

Introduction – Personal Protective Clothing



- Personal protective clothing and equipment (PPE) is essential to shield or isolate you from the chemical, physical, and biological hazards that you may encounter at the workplace.
 - **Vapors, gases, and particulates** present risks at hazardous waste sites during emergency responses and during certain field activities.
 - Personal protective equipment (PPE) guards against chemical, physical, and biological hazards.
 - Different hazards require different combinations and types of PPE. No type or combination of PPE is right for every situation.
 - Available engineering controls and safe work practices should be used along with, not instead of, PPE.

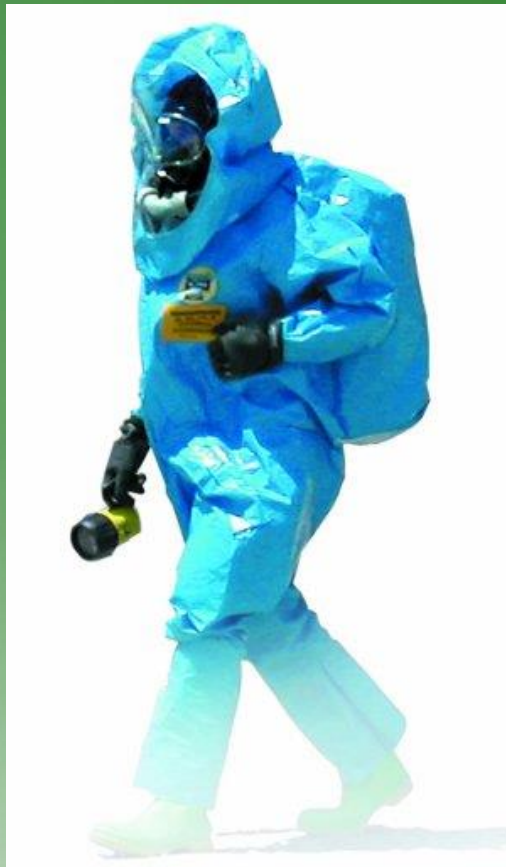
Learning Objectives

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



- Explain the uses, types, and characteristics of PPE
- Explain the concepts behind the selection of PPE
- List protection levels and corresponding equipment
- Explain the importance of correct donning and doffing procedure
- Describe proper inspection, maintenance, and storage.

Types of Personal Protective Clothing and Equipment



- The types of PPE can be placed in six categories:

- Head
- Eye and Face
- Foot
- Hearing
- Hand
- Skin and Body

Head Protection



- Hard hats can protect your head from falling objects and electrical current.
- Hard hats are required if the potential for head injury exists.
- Hard hats purchased after 7/5/94 must meet [ANSI Z89.1-1986](#). Hard hats purchased before that date must meet ANSI Z89.1-1969.
- Hard hats are divided into three classes in the new standard, four in the old. Class D is excluded from the new standard.

Eye and Face Protection



- Field activities can pose risks to the eyes and face.
- Safety glasses, goggles, and face shields can protect against these hazards
- Protection must meet ANSI Z 87.1-1989 standard if purchased after 7/5/94 and ANSI Z87.1-1968 otherwise.

Eye and Face Protection



- The following list of protective items are worn over the eyes or face:

- Spectacles
- Flexible/cushion fitting goggles
- Eyecup goggles
- Faceshields
- Full-face respirators.

Foot Protection



- There are several important features of protective footwear:
 - Protects against impact with metal or plastic in the toe
 - Protects against puncture from below with steel shanks or insects
 - Has elastomer construction (e.g., neoprene, PVC, butyl rubber) to protect against liquid hazardous chemicals
 - Must meet ANSI Z41.1-1991 if purchased after 7/5/94 and ANSI A41.1-1967 otherwise
 - May be either shoe-boots or pullover boots.

Hearing Protection



- Loud noises can damage your hearing unless you take proper precautions. Hearing protection must be worn when noise exceeds certain levels, such as near heavy equipment or loud tools.
- Hearing protection devices are rated according to the amount of sound they screen out. These devices must be used properly and should be clear of objects such as eyeglasses, excessive hair, and clothing.

Hand Protection



- Hand protection is required when there is a potential for exposure to hazards such as:

- Skin absorption of harmful substances
- Severe cuts, lacerations, abrasions, or punctures
- Chemical or thermal burns
- Temperature extremes of hot or cold.

