Hazardous Materials for First Responders 4th Edition

Chapter 8 — Personal Protective Equipment

HAZ MAT FOR FIRST RESPONDERS

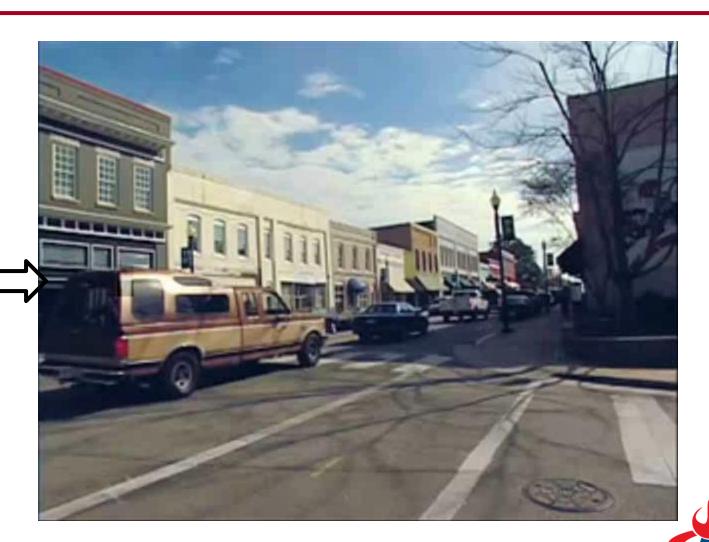


Learning Objective 1

Discuss respiratory protection.



Respiratory protection is a primary concern for first responders.



Click image to play

Protective breathing equipment protects the body from inhaling hazardous substances.

Self contained breathing apparatus (SCBA)

Closed circuit

Open circuit

Supplied-air respirators (SARs)

Air-purifying respirators (APRs)

Particulate removing

Vapor and gas removing

Combination

Powered air-purifying respirators (PAPRs)



Respiratory protection standards are developed by NIOSH and NFPA®.

 Performance and design requirements

> NIOSH CBRN standard for Open-Circuit SCBA

NIOSH standard for CBRN Full Facepiece APR

 Minimum requirements for entry in NOT IDLH Minimum requirements for use by general population

> NIOSH standard for CBRN Air-Purifying Escape Respirator and CBRN Self-Contained Escape Respirator



Respiratory protection standards are developed by NIOSH and NFPA®.

 Minimum requirements for selection, care, and maintenance of opencircuit SCBA and combination SCBA/SAR

NFPA® 1852

NFPA® 1981

 Minimum requirements for design, performance, testing, and certification of open-circuit SCBA and combination SCBA/SAR



Respiratory protection standards are developed by NIOSH and NFPA®.

 Establishes major requirements for respiratory protection

OSHA Regulation 29 CFR 1910.134

NIOSH Regulation 42 CFR Part 84

- Establish
- Provide
- Specify



A Self-Contained Breathing Apparatus (SCBA) can be one of the most important pieces of PPE.



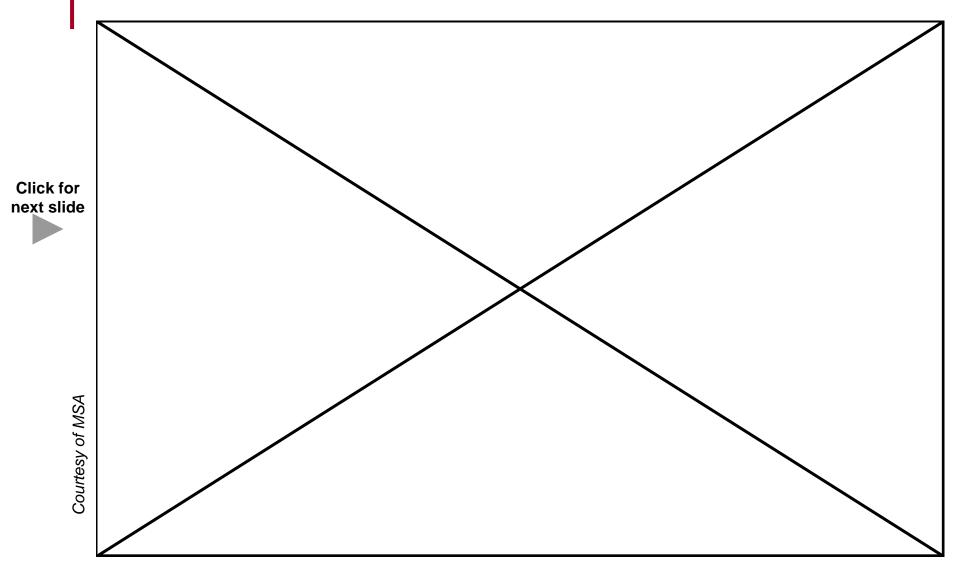


Only positive-pressure open-circuit or closed-circuit SCBAs are allowed in haz mat incidents.





