Learning Objective 1

Discuss respiratory protection.
Respiratory protection is a primary concern for first responders.
Protective breathing equipment protects the body from inhaling hazardous substances.

<table>
<thead>
<tr>
<th>Self contained breathing apparatus (SCBA)</th>
<th>Supplied-air respirators (SARs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed circuit</td>
<td></td>
</tr>
<tr>
<td>Open circuit</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Air-purifying respirators (APRs)</th>
<th>Powered air-purifying respirators (PAPRs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particulate removing</td>
<td></td>
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<tr>
<td>Vapor and gas removing</td>
<td></td>
</tr>
<tr>
<td>Combination</td>
<td></td>
</tr>
</tbody>
</table>
Respiratory protection standards are developed by NIOSH and NFPA®.

- Performance and design requirements
  - NIOSH CBRN standard for Open-Circuit SCBA

- Minimum requirements for entry in NOT IDLH
  - NIOSH standard for CBRN Full Facepiece APR

- Minimum requirements for use by general population
  - NIOSH standard for CBRN Air-Purifying Escape Respirator and CBRN Self-Contained Escape Respirator

(Continued)
Respiratory protection standards are developed by NIOSH and NFPA®.

- Minimum requirements for selection, care, and maintenance of open-circuit SCBA and combination SCBA/SAR

NFPA® 1981
- Minimum requirements for design, performance, testing, and certification of open-circuit SCBA and combination SCBA/SAR

(Continued)
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
- Combination particulate-removing and vapor- and-gas-removing
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.

<table>
<thead>
<tr>
<th>9 classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 levels of filtration</td>
</tr>
<tr>
<td>- 95</td>
</tr>
<tr>
<td>- 99</td>
</tr>
<tr>
<td>- 99.97</td>
</tr>
<tr>
<td>3 categories of filter degradation</td>
</tr>
<tr>
<td>- N - not resistant to oil</td>
</tr>
<tr>
<td>- R – resistant to oil</td>
</tr>
<tr>
<td>- P – used when oil or nonoil lubricants are present</td>
</tr>
</tbody>
</table>
Vapor-and gas-removing filters use sorbent material to remove targeted vapor or gas from the air.
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
Escape respirators are designed for escaping a hot zone.
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
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.
Standards for protective clothing and equipment are developed by several agencies.

- **NFPA® 1991**
  - Minimum levels against vapor, liquid-splash, and particulate

- **NFPA® 1994**
  - Class 2 ensembles
  - Class 3 ensembles
  - Class 4 ensembles

- **NFPA® 1951**
  - Performance requirements for entry into CBRN not IDLH

(Continued)
Standards for protective clothing and equipment are developed by several agencies.

- **NFPA® 1971**
  - Optional protection from CBRN hazards

- **NFPA® 1851**
  - Minimum selection and care for structural fire fighting protective ensembles

- **NFPA® 1992**
  - Minimum design, performance, certification, and documentation for liquid splash-protective protective ensembles and clothing

(Continued)
Standards for protective clothing and equipment are developed by several agencies.

- **NFPA® 1999**
  - Minimum performance requirements from blood and body-fluid-borne pathogens

- **NFPA® 1975**
  - Requirements for design, performance, testing, and certification on station/work uniforms

- **NFPA® 1982**
  - Performance, criteria, functioning, and test methods for Personal Alert Safety Systems

(Continued)
Standards for protective clothing and equipment are developed by several agencies.

- **NFPA® 2112**: Design, performance, certification requirements, and test methods for new flash fire protective garments.
- **NFPA® 2113**: Requirements for selection, care, use, and maintenance of flash fire protective garments meeting NFPA® 2112.
- **ANSI/ISEA 105-2005**: Guidelines for selecting protective gloves.

(Continued)
Standards for protective clothing and equipment are developed by several agencies.

- **ANSI/ISEA 107-2004**
  - Guide for use of high-visibility and reflective apparel

- **ANSI Z87.1-2003**
  - Performance criteria and testing for devices used to protect eyes and faces from injury and impact

- **ANSI Z87.1-2003**
  - Performance and testing requirements for industrial helmets

(Continued)
Standards for protective clothing and equipment are developed by several agencies.

- **HAZWOPER** standard that applies to five distinct groups
  - OSHA Regulation 29 CFR 1910.120

- **Applies to PPE for eyes, face, head, and extremities**
  - OSHA Regulation 29 CFR 1910.132

- **Protects employees of state and local governments engaged in hazardous waste operations**
  - EPA Regulation 40 CFR Part 311

- **PPE requirements for industrial fire brigades**
  - OSHA Regulation 29 CFR 1910.156
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

Seals with heat-resistant magnets

Courtesy of IAFF and Morning Pride Manufacturing
High-temperature protective clothing is designed for short-term high-temperature exposure.
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.
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
Certain operations may require the use of CPC.

- Site Survey
- Rescue
- Spill Mitigation
- Emergency Monitoring
- Decontamination
- Evacuation

8–40
CPC management programs work to protect the wearer from hazards of incorrect use.

Policy statements, procedures, and guidelines

<table>
<thead>
<tr>
<th>Hazard identification</th>
<th>Medical monitoring</th>
<th>Environmental surveillance</th>
<th>Selection, care, testing, and maintenance</th>
<th>Training</th>
</tr>
</thead>
</table>

8–41
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.

Courtesy of U.S. Marine Corps, photo by Cpl. Antonio Rosas
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.

- Level A
- Level B
- Level C
- Level D
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
- Incompletely identified vapors or gas, with low skin harm or absorption risk
- Atmospheric oxygen levels
- 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
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

(Continued)
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**
What factors determine the selection of PPE?
Response personnel ensembles will vary depending on the mission of the responder.

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

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

(Continued)
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)
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 related
- No insulation from cold
- Prevent temperature extremes
- Requires medical monitoring
Heat disorders can range from transient heat fatigue to serious illness or death.
Heat disorders can be prevented through a variety of methods.

- Fluid consumption
- Air cooling
- Ice cooling
- Water cooling
- Cooling vests

(Continued)
Heat disorders can be prevented through a variety of methods.

- Work rotation
- Proper liquids
- Rest/Rehab areas
- Physical fitness

Prevention
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.

Conducted
Before and after entering and exiting hot zone

Check
Vital signs, hydration, skin, mental status, medical history

Measure
Blood pressure, weight, respirations, pulse, core body temperature, ECG

Written
Guidelines must be established
The safety briefing will cover relevant information in addition to other PPE issues.

<table>
<thead>
<tr>
<th>Status of incident</th>
<th>Hazards identified</th>
<th>PPE requirements</th>
<th>Monitoring requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of site</td>
<td>Tasks and expected duration</td>
<td>Notification of identified risks</td>
<td>Any other pertinent information</td>
</tr>
</tbody>
</table>
Air management is another safety procedure used to protect responders.
Another method to address safety and emergency procedures is communications.

- Pre-designated hand signals
- Buddy systems and back up
- Radio channels
- Signals for emergencies
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.

- Conduct in accordance
- Include records
- Stored properly
- Inspection
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®.