Skin and Body Protection



- Skin and body protection must be chosen for the specific hazard encountered. No single material is right for every situation.

Selecting and Using Protective Clothing



- When selecting protective clothing, remember that the materials:
 - Are designed for limited exposure
 - Must be discarded if they cannot be **decontaminated**
 - Should be selected for resistance to **degradation** and **permeation** to the chemicals to which they will be exposed.

Test your knowledge

- Protective material comes in different styles, but the most versatile materials can be used to protect against all possible chemical hazards.

- True

- False

Classification of Chemical-Protective Clothing



- Protective clothing can be classified in terms of:

- Style
- Types of material
- Intended use (single use vs. reusable).

Styles of Protective Suits



- The different styles of protective suits are:
 - Fully encapsulating (completely enclosed)
 - Non-encapsulation (also called a splash suit)

Types of Materials



- There are two basic types of protective material:
 - Elastomers
 - Non-elastomers.
- Elastomers are polymeric materials that return to their original shape after being stretched. Non-elastomers do not stretch.

Protective Clothing



- Protective clothing can be either disposable or reusable. Reusability depends on:
 - The cost of the clothing
 - The ease with which it can be decontaminated.

Test your knowledge

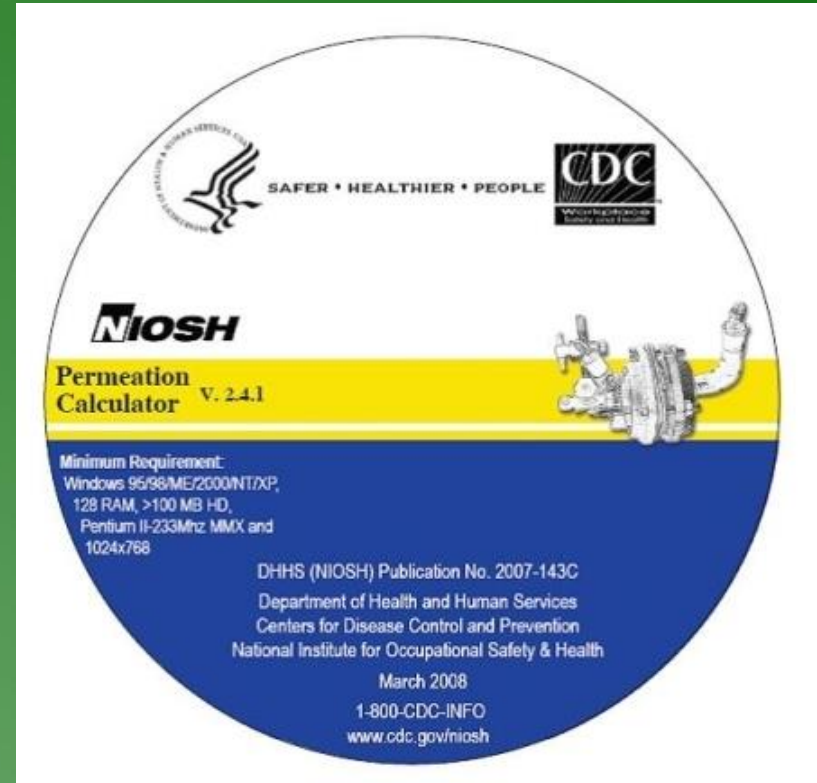
- Fully-encapsulating suits are available in one-piece or two-piece pant/jacket combinations.

- True

- False

Performance Requirements

- Chemical resistance and permeation, the most important performance requirements, are the ability to withstand chemical and physical change. Resistant material retains its structural integrity and protective qualities on contact with the **hazardous substance** which it is designed.
- Penetration, degradation, and permeation are the determining factors for chemical resistance.



Other Performance Requirements



- Durability
- Flexibility
- Temperature Resistance
- Service/Shelf Life
- Cleanability
- Design
- Size
- Color and Cost

Test your knowledge

- Match the statement with the item
- Statement
 - Keeps workers cool and visible
 - Can cause rips or reduced mobility
 - Can reduce a material's chemical resistance
 - Can reduce a material's flexibility
 - Can collect contamination
- Items
 - Pockets
 - Low Temperatures
 - Improperly fitted protective suits
 - High Temperatures
 - Bright Colors

Selecting Chemical Protective Clothing

- Uncertainty about the presence or type of chemicals and the presence of multiple chemicals make selection difficult. Here are five selection steps:
- 5. Decide if fully encapsulation suit is needed.
- 4. Select protective material with the least permeation, penetration, and degradation for the longest period.
- 3. Determine if the substance is a skin hazard at expected concentrations.
- 2. Identify physical, chemical, and toxicological properties of chemical (s) involved.
- 1. Decide if worker must face exposure by identifying the type of work and the amount of time in the area.

