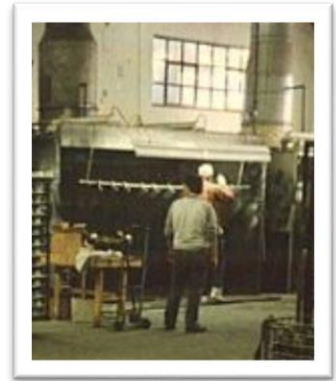
Below are examples of these two strategies.

- Removing the source of excessive temperatures, noise, or pressure

- Substituting a toxic chemical with a less toxic or non-toxic chemical

### Engineering Controls

Workplace hazards may be corrected using engineering controls which may be thought of as replacing or redesigning machinery, equipment, and tools, and/or substituting materials. Engineering controls are the "first line of defense" against injury/illness, because they have the potential to completely eliminate a hazard, and do not rely on human behavior to be effective. For instance, rather than require employees to wear respiratory protection which must be monitored, inspected, trained, managed, it's much more effective to install a ventilation system that does not require any of those management activities.



### Administrative Controls

Administrative controls can be accomplished with the stroke of the pen. It involves changing or redesigning work procedures, rescheduling breaks, changing the number of workers doing a job, and using personal protective equipment to reduce the frequency and duration exposure to the hazards of tasks. Using administrative controls alone is not as effective as engineering controls because, in most cases, they only reduce exposure - they don't eliminate the hazard. And even more importantly, administrative controls rely on human behavior (which introduces many variables in the long run) that must be continually managed.



### Personal Protective Equipment

The important thing to remember here is that PPE alone should not be relied on to provide protection against hazards, but should be used in conjunction with engineering controls and other administrative controls.

### Final Thoughts

That's a lot to remember, isn't it? Not to worry. You can always refer back to this information. It's time now for your first module quiz. Remember, final exam questions come from the quizzes, so be sure to complete each quiz.

## Module 1 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

**1. Which of the following root causes may result in general non-compliance with PPE requirements?**

- a) The employer does not provide quality PPE.
- b) The employer does not properly supervise the use of PPE.
- c) The employer does not properly train employees on the use of PPE.
- d) All of the above are correct.

**2. According to OSHA law, who is obligated to provide and to pay for required personal protective equipment?**

- a) The employee
- b) The employer
- c) The insurer
- d) The government

**3. PPE is required wherever which of the following conditions are encountered that are capable of causing injury or impairment by being absorbed, inhaled, or physically contacted?**

- a) Radiological hazards
- b) Chemical hazards
- c) Mechanical irritants
- d) Any of the above

**4. Are devices such as back belts recognized by OSHA as control measures to prevent back injury?**

- a) Yes
- b) No

**5. A/An \_\_\_\_\_ is an important element of a PPE program because it produces the information needed to select the appropriate PPE for any hazards present or likely to be present at particular worksites:**

- a) observation program
- b) feedback mechanism
- c) training program
- d) hazard assessment

**6. Personal protective equipment is most often used \_\_\_\_\_ engineering and administrative controls.**

- a) as a replacement for
- b) in conjunction with
- c) prior to the use of
- d) to reduce the need for

**7. If the person conducting the hazard assessment discovers that hazards requiring PPE are present, or likely to be present, management must do which of the following?**

- a) Select PPE for the affected employee for the specific hazard.
- b) Communicate selection decisions to each affected employee.
- c) Select PPE that properly fits each affected employee.
- d) All of the above are correct.

**8. When it comes to PPE, "One does NOT fit all!"**

- a) True
- b) False

**9. The most important strategy for surveying the work area is to conduct a hazard assessment.**

- a) True
- b) False

**10. Workplace hazards may be most effectively corrected using \_\_\_\_\_.**

- a) administrative controls
- b) personal protective equipment
- c) engineering controls
- d) education controls

## Module 2: PPE Training Requirements

### Introduction

You are told to mix a certain chemical with water to use as a cleaning agent to wash down your company trucks. You check out the chemical. It looks like water, doesn't feel any different than water...so you assume PPE isn't really necessary. So, you go about washing the trucks. Your hands and arms get pretty wet with the solution you've mixed, but, heck...no pain, no sting...must be safe. No worse than water, right? Wrong, very wrong.

You've been using a mixture of hydrofluoric acid and water. By the time you get home your arms are hurting like crazy. You hurry off to the hospital, but by the time you arrive, it's too late. The hydrofluoric acid has penetrated your skin on both of your arms, clear through to the bone. Fluorine ions have replaced calcium ions in the bone, effectively turning it into a sponge-like consistency. But, you are lucky; only one arm must be amputated. The doctors were able to save the other arm.

This scenario would not have occurred had you been properly trained in using PPE. The PPE standard mandates that the employer must provide training to each employee who is required to use Personal Protective Equipment. But, what is effective PPE Training? What methods work, and what are the goals of training PPE? We'll try to answer these questions, and others, throughout this module so that you'll be better able to participate in, conduct, or manage PPE training that is beneficial to the employee and cost effective for the employer.

### What subjects must be trained?

According to the standard, to meet the minimum training requirements, each employee receiving PPE training must be trained to know at least the following:

1. when PPE is necessary;
2. what PPE is necessary;
3. how to properly don, doff, adjust, and wear PPE;
4. the limitations of the PPE; and
5. the proper care, maintenance, useful life, and disposal of the PPE.

So far, we meet minimum OSHA requirements... but one very important element is missing: The PPE standard does not specifically require education on "why" PPE is necessary

So, why is this element so important? Because study after study tells us the most common reason employees don't follow rules in the workplace is because they don't know why the rules are important.

### Educate the "why" as well as train the "how"!

It's important to understand that whenever we conduct PPE training, educating the "why" and training the "how" must always occur. If we neglect the educational component, we jeopardize the long-term effectiveness of the overall training.

The first five elements in the list describe the *what*, *when*, and *how* about PPE use. The goal is to increase both *knowledge* and *skill* so that the employee is better able to properly use PPE. The methods used to train the employee are primarily discussion and demonstration. To measure knowledge and skill, the instructor usually tests the employee by asking them to do something.

The final "why" element addresses the importance of using PPE and what the consequences of behavior (compliance and failure to comply) will be. The natural consequences include some form of resulting injury or health to the employee. The system consequences describe the nature of the discipline or recognition that will result from performance. The goal of this last element is to increase employee *motivation* to use PPE so that the employee is more likely to use PPE properly. The method used to educate is primarily classroom lecture or discussion. To measure motivation, the instructor usually tests the employee by asking them to write or say something.

### Demonstration is the key

Before an employee is allowed to do work requiring PPE, the employer must require each affected employee to:

- demonstrate an understanding of the training elements listed above; and
- demonstrate the ability to use PPE properly.

Demonstration is really the most common and probably the most efficient method to determine employee knowledge and skills. How does the employee demonstrate an understanding of the six PPE training subjects listed above? Simple, their level of knowledge is measured by asking the employee questions similar to those listed below.

1. What PPE is required for your particular job?
2. When is the PPE required to be used in your job?

3. What are the possible defects your PPE might have?
4. How do you properly care for and maintain/store your PPE?
5. What is the useful life of your PPE?
6. From what hazards does the PPE protect you?

The form of the "test" may be either written or oral. If you are training a number of employees, you should give them a written test to best measure individual knowledge. It's also the intent of most OSHA law that knowledge be measured by written exams. In addition to the oral or written test, the standard requires some kind of method that provides an opportunity for the employee to demonstrate adequate skills. Here is a simple training strategy that ensures the student will have an opportunity to demonstrate.

### On-The-Job Training Strategy

On-The-Job (OJT) is the most common training strategy used in the workplace and for a good reason. OJT can be very effective because it tests both knowledge and skills during the training process. Let's take a look at the OJT steps.

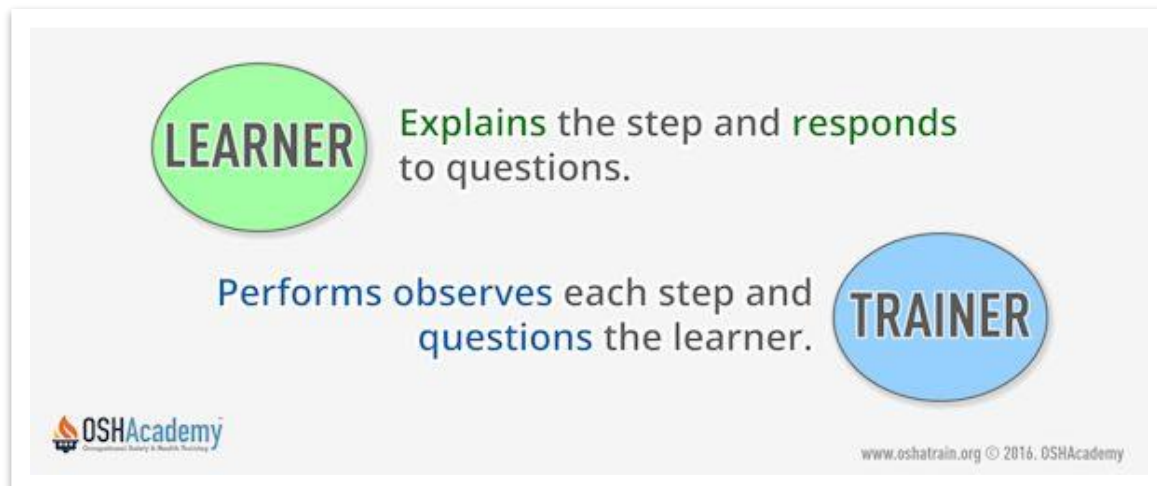
**Step 1: Introduction.** State and discuss the learning objectives and answer any questions the employee may have. Discuss the acceptable standards of knowledge and performance. Tell the trainee what you're going to train. Emphasize the importance of the procedure to the success of the production/service goals. Invite questions. Emphasize the natural and system consequences of their performance. The natural consequences describe the hurt or health that automatically results. The system consequences are those consequences the organization applies as a result of an employee's performance; discipline or positive recognition.



