

PPE WORKSHOP LESSON PLAN

Title	Personal Protective Equipment Workshop
Suggested Use	Applicable for hazardous waste worker and emergency response training. Exercise for reinforcing and enhancing worker's knowledge of PPE, as in refresher training. Also useful following video and/or instructor presentations on PPE during initial training.
Learning Objectives	<p>After completing this exercise, the learner will be able to:</p> <ul style="list-style-type: none">• Explain the advantages, disadvantages, and limitations of commonly used respirators.• Inspect respirators and identify flaws which should be corrected before use.• Identify the three major ways in which chemicals attack or by-pass chemical protective clothing (CPC) materials.• Use both quantitative and qualitative data to evaluate the expected effectiveness of assigned CPC materials in resisting specified chemicals.• Describe the differing protective capabilities of totally encapsulating chemical protective (TECP) suits and chemical splash suits.• Inspect a TECP suit and identify flaws which should be corrected before use.• Explain how various accessory items can be used in protective ensembles to enhance worker safety.• Identify each of the four EPA levels of protection and describe the protective capabilities and limitations of each.
Materials Needed	<p>Table space for workshop set up. All items described in workshop instructions. One answer sheet handout per trainee. Transparencies for review of stations 5 and 6. Overhead projector and screen.</p>
Time Required	Two hours total.

Procedure	<p>Set up exercise as described in instruction set before class.</p> <p>Hand out answer sheets and introduce exercise (10 min.).</p> <p>Allow class 40 minutes to complete stations 1 through 9.</p> <p>Conduct detailed review and discussion of stations 1 through 9 (40 min.).</p> <p>Break class for 10 minutes and set up for part on Levels of Protection.</p> <p>Allow class to gather PPE ensemble components (10 min.)</p> <p>Allow each team to present their level, followed by questions and discussion with rest of class (10 min).</p>
Trainee Prerequisites	<p>Basic knowledge of classification, selection, and use of PPE as provided through previous training or introductory video or instructor presentation.</p>
Adaptation for Specific Groups	<p>Exercise can be modified by placing different items at key stations. For example, for site worker trainees who only use Level C PPE, an APR could be replace the SCBA for inspection at station 4. Likewise, a splash suit could replace the TECP suit at station 8.</p>

PERSONAL PROTECTIVE EQUIPMENT WORKSHOP

Trainer Instruction Set

This exercise is intended as an alternative to a lecture format for reviewing and reinforcing basic knowledge related to PPE. It is set up to roughly follow the order of topics as presented in the PPE modules currently used by UAB/CLEAR. This exercise should be followed by the exercise in levels of protection (attached).

This is a practical exercise and requires that an exercise area be set up within the classroom or some other room. Each exercise station is designated by a station sign and equipped with the items listed below. Students rotate from station to station and perform the tasks as required to complete the answer sheet (attached). After completion of the exercise, the instructor leads the class in a review of each station. In so doing PPE-related learning objectives can be achieved.

The stations should be supplied with the following items:

- Station 1: 1 half-mask twin-cartridge air-purifying respirator, equipped with organic vapor cartridges.
1 full-facepiece canister-type air-purifying respirator equipped with an organic vapor canister.
- Station 2: 1 fullface supplied air (or airline) respirator, with or without an escape air supply (note that the answer to part D varies according to the presence or absence of this feature).
- Station 3: 1 fullface pressure-demand self-contained breathing apparatus.
- Station 4: 1 self-contained breathing apparatus which has several obvious defects such as the following:
- air cylinder well past date for hydrostatic pressure retest.
 - air supply low (e.g. approximately 1000 psig.).
 - clouded, scratched, or crazed facepiece visor
 - twisted, improperly attached harness.
 - damaged or missing exhalation valve.
 - etc.