Supplied-Air Respirators do not require the user to carry the breathing air source.



Air-Purifying Respirators remove specific contaminants found in ambient air.



Particulate-removing



Vapor- and-gas-removing

Courtesy of MSA

Combination particulateremoving and vapor- and-gasremoving



DISCUSSION QUESTION



What respirator will NOT protect against CBR materials that can be absorbed through the skin or eyes?



Responders must know the hazards present in the atmosphere in order to select the appropriate filter.



Courtesy of FEMA News Photos, photo by Jocelyn Augustino



Precautions before using APRs include knowing the conditions at the incident.

KNOW

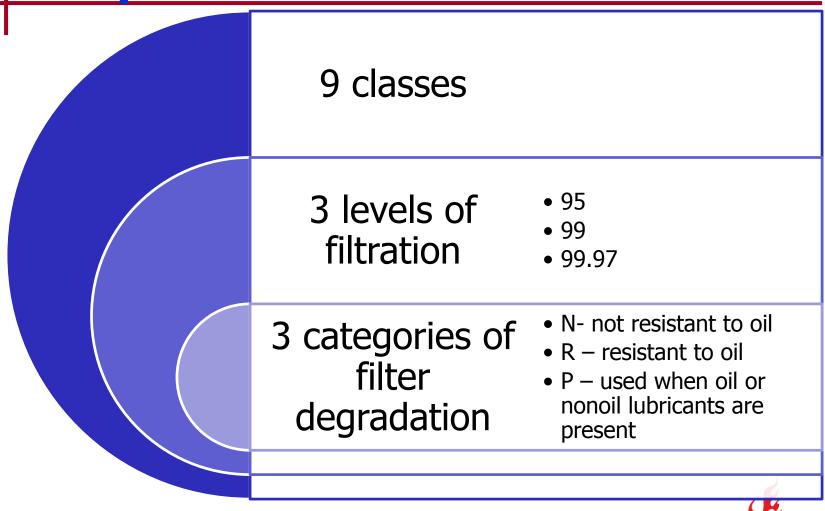
- What is present
- How much is present

ENSURE

- Oxygen level is between 19.5-23.5 percent
- Atmospheric hazards are below IDLH



Particulate-removing filters may be used with either half or full facepiece masks.





Vapor-and gas-removing filters use sorbent material to remove targeted vapor or gas from the air.



Courtesy of MSA



Power Air-Purifying Respirators (PAPRs) offer a greater degree of safety than standard APRs.



Courtesy of New South Wales Fire Brigades



Combined respirators can provide more flexibility and extended work duration in hazardous areas.



Courtesy of MSA



Supplied-Air Hoods provide loose fitting and lightweight protection.



Courtesy of U.S. Air Force, photo by Airman 1st Class Bradley A. Lail **8–18**



Escape respirators are designed for escaping a hot zone.



Courtesy of MSA



REVIEW QUESTION



What types of respiratory protection are used by responders at haz mat/WMD incidents? Describe each.



Respiratory equipment presents specific limitations.

Limited visibility

Decreased ability to communicate

Increased weight

Decreased mobility

Inadequate oxygen levels

Chemical specific

Air-supply limits



New technology may help overcome some of these limitations.

Next Generation SCBA/SCBA Profile Comparison





REVIEW QUESTION



What are the advantages and disadvantages of SCBA?

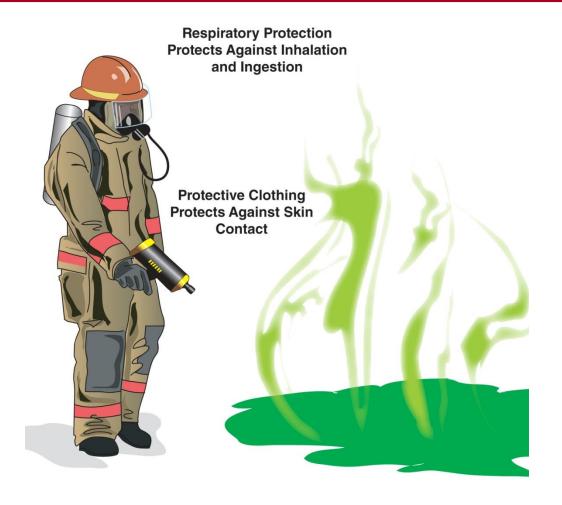


Learning Objective 2

Discuss protective clothing and ensembles.



Protective clothing must be worn whenever the user faces potential hazards.