**Step 2: Trainer tells and does.** In this step the trainee becomes familiar with each work practice and why it is important. Review the initial conditions for the procedure. Demonstrate the process, carefully explaining each step as you go. Answer questions and continue to demonstrate and explain until the employee understands what to do, when and why to do it, and how to do it.



**Step 3: Learner tells - Trainer does.** This step is necessary when exposure to hazards inherent in the procedure could cause serious harm. It protects the trainee because the trainer performs the procedure. The trainee explains the procedure to the trainer, while the trainer does it. This gives the trainer an opportunity to discover whether there were any misunderstandings in the previous step. The trainee also responds to trainer questions.



**Step 4: Learner tells and does.** The trainer has the trainee do it. The trainee performs the procedure but remains protected because the trainee explains and gets permission to do the step before proceeding to do it.



**Step 5: Conclusion.** Recognize accomplishment - "Good job!" Reemphasize the importance of the procedure and how it fits into the overall process. Tie the training again to accountability by discussing the natural and system consequences of performance.

**Step 6: Document.** Training documentation should be more than an attendance sheet. Be sure to include the information below to properly document (certify) training in specific safety procedures and practices. Include all of the following even though OSHA rules tell you all that's required is name, subject, and date.

- Trainee's and trainer's name.
- Date of training.
- Subject(s) being trained - procedures, practices, related policies, rules, etc.
- Certification - trainee and trainer signatures.
- Trainee statement of understanding and intent to comply.
- Trainee statement that he/she was provided opportunity to practice.
- Trainer statement that testing of knowledge and skills was conducted.
- Trainer statement that student demonstrated adequate knowledge and skill.

**Step 7: Validate.** At some point in time after the conclusion of the OJT session, observe and question the employee to validate that the training has been successful and that the employee has developed a proper attitude related to the work.

## Online Training

According to a recent letter of interpretation (2/4/09) about online training, OSHA states that an employer may not rely solely on the use of an online or video training program when training the use of PPE. According to OSHA, the trainee must be able to "don, doff, touch, feel and otherwise manipulate a particular piece of personal protective equipment that an employer may require or provide to protect their employees to prevent injury or illness." In addition to the online training (including this course), PPE training must also include a hands-on portion so that the employee can practice using the PPE.

## Retraining Requirements

When the employer has reason to believe that any affected employee who has already been trained does not have the understanding and skill required by the PPE standard, the employer must retrain the employee. Circumstances where retraining is required include, but are not limited to, situations where:

- changes in the workplace render previous training obsolete;
- changes in the types of PPE to be used render previous training obsolete; or
- inadequacies in an affected employee's knowledge or use of assigned PPE indicate that the employee has not retained the requisite understanding or skill.

## Conducting Training

Who will be conducting the training is a very important question. Whoever the person training PPE is, he or she needs to be an expert who not only understands how to use PPE correctly, but has a thorough understanding of the importance of doing so. It's critical that the employee understands the importance of wearing PPE, not only for their safety, but their "continuing employment."

## If it isn't in writing... it didn't happen!

To meet minimum rule requirements, the employer must verify that each affected employee has received and understood the required training. This must be done using a written certification that contains:

1. the name of each employee trained;
2. the date(s) of training; and
3. the subject of the certification.

However, when it comes to documentation of PPE training, it's a good idea to go beyond the minimum requirements stated in the standard to make sure the employer can demonstrate (prove) they have met or exceeded their legal obligations with respect to safety training.

Solid PPE training documentation will contain the elements below.

- A statement by the employee that they have received training by the employer on the six subjects listed above, and that the trainer has demonstrated proper use of the PPE and answered all employee questions about the PPE satisfactorily.
- A statement by the trainer that, through oral/written test, the employee has satisfactorily demonstrated an understanding of the subjects covered during training, and has, through practice, demonstrated the ability to properly don, use, doff, care for, and maintain the PPE.

Below is a one example of training documentation. Your training documentation may look different, but it's very important that both the employee and trainer sign and date the document.

<b>Training Subject</b> _____ <b>Date</b> _____ <b>Location</b> _____		
<b>Trainee certification.</b> I have received on-the-job training on those subjects listed (see lesson plan).		
This training has provided me adequate opportunity to ask questions and practice procedures to determine and correct skill deficiencies. I understand that performing these procedures/practices safely is a condition of employment. I fully intend to comply with all safety and operational requirements discussed. I understand that failure to comply with these requirements may result in progressive discipline (or corrective actions) up to and including termination.		
<b>Employee Name</b>	<b>Signature</b>	<b>Date</b>
_____	_____	_____
_____	_____	_____
<b>Trainer certification.</b> I have conducted orientation/on-the-job training to the employees(s) listed above. I have explained related procedures, practices and policies. Employees were each		

given opportunity to ask questions and practice procedures taught under my supervision. Based on each student's performance, I have determined that each employee trained has adequate knowledge and skills to safely perform these procedures/practices.

\_\_\_\_\_  
**Trainer Name**

\_\_\_\_\_  
**Signature**

\_\_\_\_\_  
**Date**

## Last Words

Remember, PPE training is absolutely critical to an effective program. Effective training will likely prevent serious injury or even a fatality which makes it all worthwhile. OK, let's complete the review quiz.

## Module 2 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. According to OSHA, which of the following is not a required PPE training subject?**
  - a. How to don and doff PPE
  - b. Why PPE is necessary
  - c. What PPE is necessary
  - d. When PPE is necessary
  
- 2. When training a number of employees, knowledge and skills related to the use of PPE is best measured by \_\_\_\_\_.**
  - a. oral or written exam
  - b. demonstration
  - c. written tests and demonstration
  - d. lecture and group exercise
  
- 3. Before an employee is allowed to perform work requiring PPE, the employer must require each affected employee to demonstrate an understanding of the training elements and the ability to use PPE properly.**
  - a. True
  - b. False
  
- 4. This method of training on how to use PPE is most common.**
  - a. Classroom
  - b. Lecture
  - c. On-the-job training (OJT)
  - d. Computer-based training (CBT)

5. To meet minimum rule requirements, the employer must verify that each affected employee has received and understood the required training through a written certification that contains all of the following except: \_\_\_\_\_.
- a. method of training
  - b. name of employee trainer
  - c. date of training
  - d. subject of training

## Module 3: Eye and Face Protection

### Introduction

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 in lost production time, medical expenses, and workers compensation. No dollar figure can adequately reflect the personal toll these accidents take on the injured workers.

### Eye Injuries at Work

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

- Not wearing eye protection. BLS reports that nearly three out of every five workers injured were not wearing eye protection at the time of the accident.
- 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.

### Eye Injury Causes

- Flying particles. 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 a pin head. Most of the particles were said to be traveling faster than a hand-thrown object when the accident occurred.
- Contact with chemicals caused one-fifth of the injuries. Other accidents were caused by objects swinging from a fixed or attached position, like tree limbs, ropes, chains, or tools which were pulled into the eye while the worker was using them.

### Where 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.
- More than a third of the injured workers were operatives, 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.



## Preventing Eye Injuries

- Always wear effective eye protection. To be effective, eye wear must be appropriate for the hazard encountered and properly fitted.
- Better training and education. 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 where and what kind of eyewear should be used.
- Maintenance. Eye protection devices must be properly maintained. Scratched and dirty devices reduce vision, because they glare and may contribute to accidents.

## Description and Use of Eye/Face Protectors

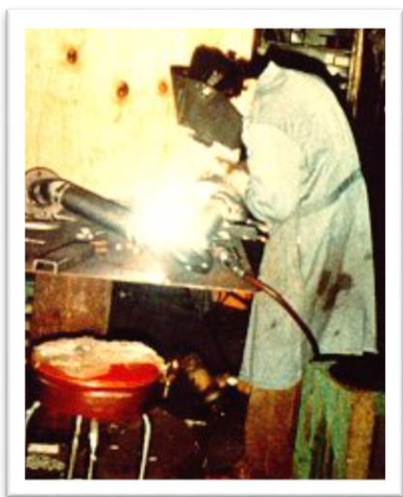
- *Glasses:* Protective eyeglasses are made with safety frames, tempered glass or plastic lenses, temples and side shields which provide eye protection from moderate impact and particles encountered in job tasks such as carpentry, woodworking, grinding, scaling, etc. Safety glasses are also available in prescription form for those persons who need corrective lenses.



- *Goggles:* Vinyl framed 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 insure protection along with proper vision. Welders goggles provide protection from sparking, scaling, or splashing metals and harmful light rays. Lenses are impact resistant and are available in graduated shades of filtration. Chipper/Grinder goggles provide eye protection from flying particles. The dual protective

eye cups house impact resistant clear lenses with individual cover plates.

- *Face Shields:* These normally consist of an adjustable headgear and face shield of tinted/transparent acetate or polycarbonate materials, or wire screen. Face shields are available in various sizes, tensile strength, impact/heat resistance and light ray filtering capacity. Face shields will be used in operations when the entire face needs protection and should be worn to protect eyes and face against flying particles, metal sparks, and chemical/biological splash.



- *Welding Shields:* These shield assemblies consist of:

1. vulcanized fiber or glass fiber body
2. a ratchet/button type adjustable headgear or cap attachment
3. a filter and cover plate holder

These 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:

1. welding;
2. brazing;
3. soldering;
4. resistance welding;
5. bare or shielded electric arc welding;
6. oxyacetylene welding; or
7. cutting operations.

*Let's take a look at the standard...*

## General Requirements

The employer must ensure that each affected employee uses appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.

The employer must ensure that each affected employee uses eye protection that provides side protection when there is a hazard from flying objects. Detachable side protectors (e.g. clip-on or slide-on side shields) meeting the pertinent requirements of the PPE standard are acceptable.

The employer must ensure that each affected employee who wears prescription lenses while engaged in operations that involve eye hazards wears eye protection that incorporates the prescription in its design, or wears eye protection that can be worn over the prescription lenses without disturbing the proper position of the prescription lenses or the protective lenses.

