

Chapter 29: Hazardous Materials Regulations, Standards, and Laws

Matching

- | | | | | |
|------------------|------------------|------------------|------------------|-------------------|
| 1. F (page 1065) | 3. G (page 1063) | 5. B (page 1063) | 7. D (page 1071) | 9. H (page 1071) |
| 2. A (page 1069) | 4. C (page 1065) | 6. E (page 1064) | 8. J (page 1070) | 10. I (page 1066) |

Multiple Choice

- | | | | | |
|------------------|------------------|------------------|------------------|-------------------|
| 1. B (page 1063) | 3. B (page 1065) | 5. C (page 1070) | 7. C (page 1071) | 9. B (page 1066) |
| 2. A (page 1064) | 4. D (page 1070) | 6. A (page 1071) | 8. A (page 1065) | 10. C (page 1069) |

Vocabulary

1. Local Emergency Planning Committee (LEPC): A group consisting of members of industry, transportation officials, the public at large, media, and fire and police agencies that gathers and disseminates information on hazardous materials stored in the community and ensures that there are adequate local resources to respond to a chemical event in the community. (page 1071)
2. Hazardous waste: Hazardous waste is what remains after a process or manufacturing activity has used a substance and the material is no longer pure. (page 1063)
3. Target hazard: Includes any occupancy type or facility that presents a high potential for loss of life or serious impact to the community resulting from fire, explosion, or chemical release. (page 1071)
4. HAZWOPER: Hazardous Waste and Emergency Response. This OSHA regulation governs hazardous materials waste sites and response training. Specifics can be found in 29 CFR 1910.12. Subsection (q) is specific to emergency response. (page 1065)
5. Operations level: The level at which the responder should be able to recognize a potential hazardous materials incident, isolate the incident, deny entry to other responders and the public, and take defensive actions, such as shutting off valves and protecting drains without having contact with the product. Operations-level responders act in a defensive manner. (page 1066)

Fill-In

- | | |
|---|--------------------------------|
| 1. dangerous goods (page 1063) | 6. technicians (page 1069) |
| 2. Chemical, Biological, Radiological, Nuclear, Explosive (page 1063) | 7. 472 (page 1065) |
| 3. regulations (page 1064) | 8. HAZWOPER (page 1065) |
| 4. Preplanning (page 1071) | 9. hazardous waste (page 1063) |
| 5. awareness (page 1065) | 10. state plan (page 1064) |

True/False

- | | |
|----------------------|----------------------|
| 1. True (page 1062) | 6. True (page 1063) |
| 2. False (page 1064) | 7. False (page 1071) |
| 3. True (page 1071) | 8. False (page 1064) |
| 4. True (page 1062) | 9. True (page 1070) |
| 5. False (page 1065) | 10. True (page 1063) |

Short Answer

1. Identify the four levels of hazardous materials training and competencies according to NFPA 1072.

Awareness level (personnel): Personnel who, in the course of their normal duties, could encounter an emergency involving hazardous materials/weapons of mass destruction (WMDs) and who are expected to recognize the presence of the hazardous materials/WMDs, protect themselves, call for trained personnel, and secure the scene.

Operations level (responders): Persons who respond to hazardous materials/weapons of mass destruction (WMDs) incidents to implement or support actions to protect nearby persons, the environment, or property from the effects of the release.

Technician/Specialist level: A person who responds to hazardous materials/WMD incidents using a risk-based response process by which he or she analyzes a problem involving hazardous materials/WMDs, selects applicable decontamination procedures, and controls a release using specialized protective clothing and control equipment.

Incident Commander level: The person who is responsible for all incident activities, including the development of strategies and tactics and the ordering and release of resources. (pages 1065–1070)

- Discuss the role of the NFPA in developing standards for hazardous materials response. The NFPA develops and issues voluntary consensus-based standards that anyone can comment on before the members of the appropriate NFPA technical committee agree to adopt them. The technical committee must meet regularly; revise, update, and possibly change a standard; and review and act on any public comments during the revision process. Once the standard is finalized, agencies may choose to adopt it. (page 1064)

Hazardous Materials Alarms

- Appropriate actions include the following: recognize that it is a potential hazardous materials incident, protect yourself and others, call for trained response personnel, and secure and isolate the area. Additional appropriate actions would include gathering information such as the UN/NA identification number, the type of placard, or other markings, and using the Emergency Response Guidebook (ERG) to identify protective actions. (page 1065)
- Appropriate discussion points include the following: once an incident is identified as including hazardous materials, the thought process of the responder must change; hazardous materials incidents are handled in a more deliberate fashion than structural firefighting, it may take longer to get the full picture of the incident before taking action; responders often take more time to get oriented to the problem; the actions taken are largely dictated by the chemicals involved; and personnel must be conscious of the potential or actual law enforcement aspect of the incident. Responders must make a conscious effort to change their perspective: slow down, think about the problem and the available resources, and take well-considered action. (pages 1062–1064)

Chapter 30: Recognizing and Identifying the Hazards

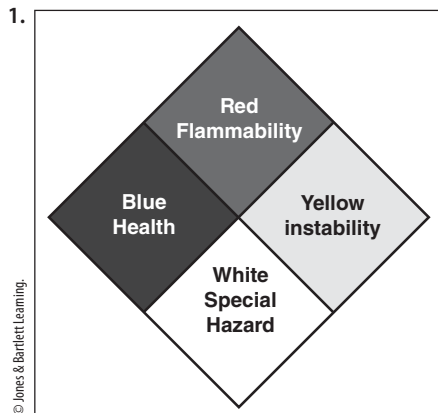
Matching

- | | | | | |
|------------------|------------------|------------------|------------------|-------------------|
| 1. E (page 1079) | 3. A (page 1080) | 5. B (page 1084) | 7. C (page 1088) | 9. G (page 1101) |
| 2. F (page 1080) | 4. H (page 1080) | 6. D (page 1088) | 8. I (page 1099) | 10. J (page 1102) |