 Minimum levels against vapor, liquid-splash, and particulate

NFPA® 1991

NFPA® 1994

- Class 2 ensembles
- Class 3 ensembles
- Class 4 ensembles

 Performance requirements for entry into CBRN not IDLH

NFPA® 1951



 Optional protection from CBRN hazards

NFPA® 1971

NFPA® 1851

 Minimum selection and care for structural fire fighting protective ensembles Minimum design, performance, certification, and documentation for liquid splashprotective ensembles and clothing

NFPA® 1992



 Minimum performance requirements from blood and body-fluidborne pathogens

NFPA® 1999

NFPA® 1975

 Requirements for design, performance, testing, and certification on station/work uniforms Performance, criteria, functioning, and test methods for Personal Alert Safety Systems

NFPA® 1982



 Design, performance, certification requirements, and test methods for new flash fire protective garments

NFPA® 2112

NFPA® 2113

 Requirements for selection, care, use, and maintenance of flash fire protective garments meeting NFPA® 2112 Guidelines for selecting protective gloves

ANSI/ISEA 105-2005



 Guide for use of highvisibility and reflective apparel

> ANSI/ISEA 107-2004

ANSI Z87.1-2003

 Performance criteria and testing for devices used to protect eyes and faces from injury and impact Performance and testing requirements for industrial helmets

ANSI Z87.1-2003



 HAZWOPER standard that applies to five distinct groups

> OSHA Regulation 29 *CFR* 1910.120

OSHA Regulation 29 *CFR* 1910.132

 Applies to PPE for eyes, face, head, and extremities Protects employees of state and local governments engaged in hazardous waste operations

EPA Regulation 40 *CFR* Part 311

OSHA Regulation 29 *CFR* 1910.156

 PPE requirements for industrial fire brigades



Structural firefighters' protective clothing only provides limited protection.

Inadequate Vapor Protection





Structural protective clothing may be appropriate in limited conditions.

Contact unlikely

CBR hazards are identified

Atmospheric concentrations are not toxic to skin

Fire or a chance of fire

Structural PPE is the only available, CPC is not available, the IC deems it appropriate



Next generation firefighter's protective clothing is designed with CBRN in mind.





Seals with flexible gasket, coat seals around facepiece

Sourtesy of IAFF and Morning Pride Manufacturing

Seals with heat-resistant magnets



High-temperature protective clothing is designed for short-term high-temperature exposure.



REVIEW QUESTION



What are the limitations of using high-temperature protective clothing?



Chemical protective clothing (CPC) works to shield from hazards that may be at haz mat operations.

Materials

 Each material protects but has limitations

KNOWN

 Designed to protect if fitted properly and worn correctly

- Impermeable to moisture
- Decontaminated before storage/disposal



Liquid-splash protective clothing does not protect against chemicals or vapors.



Courtesy of the U.S. Air Force, photo by Airman 1st Class Jason Epley



Vapor-protective clothing is designed to offer a greater level of protection but with limitations.



Courtesy of the U.S. Air Force, photo by Senior Airman Taylor Marr

Not all hazards



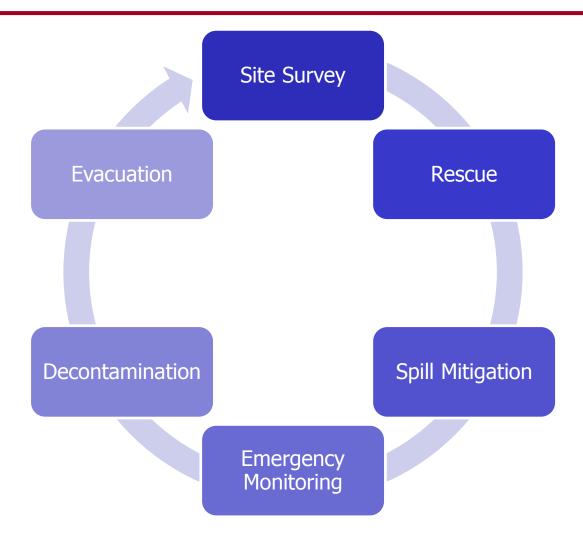
Impairs



Heat stress



Certain operations may require the use of CPC.





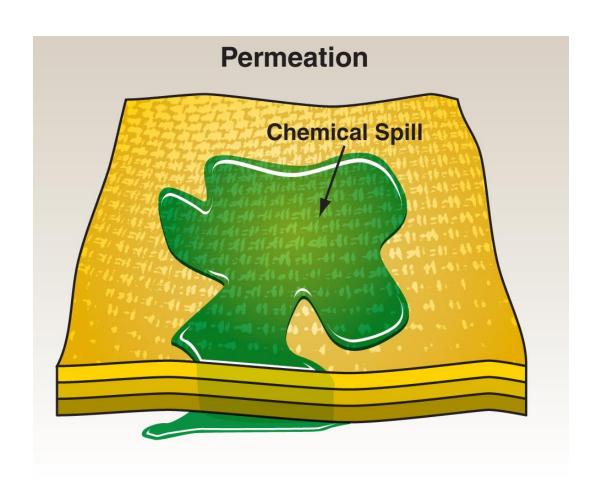
CPC management programs work to protect the wearer from hazards of incorrect use.