The employer must ensure that each affected employee uses equipment with filter lenses that have a shade number appropriate for the work being performed for protection from injurious light radiation.

## Criteria for Protective Eye and Face Devices

Protective eye and face devices purchased after July 5, 1994 must comply with any of the last three national consensus standards, e.g., ANSI Z87.1-1989, ANSI Z87.1-2003, or ANSI Z87.1-2010 "American National Standard Practice for Occupational and Educational Eye and Face Protection."

Eye and face protective devices purchased before July 5, 1994 must comply with the ANSI "USA standard for Occupational and Educational Eye and Face Protection," Z87.1-1968, or must be demonstrated by the employer to be equally effective.

Eye and face PPE must be distinctly marked to facilitate identification of the manufacturer.

## Lasers

Employees whose occupation or assignment requires exposure to laser beams should be furnished laser safety goggles which will protect for the specific wavelength of the laser and be of optical density adequate for the energy involved.

## What about emergencies?

Emergency eyewash facilities meeting the requirements of ANSI Z358.1-2009 must be provided in all areas where the eyes of any employee may be exposed to corrosive materials. All such emergency facilities will be located where they are easily accessible in an emergency. Technically, the OSHA standard 29 CFR 1910.151(c) addresses exposure only to corrosive materials. However, best practices and the American National Standards Institute (ANSI) recommends eyewash stations and shower equipment in appropriate locations when employees are exposed to hazardous materials, including caustics, as well as additional substances and compounds that are able to produce adverse effects on the health and safety of employees.

### Selection chart guidelines for eye and face protection

Some occupations (not a complete list) for which eye protection should be routinely considered are: carpenters, electricians, machinists, mechanics and repairers, millwrights, plumbers and pipe fitters, sheet metal workers and tinsmiths, assemblers, sanders, grinding machine operators, lathe and milling machine operators, sawyers, welders, laborers, chemical process operators and handlers, and timber cutting and logging workers. The following chart provides general guidance for the proper selection of eye and face protection to protect against hazards associated with the listed hazard "source" operations.

Eye and Face Protection Selection Chart		
Source	Assessment of Hazard	Protection
IMPACT - Chipping, grinding, machining, drilling, chiseling, riveting, sanding, etc.	Flying fragments, objects, large chips, particles, sand, dirt, etc.	Spectacles with side protection, goggles, face shields.  For severe exposure, use face shield over primary eye protection.
HEAT - Furnace operations, pouring, casting, hot dipping, and welding.	Hot sparks	Face shields, goggles, spectacles with side protection. For severe exposure use face shield.
	Splash from molten metals	Face shields, reflective face shields.

	High temperature exposure	Screen face shields, reflective face shields.
CHEMICALS - Acid and chemicals handling	Splash	Goggles, eyecup and cover types. For severe exposure, use face shield over primary eye protection
	Irritating mists	Special-purpose goggles
DUST - Woodworking, buffing, general dusty conditions	Nuisance dust	Goggles, eyecup and cover types.
<b>LIGHT and/or RADIATION</b>		
Welding - electric arc	Optical radiation	Welding helmets or welding shields. Typical shades: 10-14
Welding - gas	Optical radiation	Welding goggles or welding face shield. Typical shades: gas welding 4-8, cutting 3-6, brazing 3-4
Cutting, torch brazing, torch soldering	Optical radiation	Spectacles or welding face shield. Typical shades: 1.5-3

Glare	Poor vision	Spectacles with shaded or special-purpose lenses, as suitable.
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Notes to Eye and Face Protection Selection Chart:

(1) Care should be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards. Adequate protection against the highest level of each of the hazards should be provided. Protective devices do not provide unlimited protection.

(2) Operations involving heat may also involve light radiation. As required by the standard, protection from both hazards must be provided.

(3) Face shields should only be worn over primary eye protection (spectacles or goggles).

(4) As required by the standard, filter lenses must meet the requirements for shade designations in 1910.133(a)(5). Tinted and shaded lenses are not filter lenses unless they are marked or identified as such.

(5) As required by the standard, persons whose vision requires the use of prescription (Rx) lenses must wear either protective devices fitted with prescription (Rx) lenses or protective devices designed to be worn over regular prescription (Rx) eyewear.

(6) Wearers of contact lenses must also wear appropriate eye and face protection devices in a hazardous environment. It should be recognized that dusty and/or chemical environments may represent an additional hazard to contact lens wearers.

(7) Caution should be exercised in the use of metal frame protective devices in electrical hazard areas.

(8) Atmospheric conditions and the restricted ventilation of the protector can cause lenses to fog. Frequent cleansing may be necessary.

(9) Welding helmets or face shields should be used only over primary eye protection (spectacles or goggles).

(10) Non-side shield spectacles are available for frontal protection only, but are not acceptable eye protection for the sources and operations listed for "impact."

(11) Ventilation should be adequate, but well protected from splash entry. Eye and face protection should be designed and used so that it provides both adequate ventilation and protects the wearer from splash entry.

(12) Protection from light radiation is directly related to filter lens density. See note (4) . Select the darkest shade that allows task performance.



## Module 3 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

1. **According to the Bureau of Labor Statistics (BLS), most eye injuries are caused by \_\_\_\_\_.**
  - a. objects striking the eye
  - b. striking against objects
  - c. vibration trauma
  - d. ultraviolet radiation
  
2. **Which category of eye protection is most suitable to prevent exposure to irritating mists?**
  - a. Glasses
  - b. Special-purpose goggles
  - c. Face shield
  - d. Welding shield
  
3. **Employees whose occupation or assignment requires exposure to laser beams should be furnished laser safety goggles which will protect for a range of wavelengths that include that of the laser.**
  - a. True
  - b. False
  
4. **BLS reports that even though the vast majority of employers furnished eye protection at no cost to employees, about \_\_\_\_\_ percent of the workers received no information on where and what kind of eyewear should be used.**
  - a. 10
  - b. 20
  - c. 30
  - d. 40

5. According to the Bureau of Labor Statistics, workers injured while not wearing protective eyewear most often said \_\_\_\_\_.
- a. they are not stylish - they make me look funny
  - b. they believed it was not required by the situation
  - c. management doesn't provide me with any PPE
  - d. they aren't comfortable - they bother me

## Module 4: Respiratory Protection

### Introduction

Black lung, farmer's lung, asbestosis, silicosis... You've probably heard of these work-related respiratory diseases and know of their consequences. These are just a few of the medical conditions that result when workers breathe contaminated air. Protecting workers can be difficult, however, because there are so many types of contaminants and there is no single method for controlling them in all workplaces. Your workplace, like most, may contain one or more of the following hazards in the form of harmful:

- dusts
- fumes
- gases
- sprays
- fogs
- mists
- smokes
- vapors

If hazardous atmospheres are generated by any of the above, it must be controlled to prevent disease to workers. What makes a substance harmful depends on its toxicity, chemical state, physical form, concentration, and the period of time one is exposed. Examples include particulates, gases and vapors, and biological organisms. Harmful effects are wide ranging and may occur immediately or take years to develop.

When the oxygen concentration in normal breathing air drops below 19.5 percent by volume, the air becomes oxygen deficient — a significant concern for those who work in confined spaces. Harmful effects include impaired thinking and coordination, unconsciousness, and death.

### First Priority - Engineer it Out

OSHA standards mandate that employers use engineering control measures as far as feasible to control occupational diseases caused by breathing contaminated air in their workplaces. Engineering control strategies attempt to eliminate or reduce workplace hazards by redesigning or substituting machinery, equipment, tools, and materials.

Examples of acceptable engineering controls to eliminate or reduce atmospheric hazards include:

- enclosure or confinement of the operation;
- general and local ventilation; and
- substitution of less toxic materials.

It's important to know that when effective engineering controls are not feasible, or while they are being instituted, the employer must provide appropriate respirators to protect the health of the employee, and establish and maintain an effective respiratory protective program. And, the employee must use respiratory protection according to their employer's instructions and training.

### Respiratory Protection Program Requirements

The employer must develop and implement a written respiratory protection program with required worksite-specific procedures and elements for required respirator use. The program must be administered by a suitably trained program administrator.

In addition, certain program elements may be required for voluntary use to prevent potential hazards associated with the use of the respirator.

OSHA's CPL 02-02-054 - Respiratory Protection Program Guidelines will give you insight into the OSHA inspection protocol for respiratory protection. Design your own audits with these strategies in mind.



You can't just hand out respirators and expect employees to use them properly. If respirators are necessary to protect your employees, you must have a written program that describes how you will accomplish the following:

- select appropriate respirators for employees;
- conduct medical evaluations for employees who use respirators;
- fit-test employees who use tight-fitting respirators;
- ensure employees use respirators correctly during regular activities and during emergencies;
- ensure respirators are clean and properly maintained;
- ensure air-quality in atmosphere-supplying respirators;
- train employees to protect themselves from respiratory hazards; and
- evaluate your program's effectiveness.

These are the critical elements of a respiratory protection program. An effective program ensures that employees are medically able to use respirators, that their respirators fit properly, and that they know how to use and care for them.

## Inspection Requirements

Respiratory protection is no better than the respirator in use, even though it is worn correctly. Frequent random inspections must be conducted by a qualified individual to assure that respirators are properly selected, used, cleaned, and maintained.

### Inspecting respirators

Follow the important points below when inspecting respirators.

- Inspect respirators that are used routinely during cleaning.
- Replace any worn or deteriorated parts.
- Be sure to thoroughly inspect respirators for emergency use, such as self-contained devices, at least once a month and after each use.
- Inspect self-contained breathing apparatus monthly.
- Make sure air and oxygen cylinders are fully charged according to the manufacturer's instructions.
- Make sure that the regulator and warning devices function properly.
- Check the tightness of connections and the condition of the facepiece, headbands, valves, connecting tube, and canisters.
- Inspect rubber or elastomer (elastic rubber) parts for pliability and signs of deterioration.
- Stretch and manipulate rubber or elastomer parts with a massaging action to keep them pliable and flexible and prevent them from taking a set during storage.
- A record must be kept of inspection dates and findings for respirators maintained for emergency use.