Selecting Chemical Protective Clothing: Determining Factors



- Several issues are involved in working through the five steps in selecting chemical protective clothing. They include:

- Type of hazardous Material
- Type of Work
- Amount of Time
- Concentration
- Skin Hazard
- Unknown Hazards
- Protective Materials.

Test your knowledge

- A factor in the selection of an air-purifying respirator is:
 - The worker will only be in the work area a short time
 - The suit permeation rate is high enough
 - The contaminant concentration is low enough
 - There is less than 19.5% oxygen

Stresses from Wearing Chemical PPE



- Wearing chemical protective clothing can cause significant physical stresses. Several steps should be taken to minimize risks, including:
 - Altering work regimen
 - Providing medical surveillance
 - Scheduling rest periods
 - Working during cooler times
 - Maintaining fluid/electrolyte intake.

Heat Stress



- Heat stress can affect your body in a number of ways. Click on the buttons below for more information about the different stresses.
- Body temperature
- Vision
- Communication
- Dexterity
- Mobility
- Physical fatigue/exertion

Test your knowledge

- Although PPE may place several kinds of stress on the wearer, the principal stress of wearing PPE is:
 - Limited vision
 - Heat
 - Muffled hearing while wearing PPE
 - Reduced mobility and dexterity

Protection Levels

- According to 29 CFR Part 1910.120, Appendix B, Part A, there are four levels of protection requirements and guidelines for employees to follow for selecting the appropriate equipment. Level A represents the most dangerous category of hazard while Level D represents the least dangerous category.
- **Level A** Highest level of skin, eye and respiratory protection.
- **Level B** Highest level of respiratory protection but lower level of skin protection.
- **Level C** When the level of airborne concentration is known.
- **Level D** Minimum level of protective safety gear.

Test your knowledge

- Which of the following situations is the most consistent with Level C protection?
- Contaminant concentrations do not present significant skin hazard but oxygen concentration is low
- Airborne contamination is known to be minimal but there is potential for splash or immersion contact
- There is a high level of airborne contamination but sufficient oxygen for breathing
 - Contaminant is present but does not present a skin or respiratory hazard at measured levels

Inspection



- PPE should be inspected in four instances:
 - When first received (inspection/operational testing)
 - When issued
 - Before and after use or training and before maintenance
 - Periodically when stored.
- All reusable equipment should be given unique identification (ID) numbers. Inspection records, by number, should be kept. Records must include at least the date, inspector, and any findings and corrective measures.

Inspection Procedures

- Manufacturers usually recommend specific inspection procedures for suits, gloves and boots.



Test your knowledge

- Unique identification numbers must be assigned to all pieces of _____ equipment.
 - Disposable
 - Reusable

Donning and Doffing



- Procedures for putting on and removing protective equipment can be extremely important.
- Donning- provide assistance.
- Doffing- have standard and emergency procedures.

Test your knowledge

- Chemical-protective suits should NOT be decontaminated until being removed from the worker.
- True
 - False

Maintenance and Storage of Equipment



- Many equipment failures occur because of improper maintenance and storage. Manufacturers recommend maintenance procedures and often require special training before purchase.
- Proper storage can prevent equipment damage and malfunction. Procedures for storage and between uses should be specified.

Test your knowledge

- Protective equipment should be stored:
 - In a warm, sunny room to keep it pliable
 - In a moist environment to keep it pliable
 - In each worker's car trunk in case it is needed
 - In any of the above
 - In none of the above

Summary

- In this module you have learned:
 - The importance of wearing PPE
 - Stresses, especially heat, associated with wearing PPE
 - Type, protection levels, and selection of PPE
 - Limitations and correct use of PPE
 - Proper PPE storage and inspection procedures.
- The following measures protect you and other workers from hazards:
 - Being aware of hazards and having proper PPE available
 - Understanding the use and limitations of PPE
 - Being trained for new hazards or equipment
 - Maintaining and storing PPE properly.

- You have completed the module:
- Personal Protective Clothing and Equipment