Occupational Safety Competency 1.10

Competency 1.10 **Occupational safety personnel shall demonstrate a working level knowledge of the application of hazard control methods.**

1. Supporting Knowledge and Skills

a. Discuss the preferred hierarchy of hazard control methods.

b. Identify common types of engineering and administrative controls and discuss the applicability of each.

c. Discuss the appropriate actions to take in response to the report or discovery of an imminent danger situation.

d. Discuss the elements and appropriate application of a hazard abatement program.

e. Analyze a given identified hazard and recommend acceptable control measures.

f. Identify the circumstances that warrant the use of personal protective equipment (PPE) as a hazard control method.

g. Describe the various types and intended functions of personal protective equipment (PPE).

2. Self-Study Activities (corresponding to the intent of the above competency)

Below are two web sites containing many of the references you may need.

Web Sites		
Organization	**Site Location**	**Notes**
Department of Energy	http://wastenot.inel.gov/cted/stdguido.html	DOE Standards, Guides, and Orders
OSHA	http://www.osha-slc.gov/	OSHA documents and search engine
U.S. House of Representatives	http://law.house.gov/cfr.htm	Searchable Code of Federal Regulations

Read 29 CFR 1910.119, Appendix C, Compliance Guidelines and Recommendations for Process Safety Management; and the introductory chapters of *Fundamentals of Industrial Hygiene* (or a comparable fundamentals of industrial hygiene text.)

EXERCISE 1.10-A What are three primary categories of hazard control measures or methods? Provide examples.

EXERCISE 1.10-B What is the preferred hierarchy of implementation of the hazard controls and why?

Read 29 CFR 1910.120 (g), “Engineering controls, work practices, and personal protective equipment for employee protection.”

EXERCISE 1.10-C Referring to 29 CFR 1910.120 (g), under what general circumstances would the personal protective equipment (PPE) be used as a control measure to reduce and maintain to or below the permissible exposure limits or dose limits?

Read Chapter 12 of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, and **scan** 29 CFR 1910.120 (q).

EXERCISE 1.10-D What are the immediate actions one should take upon discovery of an unknown hazardous material spill?

Read Chapters 9 and 10 of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*.

EXERCISE 1.10-E Referring to Chapter 9 of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, what are the three purposes of site control?

EXERCISE 1.10-F Referring to Chapter 9 of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, what are the seven basic components of site control?

EXERCISE 1.10-G Describe how the buddy system is used when performing activities involving hazardous materials.

Read paragraphs (a) through (e) of 29 CFR 1910.119, Process safety management of highly hazardous chemicals.

EXERCISE 1.10-H Referring to paragraph (e) of 29 CFR 1910.119, what are the major steps of a process hazard analysis?

EXERCISE 1.10-I How are operating procedures related to hazardous material controls?

Read the DOE Interim Guidance for Emergency Medical Support in U.S. Department of Energy, Office of Emergency Planning and Operations, *Emergency Management Guide*.

EXERCISE 1.10-J Referring to DOE Interim Guidance for Emergency Medical Support in U.S. Department of Energy, name at least three types of facilities, equipment, and supplies that should be maintained at onsite medical decontamination and treatment centers.

Read Chapter 8, "Personal Protective Equipment (PPE)," of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*; **scan** Subpart I, "Personal Protective Equipment," of 29 CFR 1910, *Occupational Safety and Health Standards for General Industry*; and **read** 29 CFR 1910.120 (g), "Engineering controls, work practices, and personal protective equipment for employee protection," Appendix B, "General Description and Discussion of the Levels of Protection and Protective Gear."

EXERCISE 1.10-K What are the two basic objectives of any personal protective equipment (PPE) program?

EXERCISE 1.10-L Referring to paragraph (a) of Subpart I, 29 CFR 1910.132, when shall personal protective equipment be provided and used?

EXERCISE 1.10-M Referring to Chapter 8, Personal Protective Equipment (PPE), of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, what are the primary and secondary considerations when selecting protective clothing?

EXERCISE 1.10-N Referring to Subpart I, 29 CFR 1910.132 and to Appendix B of 29 CFR 1910.120, what are the areas of the human body that are afforded protection by personal protective equipment (PPE)?

EXERCISE 1.10-O Referring to Chapter 8, “Personal Protective Equipment (PPE),” of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, complete the intended purpose of the listed types of personal protective equipment (PPE) in the following table.