**Inspecting the work area:** Make sure appropriate surveillance of work area conditions and degree of employee exposure or stress is conducted.

**Inspecting the program:** Regularly inspect and evaluate the program to determine its continued effectiveness.

## Training

For an effective respirator program, it's essential that supervisors and workers be properly instructed by a competent person in:

- selecting appropriate protection;
- donning and doffing;
- using respirators;
- storing and maintaining respirators;
- detecting defects;
- proper fitting; and
- testing for proper seal.

In your initial and annual respirator training, be sure to include both an educational component and a training component. The educational component increases the learner's understanding of the importance of using respirators. The training component establishes or improves the skills needed to use the respirator.

Make sure students wear the respirator in normal air for a long familiarity period and then in a test atmosphere.

## Selecting Respirators

It's important to select and provide an appropriate respirator based on the respiratory hazard(s) to which the worker is exposed and workplace and user factors that affect respirator performance and reliability. The employer must select a NIOSH-certified respirator. The respirator must be used in compliance with the conditions of its certification.

The employer must identify and evaluate the respiratory hazard(s) in the workplace. This evaluation must include a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form.

Where the employer cannot identify or reasonably estimate the employee exposure, the employer must consider the atmosphere to be Immediately Dangerous to Life or Health (IDLH). Immediately dangerous to life or health means an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

The employer must select respirators from a sufficient number of respirator models and sizes so that the respirator is acceptable to and correctly fits the user.

## Respirators for atmospheres that Are IDLH

The employer must provide the following respirators for employee use in IDLH atmospheres:

- A full facepiece pressure demand SCBA certified by NIOSH for a minimum service life of thirty minutes, or
- A combination full facepiece pressure demand supplied-air respirator (SAR) with auxiliary self-contained air supply.

Respirators provided only for escape from IDLH atmospheres must be NIOSH-certified for escape from the atmosphere in which they will be used.

All oxygen-deficient atmospheres must be considered IDLH. Exception: If the employer demonstrates that, under all foreseeable conditions, the oxygen concentration can be maintained within the ranges specified in Table II of the standard (i.e., for the altitudes set out in the table), then any atmosphere-supplying respirator may be used.

## Respirators for Atmospheres that Are Not IDLH

The employer must provide a respirator that is adequate to protect the health of the employee and ensure compliance with all other OSHA statutory and regulatory requirements, under routine and reasonably foreseeable emergency situations.

The respirator selected must be appropriate for the chemical state and physical form of the contaminant.

For protection against gases and vapors, the employer must provide an atmosphere-supplying respirator, or an air-purifying respirator, provided that:

- The respirator is equipped with an end-of-service-life indicator (ESLI) certified by NIOSH for the contaminant; or
- If there is no ESLI appropriate for conditions in the employer's workplace, the employer implements a change schedule for canisters and cartridges that is based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life. The employer must describe in the respirator program the information and data relied upon and the basis for the canister and cartridge change schedule and the basis for reliance on the data.

For protection against particulates, the employer must provide:

- An atmosphere-supplying respirator; or
- An air-purifying respirator equipped with a filter certified by NIOSH under 30 CFR part 11 as a high efficiency particulate air (HEPA) filter, or an air-purifying respirator equipped with a filter certified for particulates by NIOSH under 42 CFR part 84; or
- For contaminants consisting primarily of particles with mass median aerodynamic diameters (MMAD) of at least 2 micrometers, an air-purifying respirator equipped with any filter certified for particulates by NIOSH.

## Using Respirators

*Written procedures:* It's important to develop standard procedures for respirator use. These should include all information and guidance necessary for their proper selection, use, and care. Also include possible emergency and routine uses of respirators.

*Physical ability to use:* Make sure employees are not assigned to tasks requiring respirators unless they are physically able to adequately perform the work and use the equipment. If there is any question or concern about using the respirator, a local physician must determine what health and physical conditions are pertinent. In such cases, periodically review the respirator user's medical status.

*Face seal:* Do not wear respirators when conditions prevent a good face seal. Such conditions may be a growth of beard, sideburns, a skull cap that projects under the facepiece, or temple pieces on glasses. Also, the absence of one or both dentures can seriously affect the fit of a facepiece. It's important to conduct periodic evaluation of worker compliance with this requirement. To assure proper protection, the facepiece fit must be checked by the wearer, using the manufacturer's facepiece fittings instructions, each time he or she puts on the respirator.

*Using corrective lenses:* Providing respiratory protection for individuals wearing corrective glasses is a serious problem. A proper seal is impossible if the temple bars of eye glasses extend through the sealing edge of the full facepiece. As a temporary measure, taping glasses with short temple bars or without temple bars to the wearer's head is acceptable. Systems have been developed for mounting corrective lenses inside full facepieces. When a worker must wear corrective lenses as part of the facepiece, the facepiece and lenses must be fitted by qualified individuals to provide good vision, comfort, and a gas-tight seal.

If corrective spectacles or goggles are required, they must not affect the fit of the facepiece. Proper selection of equipment is important to avoid this problem.



*Using contact lenses:* 1910.134, Respiratory Protection, states that wearing contact lenses in contaminated atmospheres is not permitted.

### Maintaining Respirators

Equipment must be properly maintained to retain its original effectiveness.

Respirators must be regularly cleaned and disinfected. Those used by more than one worker must be thoroughly cleaned and disinfected after each use.

Respirators must be stored in a convenient, clean, and sanitary location. A program for maintenance and care of respirators must be adjusted to the type of plant, working conditions, and hazards involved, and must include the following basic services:

- inspection for defects (including a leak check);
- cleaning and disinfecting;
- repair; and
- storage.

Routinely used respirators must be collected, cleaned, and disinfected as frequently as necessary to insure that proper protection is provided for the wearer. Respirators maintained for emergency use must be cleaned and disinfected after each use.

Replacement or repairs must be done only by experienced persons with parts designed for the respirator. No attempt must be made to replace components or to make adjustments or repairs beyond the manufacturer's recommendations. Reducing or admission valves or regulators must be returned to the manufacturer or to a trained technician for adjustment or repair.

### Storing Respirators

After inspection, cleaning, and necessary repair, respirators must be stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Respirators placed at stations and work areas for emergency use should be quickly accessible at all times and should be stored in compartments built for the purpose. The compartments should be clearly marked. Routinely used respirators, such as dust respirators, may be placed



in plastic bags. Respirators should not be stored in such places as lockers or tool boxes unless they are in carrying cases or cartons.

Respirators should be packed or stored so that the facepiece and exhalation valve will rest in a normal position and function will not be impaired by the elastomer setting in an abnormal position.

### Emergency Procedures

In areas where the wearer, with failure of the respirator, could be overcome by a toxic or oxygen-deficient atmosphere, at least one additional person must be present. Communications (visual, voice, or signal line) must be maintained between both or all individuals present. Planning must be such that one individual will be unaffected by any likely incident and have the proper rescue equipment to be able to assist the other(s) in case of emergency.

When self-contained breathing apparatus or hose masks with blowers are used in atmospheres immediately dangerous to life or health, standby persons must be present with suitable rescue equipment.

Persons using air line respirators in atmospheres immediately hazardous to life or health must be equipped with safety harnesses and safety lines for lifting or removing persons from hazardous atmospheres or other and equivalent provisions for the rescue of persons from hazardous atmospheres must be used. A standby person or persons with suitable self-contained breathing apparatus must be at the nearest fresh air base for emergency rescue.

### Medical Evaluation

Using a respirator may place a physiological burden on employees that varies with the type of respirator worn, the job and workplace conditions in which the respirator is used, and the medical status of the employee.

The employer must provide a medical evaluation to determine the employee's ability to use a respirator, before the employee is fit tested or required to use the respirator in the workplace. The employer may discontinue an employee's medical evaluations when the employee is no longer required to use a respirator.

## Medical Evaluation Procedures

The employer must identify a physician or other licensed health care professional (PLHCP) to perform medical evaluations using a medical questionnaire or an initial medical examination that obtains the same information as the medical questionnaire.

The medical evaluation must obtain the information requested by the questionnaire in Sections 1 and 2, Part A of Appendix C of the standard.

## Follow-up Medical Examination

The employer must ensure that a follow-up medical examination is provided for an employee who gives a positive response to any question among questions 1 through 8 in Section 2, Part A of Appendix C of the standard or whose initial medical examination demonstrates the need for a follow-up medical examination.

The follow-up medical examination must include any medical tests, consultations, or diagnostic procedures that the PLHCP deems necessary to make a final determination.

## Medical Determination

In determining the employee's ability to use a respirator, the employer must obtain a written recommendation regarding the employee's ability to use the respirator from the PLHCP. The recommendation must provide only the following information:

- any limitations on respirator use related to the medical condition of the employee, or relating to the workplace conditions in which the respirator will be used, including whether or not the employee is medically able to use the respirator;
- the need, if any, for follow-up medical evaluations; and
- a statement that the PLHCP has provided the employee with a copy of the PLHCP's written recommendation.

If the respirator is a negative pressure respirator and the PLHCP finds a medical condition that may place the employee's health at increased risk if the respirator is used, the employer must provide a PAPR if the PLHCP's medical evaluation finds that the employee can use such a respirator; if a subsequent medical evaluation finds that the employee is medically able to use a negative pressure respirator, then the employer is no longer required to provide a PAPR.

### Additional Medical Evaluations

At a minimum, the employer must provide additional medical evaluations that comply with the requirements of this section if:

- an employee reports medical signs or symptoms that are related to their ability to use a respirator;
- a PLHCP, supervisor, or the respirator program administrator informs the employer that an employee needs to be reevaluated;
- information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or
- a change occurs in workplace conditions (e.g., physical work effort, protective clothing, or temperature) that may result in a substantial increase in the physiological burden placed on an employee.

### Identification of Filters, Cartridges, and Canisters

The employer must ensure that all filters, cartridges and canisters used in the workplace are labeled and color coded with the NIOSH approval label and that the label is not removed and remains legible.