Policy statements, procedures, and guidelines

Hazard identification Medical monitoring Environmental surveillance Selection, care, testing, and maintenance Training



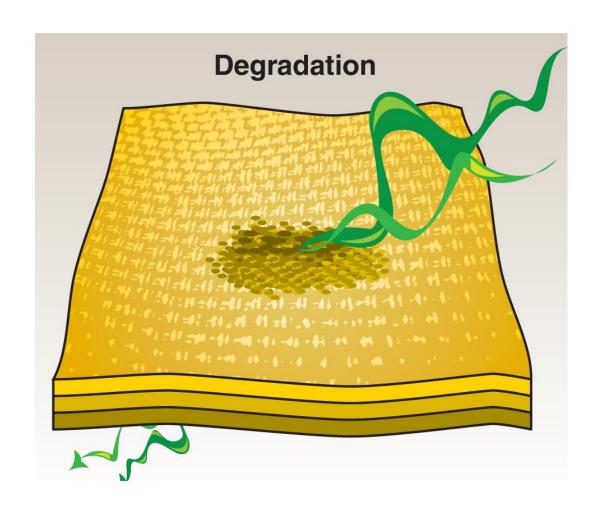
Three main processes can reduce the effectiveness of CPC.



(Continued)



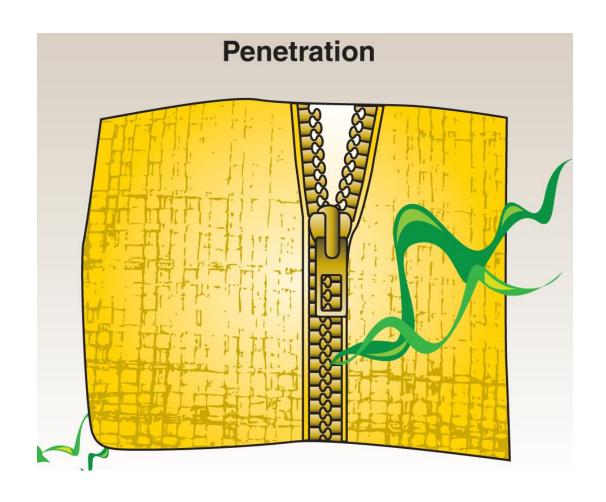
Three main processes can reduce the effectiveness of CPC.



(Continued)



Three main processes can reduce the effectiveness of CPC.





CPC service life is indicated by three labels, all require decontamination before leaving a contaminated area.

Reusable

Limited Use

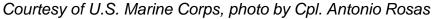
Disposable



Body armor is designed to protect against ballistic threats.



Should be replaced if impacted or damaged





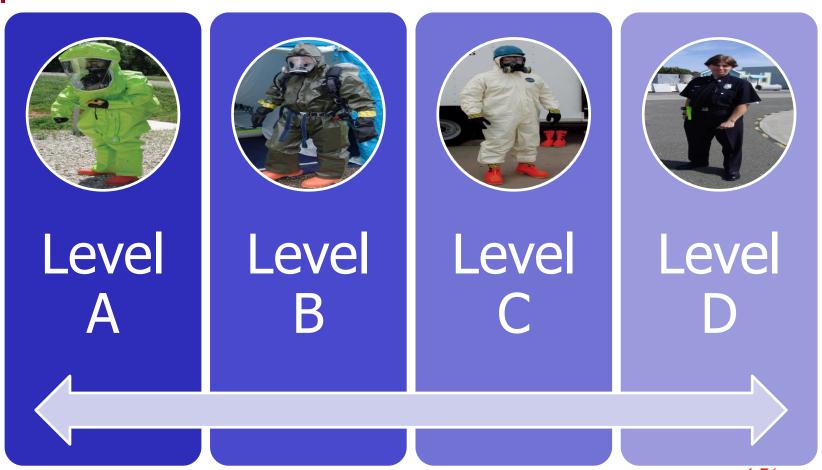
Bomb disposal suits can impair dexterity and range of motion.





Courtesy of the U.S. Marine Corps, photo by Cpl. Brian A. Tuthill.

There are four U.S. EPA levels of protection.