Trainer Instruction Set, Continued

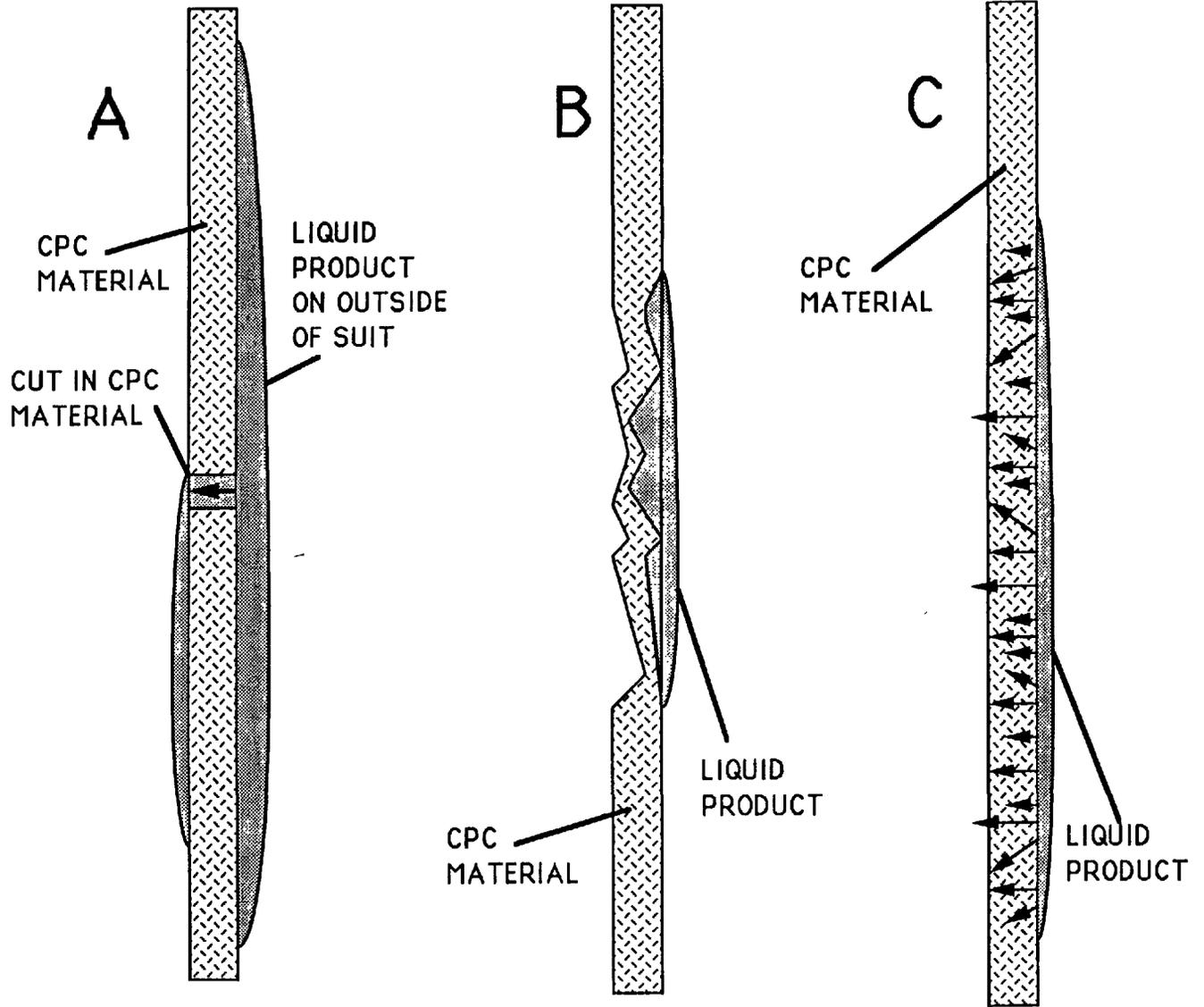
- Station 5: Several copies of drawings labeled A, B, and C depicting degradation, penetration, and permeation of chemical protective clothing (attached).
- Station 6: Several copies of the *Quick Selection Guide to Chemical Protective Clothing* by Forsberg and Mansdorf (available from Van Nostrand Reinhold) showing qualitative data on chemical protective materials.
Vendor information from Life-Guard(attached) showing quantitative data on chemical protective materials.
- Station 7: 1 totally-encapsulating chemical protective suit
1 chemical-protective splash suit
- Station 8: 1 totally-encapsulating chemical-protective suit which has various defects such as the following:
- damaged seam(s)
 - missing or damaged exhalation valves
 - abrasion or other physical damage to suit material (e.g. a torn glove)
 - visible evidence of previous chemical exposure in one or two small areas (e.g. a butyl suit splashed with kerosene into which a small amount of used motor oil has been dissolved, then removed leaving an area of discoloration)
 - components not properly attached (e.g. hardhat-to-suit attachments which are broken or not fully connected) (e.g. boots or gloves which are not properly attached to suit)
 - physical abrasion to the right knee
 - chemical degradation to the left knee (which can be produced by exposing the material to some product such as paint stripper to produce degradation, then decontaminating the garment.
- NOTE: It may be advisable to label the knees of the pants to prevent confusion about which is which.
- Station 9: Various accessory items for PPE ensembles or other types of safety equipment, such as
- cooling vest
 - duct tape
 - two-way radio (respirator compatible)
 - harness and lifeline
 - flash cover