### Where respirator use is not required

An employer may provide respirators at the request of employees or permit employees to use their own respirators, if the employer determines that such respirator use will not in itself create a hazard.

If the employer determines that any voluntary respirator use is permissible, the employer must provide the respirator users with the information contained in Appendix D of the standard.

In addition, the employer must establish and implement those elements of a written respiratory protection program necessary to ensure that any employee using a respirator voluntarily is medically able to use that respirator, and that the respirator is cleaned, stored, and maintained so that its use does not present a health hazard to the user. Exception: Employers are not required to include in a written respiratory protection program those employees whose only use of respirators involves the voluntary use of filtering face pieces (dust masks).

## Last Words

OK, that was a lot of information. Remember this was only a brief overview of respirator use. In the next module, we'll be taking a look at requirements for head, hand, and foot personal protective equipment. Well, it's time for the review quiz, so let's do it!

## Module 4 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. Which of the following is not listed as a respiratory hazard in the text?**
  - a. Particles
  - b. Mists
  - c. Fumes
  - d. Sprays
  
- 2. OSHA mandates that controlling occupational diseases caused by breathing contaminated air should be done primarily by \_\_\_\_\_.**
  - a. engineering controls
  - b. administrative controls
  - c. educational controls
  - d. enforcement controls
  
- 3. All of the following are considered acceptable engineering controls to eliminate the need for respiratory protection, except \_\_\_\_\_.**
  - a. general and local ventilation
  - b. substitution with less toxic materials
  - c. warning signs directing no entry
  - d. enclosure of the operation

- 4. Which of the following is not listed in the text as a factor that makes a substance harmful?**
- a. Chemical state
  - b. Physical form
  - c. Dose
  - d. Period of exposure
- 5. Which of the following is not listed as an element in a respiratory protection program?**
- a. Ensure employees know how to use respirators
  - b. Respirators fit properly
  - c. Employees know about respirator use and care
  - d. Disciplinary procedures

## Module 5: Head, Hand and Foot Protection

### Head Protection

There are primarily two situations when employees must wear protective helmets.

#### 1. Falling objects

When there is a potential in the workplace for injury to the head from falling objects, the employer must make sure that each affected employee wears a protective helmet.

Some examples of work that might require helmets to protect from falling objects include:

- working below other workers who are using tools and materials which could fall;
- working around or under conveyor belts which are carrying parts or materials; and
- working below machinery or processes which might cause material or objects to fall.

Some examples of occupations for which head protection should be routinely considered are:

- |                             |                              |
|-----------------------------|------------------------------|
| • carpenters                | • sawyers                    |
| • electrician               | • welders                    |
| • linemen                   | • laborers                   |
| • mechanics and repairers   | • freight handlers           |
| • plumbers and pipe fitters | • timber cutting and logging |
| • assemblers                | • stock handlers             |
| • packers                   | • warehouse laborers         |
| • wrappers                  |                              |

#### 2. Electrical hazards

The second situation requiring a helmet is to protect the worker from electrical hazards. Whenever an employee works near exposed electrical conductors which could contact the head, the employer must make sure that a protective helmet designed to reduce electrical shock hazard is worn by the employee.

The employer should also furnish and make sure all employees and contractors engaged in construction and other miscellaneous work use proper head protection. Engineers, inspectors, and visitors at construction sites must also wear protective helmets when hazards from falling or fixed objects, or electrical shock are present.



## Criteria for Protective Helmets

Protective helmets purchased after July 5, 1994 must comply with ANSI Z89.1-1986, ANSI Z89.1-1997, or ANSI Z89.1-2003 (before July 5, 1994 - Z89.1-196) or must be demonstrated by the employer to be equally effective. Purchasing helmets that meet these standards ensures that appropriate testing has been conducted and that the quality of the materials (webbing and shell) is adequate.

## Selection Guidelines for Head Protection

When selecting head protection, knowledge of potential for falling objects and electrical hazards is important. When it's determined that these hazards exist, choose the most appropriate helmet from the categories listed below.

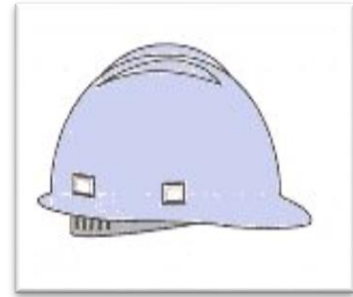
### *Impact Type Helmets*

- Type I: A helmet of Type I is designed to provide protection only to the top of the head. It is not intended to provide impact from side impacts. (This is by far the most commonly used type of hard hat in use.)
- Type II: A helmet of Type II is designed to provide protection against both top and side impacts.



### *Electrical Classes*

**Class G (General):** Class G helmets are intended to reduce the danger of contact exposure to low voltage conductors. Test samples are proof-tested at 2200 volts (phase to ground). However, this voltage is not intended as an indication of the voltage at which the helmet protects the wearer.



**Class E (Electrical):** Class E helmets are intended to reduce the danger of exposure to high voltage conductors. Test samples are proof-tested at 20,000 volts (phase to ground). However, this voltage is not intended as an indication of the voltage at which the helmet protects the wearer.

**Class C (Conductive):** Class C helmets are not intended to provide protection against contact with electrical conductors.

### *Bump Caps*

Bump caps/skull guards should be issued and worn for protection against scalp lacerations from contact with sharp objects. However, it's very important to understand that they must not be worn as substitutes for safety caps/hats because they do not provide protection from impact forces or penetration by falling objects.



### *What the Rule Says About Head Protection*

In 1997 ANSI revised the standard for Industrial Head Protection, ANSI Z89.1-1997. The following facts highlight significant points and changes to the new head protection requirements that are found in the standard and should be considered while evaluating appropriate head protection when conducting a personal protective equipment assessment.

OSHA's PPE standard (1910.135) specifies that helmets must meet requirements established by ANSI Z89.1-1986. The new ANSI Z89.1997 standard contains additional criteria for helmets. The new requirements are entirely voluntary until 1910.135 is changed to reflect the later standard.

Helmets that are designed and manufactured to the new standard are acceptable for use. The new ANSI Z89.1-1997 establishes guidelines for two different levels of impact protection: Type 1 is intended to reduce the force of impact resulting from a blow to the top of the head. Type 2 is intended to reduce the force of impact resulting from a blow which may be received off center or to the top of the head.

Workers in some occupations who are exposed to falling objects which may hit the helmet off center or on the side may be inadequately protected and at risk of injury since the type 1 hard hat is not designed to take this angle of impact.

Periodic examinations should be made of all protective helmets and, and in particular, those worn or stored in areas exposed to sunlight for long periods. Ultraviolet degradation may first manifest itself in a loss of surface gloss, called chalking or discoloration. Upon further degradation, the surface will craze or flake away, or both. At the first appearance of any of these phenomena, the shell should be replaced.

## Hand Protection

### Hazards Requiring Hand Protection

Most companies use some type of chemicals in their workplaces. Some of these chemicals are hazardous and require PPE to protect employees against toxic effects. More than any other part of the body, our hands are most likely to come in contact with these hazardous chemicals. Employees may be exposed to the chemical hazards listed below.

- Absorption of harmful substances
- Chemical burns
- Rashes

But, hazardous chemicals are not the only worry. Employees may also be exposed to other hazards that could injure their hands. These hazards include:

- cuts or lacerations;
- abrasions;
- punctures;
- thermal burns; and
- harmful temperature extremes.

Consequently, it's crucial that employers select and require employees to use appropriate hand protection when exposed to any of these hazards.

### Selection of Hand Protection

It's important that employers work closely with their PPE supplier to select appropriate hand protection based on an evaluation of the performance characteristics of the hand protection. Specifically the employer needs to look at each of the following:

- specific task(s) being performed;
- environmental conditions present;
- duration of hand protection use while performing the task;
- the actual hazards; and
- potential hazards.

The work activities of the employee should also be studied to determine:

- the degree of dexterity required;
- the duration of the task;
- the frequency of the task;
- degree of exposure of the hazard; and
- the physical stresses that will be applied.

OSHA is unaware of any gloves that provide protection against all potential hand hazards. Commonly available glove materials provide only limited protection against many chemicals. Therefore, it is important to select the most appropriate glove for a particular application as well as to determine how long it can be worn and whether it can be reused.

Chemicals will eventually soak through or "permeate" most glove materials rendering them unsafe. Gloves can be used safely for limited time periods if specific use and other characteristics (i.e., thickness, permeation rate and time) are known. Your PPE supplier can be an excellent expert source to assist in determining the specific type of glove material that should be worn for a particular chemical.

These performance characteristics should be assessed by using standard test procedures. Before purchasing gloves, the employer should request documentation from the manufacturer that the gloves meet the appropriate test standard(s) for the hazard(s) anticipated.

Read instructions and warnings on chemical container labels and MSDSs before working with any chemical. Recommended glove types are often listed in the section for personal protective equipment. However, it's important to check with your PPE supplier to make sure the list is current and accurate.

One more consideration is that as long as the performance characteristics are acceptable, in certain circumstances, it may be more cost effective to regularly replace less expensive gloves than to reuse more expensive types.

When selecting gloves for protection against chemical hazards, consider the following:

- the toxic properties of the chemical(s) must be determined; in particular, the ability of the chemical to cause local effects on the skin and/or to pass through the skin and cause systemic effects;
- generally, any "chemical resistant" glove can be used for dry powders;
- for mixtures and formulated products (unless specific test data are available), a glove should be selected on the basis of the chemical component with the shortest breakthrough time, since it is possible for solvents to carry active ingredients through polymeric materials; and
- employees must be able to remove the gloves in such a manner as to prevent skin contamination.

Skin contact is a potential source of exposure to toxic materials; it is important that the proper steps be taken to prevent such contact. Most accidents involving hands and arms can be classified under four main hazard categories: chemicals, abrasions, cutting, and heat. There are gloves available that can protect workers from any of these individual hazards or any combination thereof.

Gloves should be replaced periodically, depending on frequency of use and permeability to the substance(s) handled. Gloves overtly contaminated should be rinsed and then carefully removed after use. With this in mind, there are two important characteristics of gloves to consider.