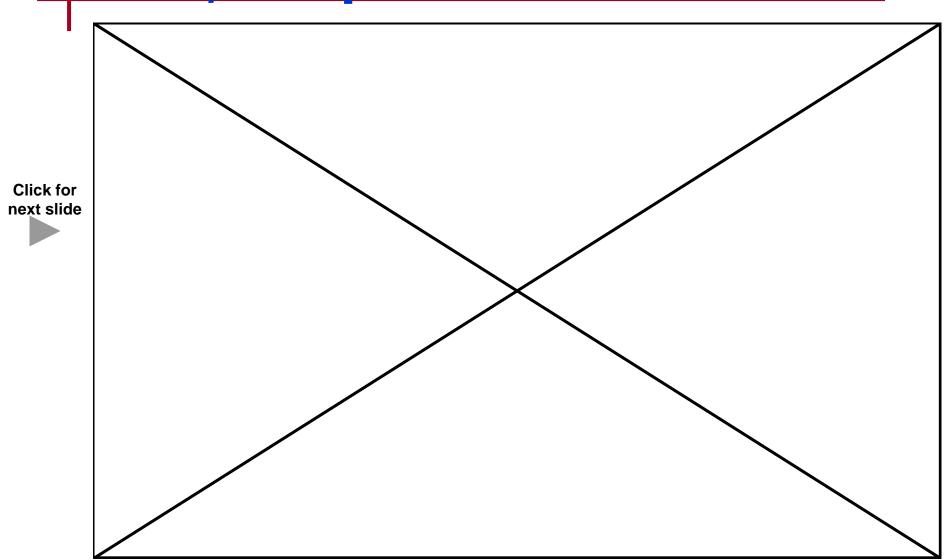
REVIEW QUESTION



Describe the U.S. EPA levels of protection.



Level A provides the greatest level of protection against vapors, gases, mists, and particles.



Level A protection is used in specific situations.

Identified, high level of hazard

High potential

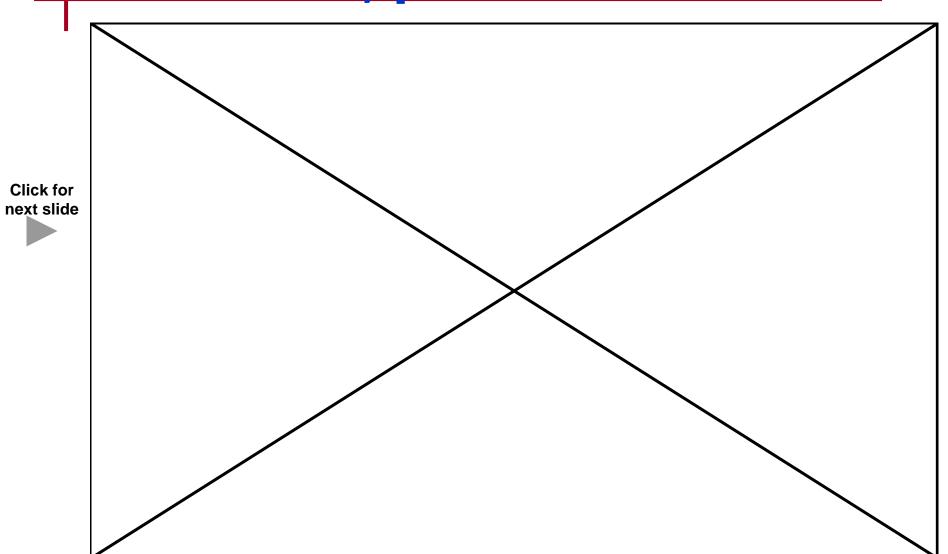
Unknown or unidentified

Known or suspected skin toxicity or carcinogenicity

Confined or poorly ventilated areas



Level B protection is worn when the highest respiratory, but a lesser level of skin, protection is needed.



Level B protection is used in specific situations.

Identified, need high respiratory but less skin protection

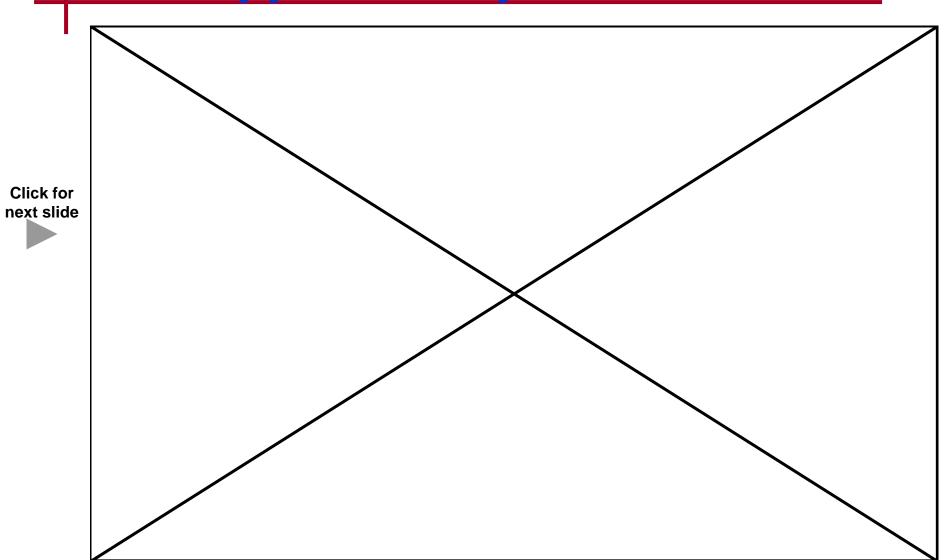
Atmospheric oxygen levels

Incompletely identified vapors or gas, with low skin harm or absorption risk

Identified liquids
or particulates
that do not
contain high
levels or skin
absorption risk