Types and Purpose of Personal Protective Equipment (PPE)		
Body Part	**PPE**	**Purpose**
Eyes and face	Face shield	
	Splash hood	
	Safety glasses	
	Goggles	
	Sweat bands	
Respiratory	Self-contained breathing apparatus	
	Supplied-air respirators	
	Air-purifying respirators	
Hands and arms	Gloves and sleeves	
Feet	Safety boots	
	Disposable shoe or boot covers	
Head	Safety helmet	
	Hood	
	Protective hair covering	

Types and Purpose of Personal Protective Equipment (PPE)		
Body Part	**PPE**	**Purpose**
Full body	Fully encapsulating suit	
	Nonencapsulating suit	
	Aprons, leggings, and sleeve protectors	

3. Summary

The control of occupational health hazards requires that an employee's exposure to harmful chemical agents, physical stresses, and physical agents does not exceed permissible levels. The variables or quantities of interest that must be measured are the concentration or intensity of the particular hazard and the duration of exposure.

The types of hazard control measures to be installed depend on the nature of the harmful substance or agent and its routes of entry or absorption into the body. An employee's exposure to an airborne substance is related to the amount of contaminants in the breathing zone and the time interval during which an employee is exposed to this concentration. Reducing the amount of contaminant in the employee's breathing zone or the amount of time that an employee spends in the area will reduce the overall exposure.

Various methods of control available to industrial hygienists are broken down into these categories:

- Engineering controls that eliminate the hazard, either by initial design specifications or by applying methods of substitution, isolation, or ventilation.
- Administrative controls that restrict employees' exposures by scheduling reduced work times in contaminated areas, and by other work rules.
- PPE that should be considered a method of last resort when engineering controls are not sufficient to achieve acceptable limits of exposure. PPE can be used in conjunction with engineering and administrative controls, and with other methods.

The specific application of these controls, used according to the hazard involved, is dictated by such regulations as 29 CFR 1910 and 29 CFR 1926.

4. Exercise Solutions

EXERCISE 1.10-A What are three primary categories of hazard control measures or methods? Provide examples.

ANSWER 1.10-A
- Engineering - built-in or designed-in protection, application of substitution, isolation, or ventilation methods
- Administrative - scheduled reduced work times, moving the work area, housekeeping, maintenance, or employee information and training
- Personal protective equipment - respirators, safety glasses and shields, gloves, aprons, and bubble suits

EXERCISE 1.10-B What is the preferred hierarchy of implementation of the hazard controls and why?

ANSWER 1.10-B Engineering controls first, then administrative, with personal protective equipment as the last choice; this approach minimizes human intervention with the hazard.

EXERCISE 1.10-C Referring to 29 CFR 1910.120 (g), under what general circumstances would the personal protective equipment (PPE) be used as a control measure to reduce and maintain to or below the permissible exposure limits or dose limits?

ANSWER 1.10-C Whenever emergency controls and work practices are not feasible or not required.

EXERCISE 1.10-D What are the immediate actions one should take upon discovery of an unknown hazardous material spill?

ANSWER 1.10-D
1. Notify personnel working in the area.
2. Stop work activities.
3. Evacuate personnel as necessary and keep people out of the affected area until assistance or emergency responders arrive.

EXERCISE 1.10-E Referring to Chapter 9 of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, what are the three purposes of site control?

ANSWER 1.10-E
1. To minimize potential contamination of workers.
2. To protect the public from the site's hazards.
3. To prevent vandalism.

EXERCISE 1.10-F Referring to Chapter 9 of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, what are the seven basic components of site control?

ANSWER 1.10-F
1. Site map
2. Site preparation
3. Site work zones
4. The buddy system
5. Site security
6. Communication systems
7. Safe work practices

EXERCISE 1.10-G Describe how the buddy system is used when performing activities involving hazardous materials.

ANSWER 1.10-G Most activities in contaminated or otherwise hazardous areas should be conducted with a buddy who is able to:
- Provide the partner with assistance.
- Observe the partner for signs of chemical or heat exposure.
- Periodically check the integrity of the partner's protective clothing.
- Notify the command post supervisor (or incident commander) or others if emergency help is needed.

EXERCISE 1.10-H Referring to paragraph (e) of 29 CFR 1910.119, what are the major steps of a process hazard analysis?

ANSWER 1.10-H
1. Determine and evaluate the hazards of the process in question, using established methodologies such as what if, failure mode and effects analysis, and fault tree analysis.
2. Identify any previous incident, that had a likely potential for catastrophic consequences in the workplace.