*Permeation rate:* The permeation rate measures the length of time it takes a given material (glove) to become saturated by the chemical through absorption.

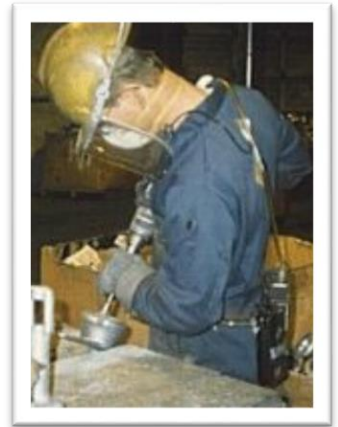
*Breakthrough or Penetration rate:* The penetration rate measures the speed with which a given chemical breaks through the layer(s) of the glove to contact the skin.

## Hand Protection When Working With Tools

Gloves should also be worn whenever it is necessary to handle rough or sharp-edged objects, and very hot or very cold materials. The type of glove material to be used in these situations includes leather, welder's gloves, aluminum-backed gloves, and other types of insulated glove materials.

Careful attention must be given to protecting your hands when working with tools and machinery. Power tools and machinery must have guards installed or incorporated into their design that prevent the hands from contacting the point of operation, power train, or other moving parts. To protect hands from injury due to contact with moving parts, it is important to:

- ensure that guards are always in place and used;
- always lock-out machines or tools and disconnect the power before making repairs;
- treat a machine without a guard as inoperative; and
- do not wear gloves around moving machinery or parts, such as drill presses, mills, lathes, and grinders.



## Glove Guide

Below is a guide to the most common types of protective work gloves and the types of hazards they can guard against.

- *Disposable Gloves:* Disposable gloves, usually made of light-weight plastic, can help guard against mild irritants.
- *Fabric Gloves:* Made of cotton or fabric blends are generally used to improve grip when handling slippery objects. They also help insulate hands from mild heat or cold.
- *Leather Gloves:* These gloves are used to guard against injuries from sparks or scraping against rough surfaces. They are also used in combination with an insulated liner when working with electricity.
- *Metal Mesh Gloves:* These gloves are used to protect hands from accidental cuts and scratches. They are used most commonly by persons working with cutting tools or other sharp instruments.
- *Aluminized Gloves:* Gloves made of aluminized fabric are designed to insulate hands from intense heat. These gloves are most commonly used by persons working molten materials.

- *Chemical Resistance Gloves:* These gloves may be made of rubber, neoprene, polyvinyl alcohol or vinyl, etc. The gloves protect hands from corrosives, oils, and solvents. The glove chart below may serve as a guide to the different types of glove materials and the chemicals they can be used against. When selecting chemical resistance gloves, be sure to consult the manufacturer's recommendations, especially if the gloved hand will be immersed in the chemical.

## Glove Chart

Type	Advantages	Disadvantages	Use Against
Natural rubber	Low cost, good physical properties, dexterity	Poor vs. oils, greases, organics. Frequently imported; may be poor quality	Bases, alcohols, dilute water solutions; fair vs. aldehydes, ketones.
Natural rubber blends	Low cost, dexterity, better chemical resistance than natural rubber vs. some chemicals	Physical properties frequently inferior to natural rubber	Same as natural rubber
Polyvinyl chloride (PVC)	Low cost, very good physical properties, medium cost, medium chemical resistance	Plasticizers can be stripped; frequently imported; may be poor quality	Strong acids and bases, salts, other water solutions, alcohols
Neoprene	Medium cost, medium chemical resistance, medium physical properties	NA	Oxidizing acids, anilines, phenol, glycol ethers
Nitrile	Low cost, excellent physical properties, dexterity	Poor vs. benzene, methylene chloride, trichloroethylene, many ketones	Oils, greases, aliphatic chemicals, xylene, perchloroethylene, trichloroethane; fair vs. toluene
Butyl	Specialty glove, polar organics	Expensive, poor vs. hydrocarbons, chlorinated solvents	Glycol ethers, ketones, esters
Polyvinyl alcohol (PVA)	Specialty glove, resists a very broad range of	Very expensive, water sensitive, poor vs. light alcohols	Aliphatics, aromatics, chlorinated solvents,



	organics, good physical properties		ketones (except acetone), esters, ethers
Fluoro-elastomer (Viton)	Specialty glove, organic solvents	Extremely expensive, poor physical properties, poor vs. some ketones, esters, amines	Aromatics, chlorinated solvents, also aliphatics and alcohols
Norfoil (Silver Shield)	Excellent chemical resistance	Poor fit, easily punctures, poor grip, stiff	Use for Hazmat work

## Foot protection

The employer must make sure that each affected employee uses protective footwear when working in areas where there is a danger of foot injuries due to:

- falling or rolling objects;
- objects piercing the sole; and/or
- where feet are exposed to electrical hazards.

### Criteria for protective footwear

Protective footwear purchased after July 5, 1994 must comply with ANSI Z41-1991, ANSI Z41-1999, or ASTM F-2413-2005 (before July 5, 1994 - ANSI Z41.1-1967) or must be demonstrated by the employer to be equally effective.

Footwear that meets established safety standards will have an American National Standards Institute (ANSI) label inside each shoe.

### Steel-Reinforced Safety Shoes

These shoes are designed to protect feet from common machinery hazards such as falling or rolling objects, cuts, and punctures. The entire toe box and insole are reinforced with steel, and the instep is protected by steel, aluminum, or plastic materials. Safety shoes are also designed to insulate against



temperature extremes and may be equipped with special soles to guard against slips, chemicals, and/or electrical hazards.

### Safety Boots

Safety boots offer more protection when splash or spark hazards (chemicals, molten materials) are present.

- When working with corrosives, caustics, cutting oils, and petroleum products, neoprene or nitrile boots are often required to prevent penetration.
- Foundry or "Gaiter" style boots feature quick-release fasteners or elasticized insets to allow speedy removal should any hazardous substances get into the boot itself.
- When working with electricity, special electrical hazard boots are available and are designed with no conductive materials other than the steel toe (which is properly insulated).

### Selection guidelines for foot protection

Safety shoes and boots which meet the ANSI Z41-1991 Standard provide both impact and compression protection.

Safety shoes or boots with impact protection would be required for carrying or handling materials such as packages, objects, parts or heavy tools, which could be dropped; and, for other activities where objects might fall onto the feet.

Safety shoes or boots with compression protection would be required for work activities involving skid trucks (manual material handling carts) around bulk rolls (such as paper rolls) and around heavy pipes, all of which could potentially roll over an employee's feet.

Safety shoes or boots with puncture protection would be required where sharp objects such as nails, wire, tacks, screws, large staples, scrap metal etc., could be stepped on by employees causing a foot injury.

## Last Words

There are many types and styles of protective head, hand and foot gear. It's important to realize that a particular job may require additional protection other than listed here. Now, it's time to take the next module quiz.

## Module 5 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. Head protection is required only when hazards from falling objects are present.**
  - a. true
  - b. false
  
- 2. Which classification of helmet should not be used around electrical conductors?**
  - a. Class A
  - b. Class B
  - c. Class C
  - d. Class D
  
- 3. When selecting hand protection, all of the following are important work activities to consider except: \_\_\_\_\_.**
  - a. the cost of the hand protection
  - b. the duration of the task
  - c. the frequency of the task
  - d. the degree of exposure of the hazard
  
- 4. The \_\_\_\_\_ rate measures the speed with which a given chemical breaks through the layer(s) of the glove to contact the skin.**
  - a. permeation
  - b. penetration
  - c. permetration
  - d. permenation

5. According to the text, safety shoes or boots with compression protection are required for work where sharp objects such as nails, wire, tacks, screws, large staples, scrap metal etc., could be stepped on by employees causing a foot injury.
- a. true
  - b. false

## Module 6: Electrical Protective Equipment

### Care and Use of Electrical Protective Equipment

To prevent injury from exposure to electrical conductors, it's important that all electrical protective equipment be maintained in a safe, reliable condition. Electrical protective equipment includes the following:

- insulating blankets;
- covers;
- line hose;
- gloves; and
- sleeves made of rubber.

All electrical protective equipment made of rubber should meet the established safety standards and specifications discussed below.

Note: For more on this topic, see Course 715, Electrical Safety Basics.

## Voltages

Maximum use voltages must conform to those listed in Table I-4.

**Table I-4: Rubber Insulating Equipment Voltage Requirements**

Class of Equipment	Maximum Use Voltage <sup>1</sup> (AC rms)	Retest Voltage <sup>2</sup> (AC - rms)	Retest Voltage <sup>2</sup> (DC - avg)
<b>00</b>	<b>500</b>	<b>2,500</b>	<b>10,000</b>
<b>0</b>	<b>1,000</b>	<b>5,000</b>	<b>20,000</b>
<b>1</b>	<b>7,500</b>	<b>10,000</b>	<b>40,000</b>
<b>2</b>	<b>17,000</b>	<b>20,000</b>	<b>50,000</b>
<b>3</b>	<b>25,500</b>	<b>30,000</b>	<b>60,000</b>
<b>4</b>	<b>36,000</b>	<b>40,000</b>	<b>70,000</b>

<sup>1</sup> The maximum use voltage is the ac voltage (rms) classification of the protective equipment that designates the maximum nominal design voltage of the energized system that may be safely worked. The nominal design voltage is equal to the phase-to-phase voltage on multiphase circuits. However, the phase-to-ground potential is considered to be the nominal design voltage if:

1. There is no multiphase exposure in a system area and the voltage exposure is limited to the phase-to-ground potential, or
2. The electric equipment and devices are insulated or isolated or both so that the multiphase exposure on a grounded wye circuit is removed.

<sup>2</sup> The proof-test voltage shall be applied continuously for at least 1 minute, but no more than 3 minutes.

## Inspecting Equipment

To make sure electrical protective equipment actually performs as designed, it must be inspected for damage before each day's use and immediately following any incident that can reasonably be suspected of having caused damage. Insulating gloves must be given an air test, along with the inspection.