Level C protection is not used unless this protection level has been approved by the IC.



Level C protection is used in specific situations.

Air contaminants identified, measured, APR to remove

Criteria for APR use are met

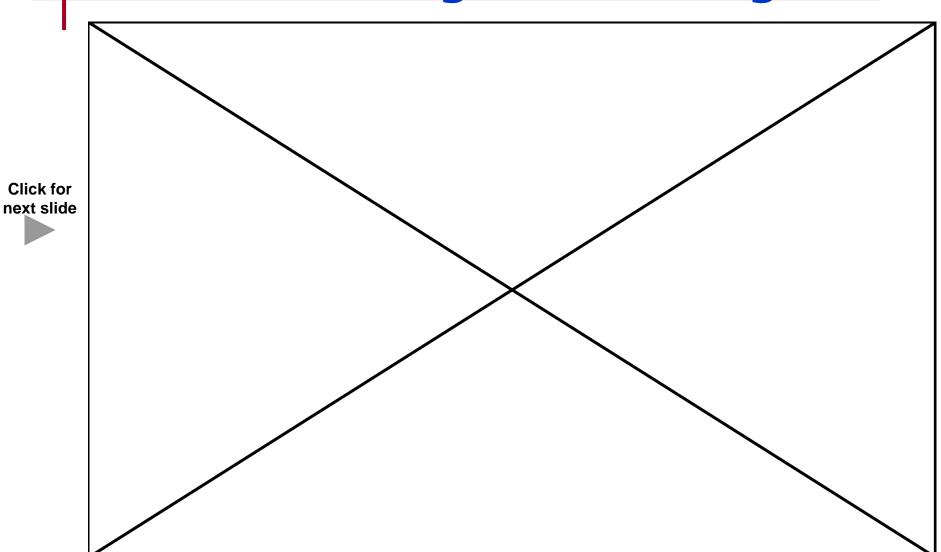
Affect on skin or absorption

Atmospheric concentration does not exceed IDLH levels

Atmospheric oxygen levels



Level D protection is worn when no atmospheric hazards exist, includes structural firefighter clothing.



Level D protection is used in specific situations.

No hazards

Work precludes exposure



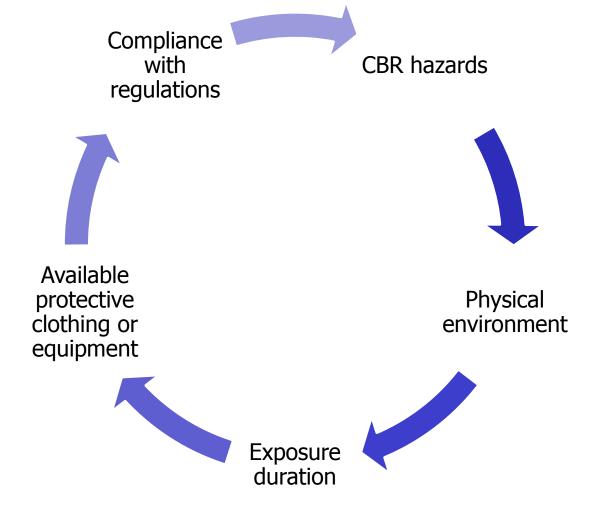
REVIEW QUESTION



What types of protective clothing may be used by responders at haz mat/WMD incidents? Describe each.



PPE selection is based on a variety of factors, often including local SOPs.





Selection of protective clothing is also based on design.

Clothing design

- Variety of styles
- Design considerations

Material chemical resistance

- Resist permeation, degradation, and penetration
- Details

Physical properties

- Strength, resistance to physical hazards, operation
- Questions to ask



Selection of protective clothing is also based on design.

Ease of decontamination

- Disposable
- Reusable
- Both

Ease of maintenance and service

Difficulty and expense

Interoperability with other equipment

Communications

Cost



REVIEW QUESTION



What factors determine the selection of PPE?



Response personnel ensembles will vary depending on the mission of the responder.