Trainer Instruction Set, Continued

For this workshop to be fully effective, it must be followed by thorough class discussion. The instructor should guide discussion into relevant topics related to PPE. This will insure that learning objectives are achieved. For example, in reviewing station 6, instead of merely pointing out the correct answers, the instructor should lead the class in a discussion of basic concepts of CPC selection. This should include discussion of the potential problems involved in CPC selection.

Questions, comments, and suggestions for improvements related to this exercise should be directed to Alan Veasey at The Center for Labor Education and Research, 1044 11th St. South, Birmingham, AL 35294-4500.

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STATION 6, Part C



Chemical Permeation Test Results (ASTM F739 Method)

Liquid	LIFE GUARD BUTYL MATERIAL		LIFE GUARD NEOPRENE MATERIAL		LIFE GUARD VITON/CHLOROBUTYL	
	Average* Breakthrough Time—minutes	Average** Perm Rate ($\mu\text{g}/\text{min cm}^2$)	Average* Breakthrough Time—minutes	Average** Perm Rate ($\mu\text{g}/\text{min cm}^2$)	Average* Breakthrough Time—minutes	Average** Perm Rate ($\mu\text{g}/\text{min cm}^2$)
Acetone	125	1	18	34	90	1
Acetonitrile	120	1	42	9	120	1
Carbon Disulfide	2	380	5	380	>480	0
Dichloromethane	4	583	6	1633	16	101
Diethylamine	3	527	16	567	13	143
Dimethylformamide	>480	0	60	107	>480	0
Ethyl Acetate	28	19	17	213	49	16
n-Hexane	4	487	20	80	>480	0
Methanol	303	1	210	3	392	1
Nitrobenzene	>480	0	45	49	>480	0
Sodium Hydroxide	>480	0	>480	0	>480	0
Sulfuric Acid	>480	0	>480	0	>480	0
Tetrachloroethylene	2	10	17	967	>480	0
Tetrahydrofuran	9	333	11	537	22	103
Toluene	6	770	12	920	>480	0

* Average time in minutes between contact of chemical on outside of material surface and detection of chemical on inside surface

** Average rate at which the chemical permeates the material

Tests performed by Radiant Corporation. Before deciding if either of these materials will work in a particular situation, a swatch of the material should be tested against the chemical hazard.

There are uses and chemicals for which these accessories are unsuitable. It is the responsibility of the user to verify that these items are appropriate for the intended use and meet all health standards.

PERSONAL PROTECTIVE EQUIPMENT WORKSHOP
Answer Sheet

STATION 1: RESPIRATORY PROTECTIVE EQUIPMENT

- (A) Observe the two respirators on display at this station. These are examples of what type of respirator?

- (B) List any advantages you can think of which this type of respirator may offer, as opposed to other types of respirators.

- (C) List any disadvantages of this type of respirator.

- (D) Both the respirators at this station are equipped to protect the wearer against organic vapors. Which of the two should offer protection against the highest concentration of organic contaminants and why?

STATION 2: RESPIRATORY PROTECTIVE EQUIPMENT

- (A) What type of respirator is on display at this station?