## Defects

Insulating equipment must not be used if any of the following defects are detected:

- a hole, tear, puncture, or cut;
- ozone cutting or ozone checking (the cutting action produced by ozone on rubber under mechanical stress into a series of interlacing cracks);
- an embedded foreign object;
- changes in the texture including, swelling, softening, hardening, or becoming sticky or inelastic; or
- any other defect that damages the insulating properties.

Insulating equipment found to have other defects that might affect its insulating properties must be removed from service and returned for testing. It must be cleaned as needed to remove foreign substances. It must be stored in such a location and in such a manner to protect it from:

- light;
- temperature extremes;
- excessive humidity;
- ozone; and
- other injurious substances and conditions.



## Gloves

Protector gloves must be worn over insulating gloves. An exception is when using Class 0 gloves, under limited-use conditions, where small equipment and parts manipulation necessitate unusually high finger dexterity. But, it's important to note that extra care must be taken while visually examining the glove. Also, make sure to avoid handling sharp objects.

Any other class of glove may be used for similar work without protector gloves if the employer can demonstrate that the possibility of physical damage to the gloves is small and if the class of glove is one class higher than that required for the voltage involved. Insulating gloves that have been used without protector gloves may not be used at a higher voltage until they have been tested.



## Testing

Electrical protective equipment must be subjected to periodic electrical tests. Test voltages and the maximum intervals between tests must be in accordance with Table I-4 and Table I-5

**Table I-5: Rubber Insulating Equipment Test Intervals**

Type of Equipment	When to Test
Rubber insulating line hose	Upon indication that insulating value is suspect and after repair.
Rubber insulating covers	Upon indication that insulating value is suspect and after repair.
Rubber insulating blankets	Before first issue and every 6 months thereafter <sup>1</sup> upon indication that insulating value is suspect; after repair; and after use without protectors.
Rubber insulating sleeves	Before first issue and every 12 months thereafter <sup>1</sup> upon indication that insulating value is suspect; and after repair.

<sup>1</sup> If the insulating equipment has been electrically tested but not issued for service, the insulating equipment may not be placed into service unless it has been electrically tested within the previous 12 months.

The test method used must reliably indicate whether the insulating equipment can withstand the voltages involved. Repaired insulating equipment must be retested before it may be used by employees.

Note: Standard electrical test methods considered as meeting this requirement are given in the national consensus standards of The American Society for Testing and Materials (ASTM).

If the insulating equipment fails to pass inspections or electrical tests, it may not be used by employees. Below is a list of exceptions.

- Rubber insulating line hose may be used in shorter lengths with the defective portion cut off.
- Rubber insulating blankets may be repaired using a compatible patch that results in physical and electrical properties equal to those of the blanket.
- Rubber insulating blankets may be salvaged by severing the defective area from the undamaged portion of the blanket. The resulting undamaged area may not be smaller than 22 inches by 22 inches (560 mm by 560 mm) for Class 1, 2, 3, and 4 blankets.
- Rubber insulating gloves and sleeves with minor physical defects, such as small cuts, tears, or punctures, may be repaired by the application of a compatible patch. Also, rubber insulating gloves and sleeves with minor surface blemishes may be repaired with a compatible liquid compound. The patched area must have electrical and physical properties equal to those of the surrounding material. Repairs to gloves are permitted only in the area between the wrist and the reinforced edge of the opening.

## Certification

The employer must certify that equipment has been tested in accordance with the requirements of the standard, and the certification must identify the equipment that passed the test and the date it was tested.

Marking equipment and entering the results of the tests and the testing dates onto logs are two acceptable ways to meet this requirement.

## Module 6 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

1. According to Table I-5, below, the maximum use ac-rms voltage for class 1 rubber equipment is \_\_\_\_\_.

- a. 1,000
- b. 7,500
- c. 10,000
- d. 40,000

Table I-5. - Rubber Insulating Equipment Voltage Requirements

Class of equipment	Maximum use voltage(1)	Retest voltage(2)	Retest voltage(2)
	ac - rms	ac - rms	dc - avg
0.....	1,000	5,000	20,000
1.....	7,500	10,000	40,000
2.....	17,000	20,000	50,000
3.....	26,500	30,000	60,000
4.....	36,000	40,000	70,000

2. To make sure electrical protective equipment actually performs as designed, it must be inspected for damage \_\_\_\_\_.

- a. at the end of each quarter
- b. prior to the beginning of a work shift
- c. monthly and following any incident causing damage
- d. before each day's use and following any incident in which damage is suspected

**3. Insulating equipment may still be used if you detect which of the following defects?**

- a. Holes, tears, punctures or cuts
- b. Ozone cutting or checking
- c. Embedded foreign object
- d. Change in color

**4. Which of the following is not a requirement if insulating equipment is found to have "other" defects that might affect insulating properties?**

- a. Removal from service and tested
- b. Cleaned as needed
- c. Disposal
- d. Protection from injurious conditions

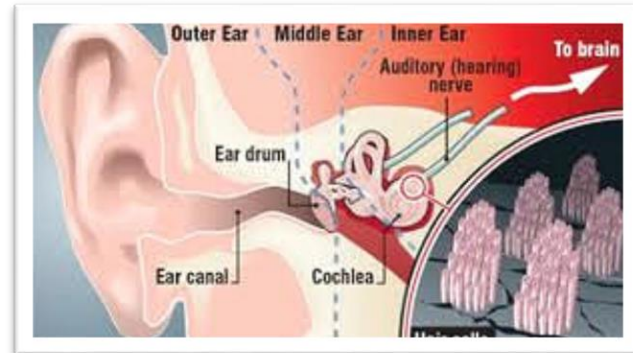
**5. To certify electrical protective equipment has been tested, it is recommended that the employer: \_\_\_\_\_.**

- a. mark the equipment
- b. record the results of the test
- c. record the date of the test
- d. all of the above

## Module 7: Hearing Protection

### What's the noise all about?

Most of us take hearing for granted. When we go home at the end of a workday and when we get up in the morning, we expect to hear well. Human hearing is amazingly sensitive. Our ears can distinguish 400,000 different sounds and can detect sounds so quiet that they cause the eardrum to vibrate less than 1/80,000,000th of an inch. But that remarkable sensitivity doesn't have a lifetime guarantee — to maintain it, you have to care for it. In our society, noise is as much a part of our lives as the air we breathe. We're exposed to noise in our workplaces, at home, and during our recreational activities. Yet our ability to hear well offers few clues when we put it at risk.

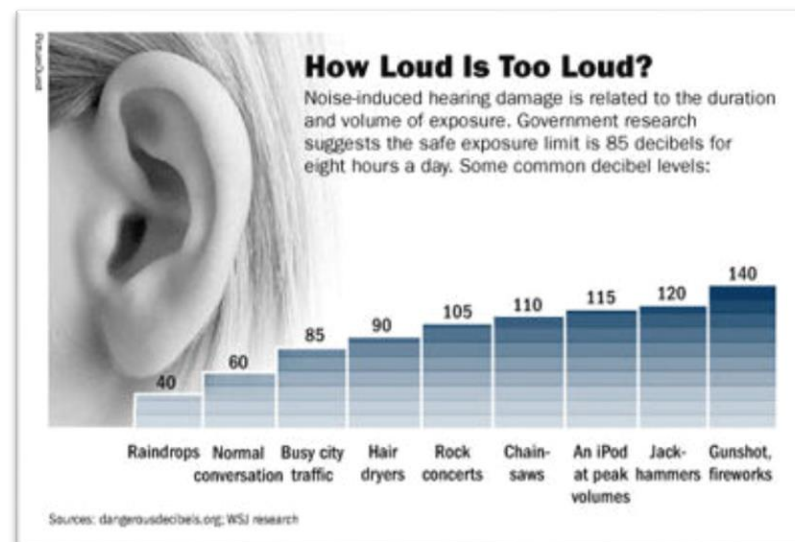


Noise-induced hearing loss is the term for hearing damaged by exposure to excessive noise. The damage to hearing caused by excessive noise at work and play may not be apparent for years. Hearing loss can't be treated or cured, but it can be prevented.

### Sound and Noise

Sound is what you hear. Of course, a dog can hear sounds that you can't, and you can feel the sound of a jet as it prepares to take off. However, most of us relate sound — our sensation of very small, rapid changes in air pressure — with things we hear.

Noise is any sound that you don't want to hear. Although one person's noise may be another person's music, there's a point at which sound becomes a problem for all of us: when it's so loud that it destroys our ability to hear the sounds we want to hear.



## How is sound measured?

Sound is measured in two ways: decibels and frequency.

- Decibels indicate the pressure of sound. Sound waves transfer that pressure from place to place and are expressed in units on a logarithmic scale.
- Frequency is related to a sound's pitch and is measured in units called hertz (Hz), or cycles per second. The pitch of a sound — how high or low it seems — is how you perceive its frequency.



The higher a sound's pitch, the higher its frequency. High-frequency sounds are generally more annoying than low-frequency sounds and can be more harmful to hearing. Human hearing is most sensitive to frequencies between 3,000-4,000 Hz. That's why people with damaged hearing have difficulty understanding higher-pitched voices and other sounds in the 3,000-4,000 Hz range.

Children usually have the best hearing and can often distinguish frequencies ranging from the lowest note on a pipe organ (about 20 Hz), to the trill of a dog whistle (20,000 Hz).

## When is workplace noise dangerous?

There's only one way to know: Have the noise evaluated by someone trained to conduct a sound survey (e.g., a person trained to use a sound-level meter and a dosimeter and that has the ability to evaluate the data).

Below is a list of three different types of surveys.

- *Basic survey (area monitoring):* Use a sound-level meter to identify areas in the workplace that may put workers' hearing at risk.
- *Detailed survey (personal monitoring):* Use a sound-level meter and a dosimeter to monitor and estimate an individual's daily noise exposure.
- *Engineering survey:* Measure noise levels produced by machinery in different operating modes to find ways to eliminate or control the noise.