3. Determine the engineering and administrative controls applicable to the hazards, and their interrelationships.
4. Identify the consequences of failure of the controls.
5. Conduct a facility siting.
6. Assess and determine the human factors requirements.
7. Conduct a qualitative evaluation of the range of possible safety and health effects of failure of controls on employees in the workplace.

EXERCISE 1.10-I How are operating procedures related to hazardous material controls?

ANSWER 1.10-I Operating procedures are part of process safety management, and as such are a tool to provide structure and repeatability while ensuring safe operations. The operating procedures encompass and incorporate safe work practices, which are controls to maintain a safety awareness and to enforce safety rules.

EXERCISE 1.10-J Referring to DOE Interim Guidance for Emergency Medical Support in U.S. Department of Energy, name at least three types of facilities, equipment, and supplies that should be maintained at onsite medical decontamination and treatment centers.

ANSWER 1.10-J (Any three of the following:)

1. Designated contaminated personnel entrance
2. Contamination removal area
3. Showers with used water collection ability
4. Radiation survey instruments and decontamination supplies
5. Separate showers and change rooms for medical and HP personnel
6. Chelation therapy treatment capability
7. Chemical burn treatments and antidotes

EXERCISE 1.10-K What are the two basic objectives of any personal protective equipment (PPE) program?

ANSWER 1.10-K

1. To protect the wearer from safety and health hazards.
2. To prevent injury to the wearer from incorrect use and/or malfunction.

EXERCISE 1.10-L Referring to paragraph (a) of Subpart I, 29 CFR 1910.132, when shall personal protective equipment be provided and used?

ANSWER 1.10-L (Any reasonable paraphrase of the following:) “Whenever it is necessary by reason of hazards of processes or environment, chemical hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation, or physical contact.”

EXERCISE 1.10-M Referring to Chapter 8, “Personal Protective Equipment (PPE),” of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, what are the primary and secondary considerations when selecting protective clothing?

ANSWER 1.10-M Primary:

- permeation
- degradation
- penetration
- heat transfer

Secondary:

- durability
- flexibility
- temperature effects
- ease of decontamination
- compatibility with other personal protective equipment
- duration of use

EXERCISE 1.10-N Referring to Subpart I, 29 CFR 1910.132 and to Appendix B of 29 CFR 1910.120, what are the areas of the human body that are afforded protection by personal protective equipment (PPE)?

ANSWER 1.10-N

- Full body
- Head
- Eyes and face
- Ears
- Hands and arms
- Feet

EXERCISE 1.10-O Referring to Chapter 8, “Personal Protective Equipment (PPE),” of NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, in the following table complete the intended purpose of the listed types of personal protective equipment (PPE) in the following table.

ANSWER 1.10-O

Types and Purpose of Personal Protective Equipment (PPE)		
Body Part	**PPE**	**Purpose**
Eyes and face	Face shield	Protects against chemical splashes.
	Splash hood	Protects against chemical splashes.
	Safety glasses	Protect eyes against large particles and projectiles.
	Goggles	Can protect against vaporized chemicals, splashes, large particles, and projectiles.
	Sweat bands	Prevent sweat-induced eye irritation and vision impairment.
Respiratory	Self-contained breathing apparatus	Provides the highest available level of protection against airborne contaminants and oxygen deficiency.
	Supplied-air respirators	Protect against most airborne contaminants and permitted for use in oxygen-deficient atmospheres.
	Air-purifying respirators	Protect against specific chemicals and particulates up to specific concentrations.
Hands and arms	Gloves and sleeves	Protect hands and arms from chemical contact.
Feet	Safety boots	Protect feet from contact with chemicals and from compression, crushing, or puncture by falling, moving, or sharp objects.
	Disposable shoe or boot covers	Protect safety shoes or boots from contamination.

Types and Purpose of Personal Protective Equipment (PPE)		
Body Part	**PPE**	**Purpose**
Head	Safety helmet	Protects head from blows.
	Hood	Protects against chemical splashes, particulates, and rain.
	Protective hair covering	Protects hair against chemical contamination, entanglement in machinery or equipment, or from interfering with vision and with the functioning of respiratory devices.
Full body	Fully encapsulating suit	Protects against splashes, dust, gases, and vapors.
	Nonencapsulating suit	Protects against splashes, dust, and other materials, but not against gases and vapors.
	Aprons, leggings, and sleeve protectors	Provide additional splash protection of chest, forearms, and legs.