- (B) List any advantages you can think of which this type of respirator may offer as opposed to other types.

- (C) List any disadvantages of this type of respirator.

(D) Is this item suitable for use during IDLH entries?

Why?

STATION 3: RESPIRATORY PROTECTIVE EQUIPMENT

(A) What type of respirator is on display at this station?

(B) List any advantages you can think of which this type of respirator may offer as opposed to other types.

(C) List any disadvantages of this type of respirator.

STATION 4: SCBA INSPECTION

(A) Visually inspect the SCBA carefully and note any flaws which should be corrected before the unit is used in a contaminated area. List three flaws in the spaces provided below.

Flaws: _____

(B) Based on the SCBA air supply as indicated by the cylinder gauge reading, provide the following information.

Approximate Cylinder Gauge Reading (psi): _____

Estimated Total Breathing Time Remaining: _____

(HINT: Allow 1 minute per 100 psi gauge pressure.)

Estimate of Breathing Time Before Alarm Sounds: _____

(HINT: Alarm should go off at about 550 psi.)

STATION 5: CHEMICAL ATTACKS ON CPC

The figures displayed at this station represent three different ways in which chemicals may attack or bypass chemical protective garments. Match the letters from the drawings with the three types of chemical attack listed below.

- _____ permeation
- _____ penetration
- _____ degradation

STATION 6: CPC SELECTION

Use the provided information sources on chemical protective materials to perform the tasks and answer the questions listed below.

- (A) Use the *Quick Selection Guide to Chemical Protective Clothing* to select the CPC material which should, according to the data provided, offer the best resistance for the chemicals listed below. To save time, the page number is provided for each chemical.

CHEMICAL HAZARDS	CHECK RECOMMENDED MATERIALS (✓)		
	Butyl Rubber	Neoprene	Viton
Acetaldehyde (p.46)			
Toluene (p.69)			
Guthion (p.84)			

- (B) Based on the information gathered in part A, what conclusion can you draw about the importance of identifying chemical hazards before selecting CPC?

(C) Using the table provided by Life-Guard, Inc., note the data supplied for toluene. Which of the three materials listed would offer the best resistance to toluene?

How can you tell?

(D) How does the type of data provided by the Life-Guard, Inc. table differ from that provided by the *Quick Selection Guide* ?

STATION 7: CHEMICAL PROTECTIVE GARMENTS

(A) Identify the types of chemical protective clothing on display at this station.

(1) _____

(2) _____

(B) How do the two types of garments differ with regard to chemical protection?

(C) What degree of thermal protection (for example, protection from flash fire) are the garments on display at this station intended to provide?

STATION 8: TECP SUIT INSPECTION

(A) Carefully examine the TECP suit on display at this station. Note any defects or damage to the suit. List at least three problems revealed by your inspection of the suit.

(B) Carefully observe the knees of the suit. Both knees have been damaged, but in completely different ways. Try to distinguish between the type of damage to the right knee as opposed to the damage to the left knee.

STATION 9: OTHER SAFETY EQUIPMENT

Identify the accessory items on display at this station and briefly describe how they might be used as part of a PPE ensemble.

EXERCISE IN LEVELS OF PROTECTION

In preparation for this exercise, the class will be divided into four groups. Each group will be assigned one of the four EPA-recommended levels of protection. Each group will then select the items needed to create a PPE ensemble representing the assigned level of protection. The required items will be selected from a variety of respirators, chemical protective garments, and accessory items provided for this exercise.

After all groups have completed the assignment, the class will review each level of protection. Each group should be able to explain the characteristics of their ensemble, including distinguishing features, advantages, and limitations as compared to other levels of protection. Each group should also be able to describe a task and work environment for which their ensemble would be appropriate.

The following items will be provided:

SCBAs
APRS
Totally-encapsulating chemical-protective suits
Chemical-protective splash suits
Coveralls
Surgical gloves
Chemical-protective gloves
Leather work gloves
Chemical-protective boots
Overboots
Boot covers
Leather safety boots
Hard hats
Safety glasses
Duct tape