- Limited protection against haz mat/WMD
- EPA Level A or B
- Protective garments
- Appropriate respiratory protection

Fire service



- Consists of
- NOT adequate for significant levels
- NOT effective for SWAT, bomb, evidence recovery, other specialty units in hot zone

Law enforcement



Response personnel ensembles will vary depending on the mission of the responder.

- Must provide
- Should include
- NO partial protection
- When not in hot zone

EMS



- Protects against
- Consists of
- Higher MOPP, greater protection
- Joint service lightweight integrated suite technology (JSLIST)

Mission-Oriented Protective Posture (MOPP)





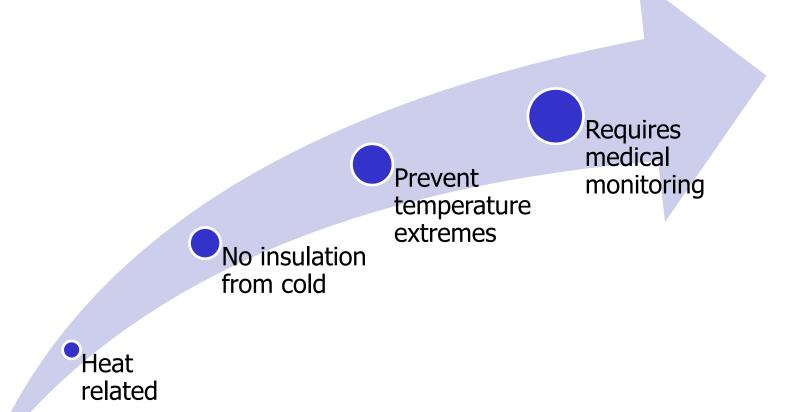
REVIEW QUESTION



What types of ensembles may be used at haz mat/WMD incidents?



Wearing PPE presents several safety related to climate concerns and health issues.





Heat disorders can range from transient heat fatigue to serious illness or death.

Heat disorders

Heat stroke

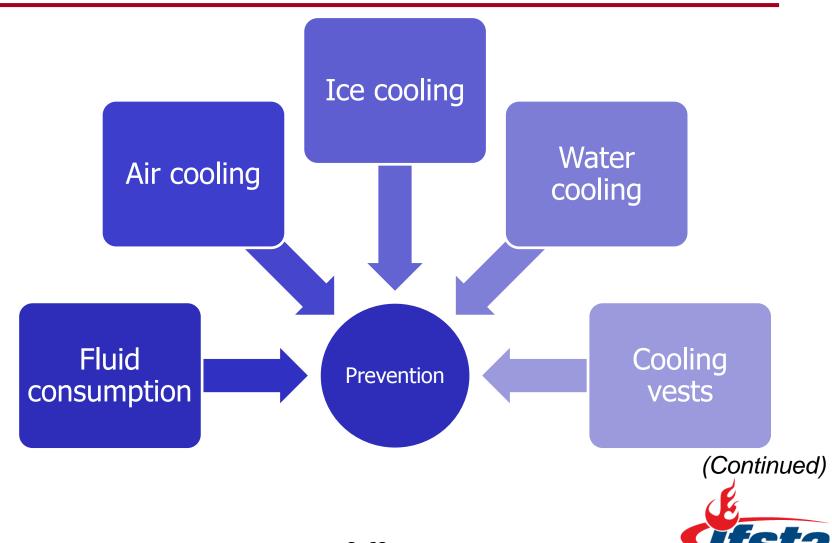
Heat exhaustion

Heat cramps

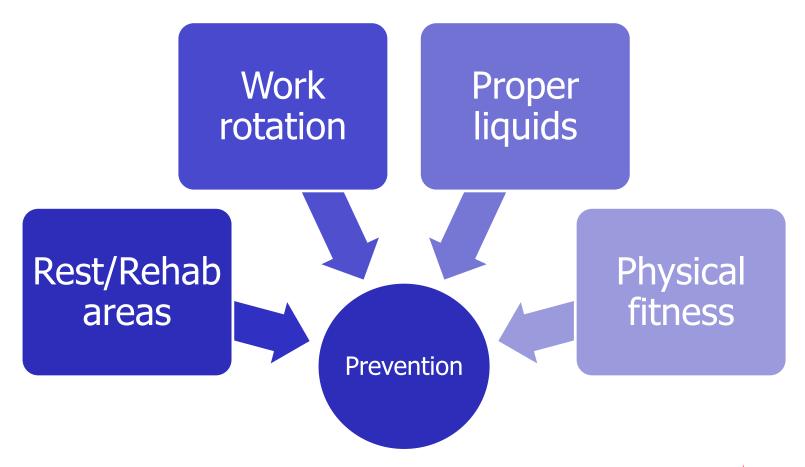
Heat rashes



Heat disorders can be prevented through a variety of methods.



Heat disorders can be prevented through a variety of methods.