An effective noise survey should give you enough information to understand a noise problem — to identify it and to determine how to control it. It is important to narrow the survey's focus, however, so that you aren't overwhelmed with more information than you need to make a good decision.

*"Yeah, that machine used to be noisy... but it's not so loud anymore."*

Think about it this way. You can walk across a grassy yard a couple of times every day without causing any damage to the grass; however, if you continually walk back and forth, you eventually beat down the grass, forming a path. The grass loses its ability to spring back. It just lies down and eventually dies. In a similar manner, continuous loud noise beats down the hair cells in the cochlea of your inner ear. Eventually, they lose the ability to spring back. The big difference, however, is that while grass can grow back, those hair cells in your ear won't. When you consider that you've only got around 16,000 hair cells in each ear, and they are thinning out from the day you are born, it's important to take good care of them.

### When Employees Need Protection

Your workplace must have a hearing-conservation program when employees are exposed to noise levels that are equal to or greater than 85 dBA averaged over an eight-hour period. And, if your workplace has noise levels that are greater than those shown in the table below, you must use engineering or administrative controls to reduce employee exposures. If these controls aren't effective, employees must also use hearing protectors to reduce exposures to safe levels.

#### PERMISSIBLE NOISE EXPOSURES\*

Duration per day, hours   Sound level dBA slow response	
8.....	90
6.....	92



4 .....	95
3 .....	97
2 .....	100
1 1/2 .....	102
1 .....	105
1/2 .....	110
1/4 or less .....	115

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**\* When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions:  $C(1)/T(1) + C(2)/T(2) + \dots + C(n)/T(n)$  exceeds unity, then, the mixed exposure should be considered to exceed the limit value.  $C_n$  indicates the total time of exposure at a specified noise level, and  $T_n$  indicates the total time of exposure permitted at that level. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.**

## Noise Hazard Controls

To control noise hazards, a hierarchy of controls has been used as a means of determining how to implement feasible and effective controls. [ANSI Z10-2005, Occupational Health and Safety Management Systems](#), encourages employers to use the following hierarchy of hazard control strategies shown below.

1. Elimination
2. Substitution
3. Engineering controls
4. Administrative controls
5. Personal protective equipment

The idea behind this hierarchy is that the control methods at the top of the list are potentially more effective and protective than those at the bottom for controlling noise hazards. Following the hierarchy normally leads to the implementation of inherently safer systems, ones where

the risk of illness or injury has been substantially reduced. Let's take a closer look at the hierarchy of control strategies.

### Elimination and Substitution

Elimination and substitution, while most effective at reducing hazards, also tend to be the most difficult to implement in an existing process. If the process is still at the design or development stage, elimination and substitution of hazards may be inexpensive and simple to implement. For an existing process, major changes in equipment and procedures may be required to eliminate or substitute for a hazard.

These strategies are considered first because they have the potential to completely eliminate the hazard, thus greatly reducing the probability of an accident. Redesigning or replacing equipment or machinery may be expensive, but remember that, according to the National Safety Council, the average direct and indirect cost of a lost work time injury is \$34,000 and \$1,115,000 to close a fatality claim. For example, if you have an old, noisy electric hand drill, you can replace it with a newer, quieter one.

### Engineering controls

Basically, all we're talking about is attempting to eliminate or reduce the noise level by redesigning the noisy equipment. When you modify a machine to make it quieter, or change the sound path so that the noise never reaches the listener, you are using engineering controls. For instance, you might enclose a shredder to isolate the noise.

### Administrative Controls

Administrative controls attempt to limit exposure by reducing the duration of exposure to the noise. Below is a list of examples.

- Reduce the time employees spend working in noisy areas. Rotate two or more employees so that each is exposed to noise less than 85 decibels, averaged over an eight-hour day.
- Shut down noisy equipment when it's not needed for production.
- Ensure employees maintain equipment so that it runs smoothly and quietly.
- Ensure employees know how to perform their tasks and operate equipment at safe noise levels.
- Use warning signs to identify work areas where noise exceeds safe levels.
- Encourage employees to report noise hazards to supervisors.

## Personal Protective Equipment

Of course, we're talking about hearing protection here. However, if you can eliminate or reduce noise levels so that you don't need earplugs or muffs, it is well worth the money spent in the long term. It can be quite a challenge to supervise proper wearing of hearing protection all the time. Running a hearing conservation program can also be quite labor intensive and expensive, more on that next...

## Hearing Conservation Program

I'm not going to talk at length about the hearing conservation program because we're trying to focus in on the actual hearing protection (PPE) itself in this module. Your workplace must have a hearing conservation program if employees are exposed to noise levels that are equal to or greater than 85 dBA average over an eight-hour period (called the 8-Hour Time Weighted Average). Check out [Course 751 Hearing Conservation Program Management](#) for more in-depth information regarding hearing conservation.

The critical elements of an effective Hearing Conservation Program include:

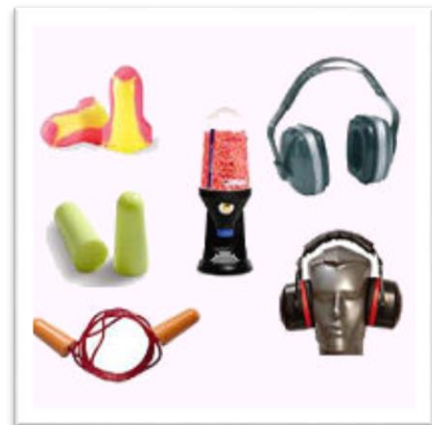
- exposure monitoring;
- audiometric testing;
- hearing protector use;
- employee training;
- access to information; and
- recordkeeping.

## Hearing Protectors

As you are probably well aware, there are basically four types of hearing protectors.

- Molded earplugs
- Custom-molded earplugs
- Self-molded earplugs
- Ear muffs

Molded earplugs are usually made of plastic or silicone rubber. They are available in a variety of shapes and sizes and are usually characterized by one or more ribs or



contours. They are considered multiple use; therefore, they must be cleaned and properly stored after each use.

Custom molded plugs are generally made of plastic and are designed from a molded wax insert of the wearer's ears. They are considered multiple use but cannot be switched ear to ear.

Self-molded earplugs are generally made of mineral wool or plastic foam and are molded or formed by the wearer. Generally one size fits all and they may be either single or multiple use.

Earmuffs are designed to be multiple use and may be designed to be worn with the harness over or behind the head, or below the chin. They are generally more comfortable, but usually provide less noise reduction, thus less protection, than ear plugs.

### **More Employer Responsibilities**

Employers must make sure that hearing protectors are worn:

1. by all employees who are required by the PPE standard to wear personal protective equipment;
2. by all employees who are exposed to an 8-hour time-weighted average of 85 decibels or greater; and who:
  - have not yet had a baseline audiogram; and
  - have experienced a standard threshold shift.

The intent of the law is that employers make hearing protectors available to all employees that meet the criteria above at no cost to employees. Also, hearing protectors must be replaced as necessary.

Employees must be given the opportunity to select their hearing protectors from a variety of suitable hearing protectors provided by the employer. The employer must also make sure that hearing protectors fit properly at the initial fitting and then supervise their correct use.

One effective way to make sure employees are involved in this process is to ask your PPE supplier account representative to display a range of products to the employees.

## Education and Training

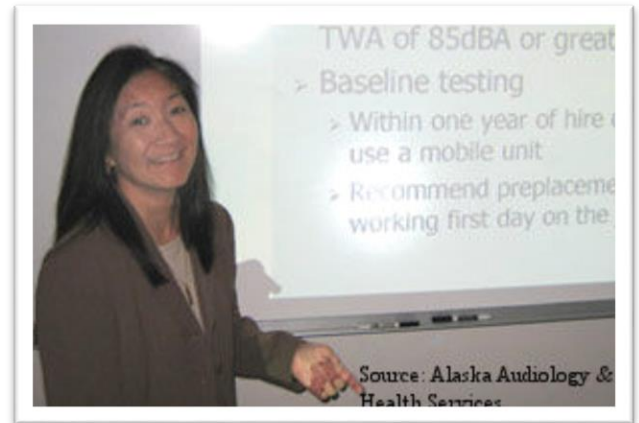
The employer must provide training in the use and care of all hearing protectors provided to employees who are exposed to noise at or above an 8-hour time-weighted average of 85 decibels, and must make sure employees participate in the program.

Although the standard only requires "training," make sure your PPE training (or any safety training for that matter) includes "educating" the employee as to the importance of the correct use of their PPE. As we talked about in Module 3, education tells employees the "why" which increases understanding.

Understanding affects attitude which, in turn, influences behavior. The goal is to get employees to "want to" use their PPE correctly. The educational component of this training includes information on:

- the effects of noise on hearing;
- the purpose of hearing protectors;
- the advantages, disadvantages;
- attenuation of various types; and
- the purpose of audiometric testing and an explanation of the test procedures.

The employer must also make sure that each employee demonstrates the ability to use and care for the PPE they are using.



## Last words

Well, it's time to take your module quiz. It's been a long seven modules, but you did it! Answer the questions on the following review quiz.

## Module 7 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

1. The human ear can distinguish \_\_\_\_\_ different sounds.
  - a. 400
  - b. 4,000
  - c. 40,000
  - d. 400,000
  
2. This term is described as something you don't want to hear.
  - a. Sound
  - b. Noise
  - c. Decibel
  - d. Nuisance
  
3. Engineering controls to eliminate or reduce exposure to noise include all of the following except \_\_\_\_\_.
  - a. enclose the source
  - b. revise work procedures
  - c. redesign the equipment
  - d. replace equipment

4. Your workplace must have a hearing-conservation program when employees are exposed to noise levels that are equal to or greater than \_\_\_\_ dBA averaged over an eight-hour period.
- a. 85
  - b. 90
  - c. 95
  - d. 100
5. The educational component of this training includes information on all of the following, except \_\_\_\_.
- a. the permeation effects of noise
  - b. the purpose of hearing protectors
  - c. the advantages, disadvantages of hearing protectors
  - d. the purpose of audiometric testing