Cold disorders are often caused by environmental conditions creating cold-related stress.

Health problems **Environmental conditions** Cold disorders Wind chill Rapid heat loss



REVIEW QUESTION



How can heat exposure be prevented when working in PPE?



Medical monitoring must be provided for responders at risk because of environmental hazards.

Before and after entering and exiting hot zone

Yital signs, hydration, skin, mental status, medical history Blood
pressure,
weight,
respirations,
pulse, core
body
temperature,
ECG

Guidelines must be established



The safety briefing will cover relevant information in addition to other PPE issues.

Status of incident

Hazards identified

PPE requirements

Monitoring requirements

Description of site

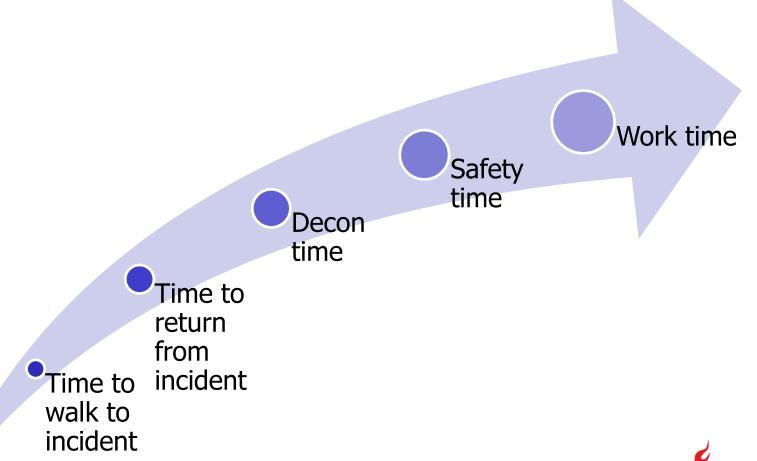
Tasks and expected duration

Notification of identified risks

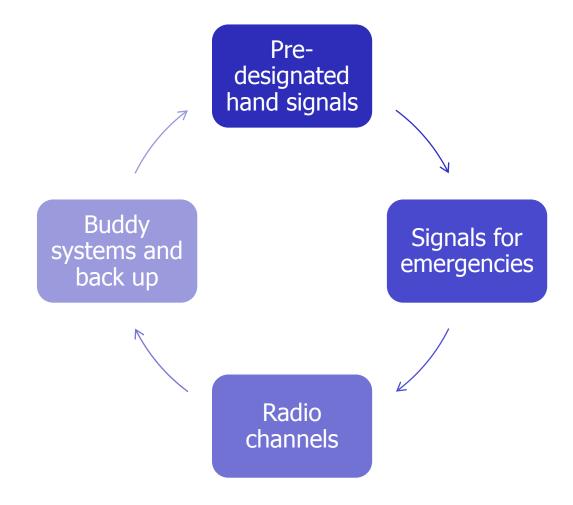
Any other pertinent information



Air management is another safety procedure used to protect responders.



Another method to address safety and emergency procedures is communications.





Learning Objective 3

Don and doff different types of personal protective equipment.

This objective is measured in Skill Sheet 8-1.

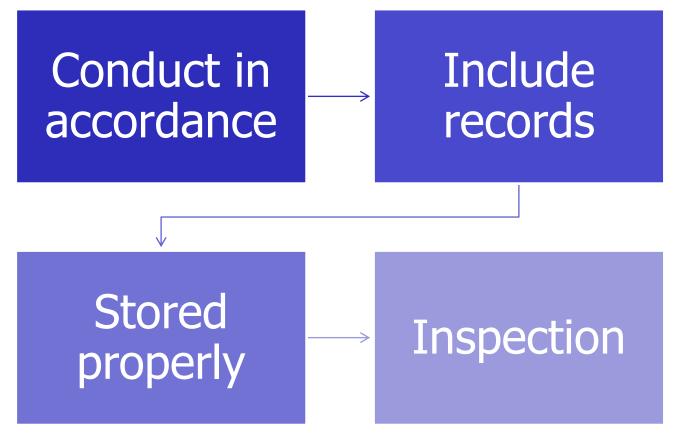


Learning Objective 4

Discuss inspection, storage, testing, and maintenance of PPE.



Inspection, storage, testing and maintenance of PPE is a vital aspect to ensure it performs as expected.





REVIEW QUESTION



How should PPE be stored?



Learning Objective 5

Given hazardous materials scenarios, determine proper PPE for each incident and report and document decision.

This objective is measured in Learning Activity 8-1.

Summary

- Personal protective equipment is needed to protect emergency responders from the hazards present at haz mat and WMD incidents.
- No type of PPE can protect against all hazards.



Summary

 All protective clothing used at haz mat/WMD incidents should meet recognized standards such as NIOSH or NFPA®.