Multiple Choice

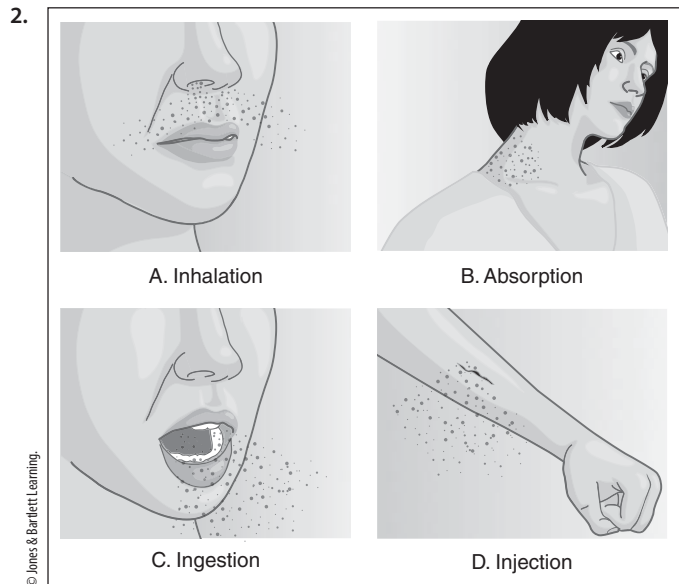
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|------------------|------------------|-------------------|-------------------|-------------------|
| 1. B (page 1076) | 5. C (page 1081) | 9. A (page 1085) | 13. A (page 1088) | 17. B (page 1094) |
| 2. A (page 1077) | 6. C (page 1082) | 10. D (page 1085) | 14. D (page 1089) | 18. C (page 1096) |
| 3. D (page 1080) | 7. D (page 1082) | 11. C (page 1088) | 15. C (page 1091) | 19. D (page 1102) |
| 4. A (page 1080) | 8. B (page 1084) | 12. A (page 1088) | 16. B (page 1093) | 20. A (page 1121) |

Labeling



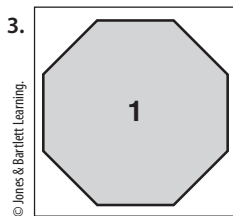
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(page 1086)



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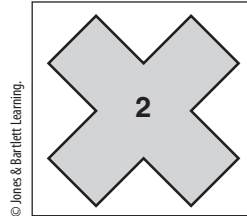
(page 1099)



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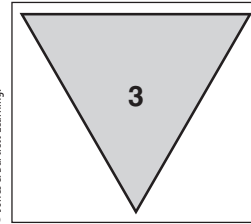
A. Mass detonation hazards

(page 1088)



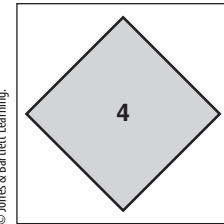
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B. Explosion-with-fragment hazards



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C. Mass fire hazards



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D. Moderate fire hazards

Vocabulary

- Shipping papers:** Shipping papers are required whenever materials are transported from one place to another. They include the name and addresses of the shipper and the receiver, they identify the material being shipped, and they specify the quantity and weight of each part of the shipment. Additionally, shipping papers allow the reader to match the chemical name found on the shipping papers with the mode of transportation. (page 1088)
- BLEVE:** An acronym that stands for *Boiling Liquid Expanding Vapor Explosion*. A BLEVE occurs when pressurized liquefied materials inside a closed vessel are exposed to a source of high heat. (page 1082)
- Emergency Response Guidebook (ERG):** The Emergency Response Guidebook, or ERG, offers a certain amount of guidance for responders operating at a hazardous materials incident. The guide is intended to help responders decide which preliminary action to take and provides information on several thousand chemicals. (pages 1091-1093)
- Pipeline right of way:** The pipeline right of way is an area, patch of land, or roadway that extends a certain number of feet on either side of the pipe itself. The company that owns the pipeline maintains this area. The company is also responsible for placing warning signs at regular intervals along the length of the pipeline. (page 1091)
- Placards and labels:** Placards are diamond-shaped indicators (10 $\frac{3}{4}$ " [27.3 cm] on each side) that are placed on all four sides of highway transport vehicles, railroad tank cars, and other forms of transportation carrying hazardous materials. Labels are smaller versions (4" [10.16 cm] diamond-shaped indicators) that are placed on all four sides of individual boxes and smaller packages being transported. (page 1093)

Fill-In

1. size-up (page 1077)
2. sheltering, in, place (page 1078)
3. safety, data, sheet (page 1084)
4. pipelines (page 1091)
5. W (page 1087)
6. Hazardous Materials Information System (page 1086)
7. military (page 1088)
8. waybills, consist (page 1088)
9. green (page 1095)
10. Canada, Mexico (page 1096)

True/False

1. True (page 1076)
2. False (page 1079)
3. True (page 1080)
4. True (page 1080)
5. False (page 1088)
6. False (page 1087)
7. True (page 1088)
8. True (page 1089)
9. False (page 1093)
10. False (page 1093)

Short Answer

1.
 1. The name of the chemical
 2. Physical and chemical characteristics of the material
 3. Physical hazards of the material
 4. Health hazards of the material
 5. Signs and symptoms of exposure
 6. Routes of entry
 7. Permissible exposure limits
 8. Responsible party contact
 9. Precautions for safe handling
 10. Applicable control measures include personal protective equipment
 11. Emergency and first-aid procedures
 12. Appropriate waste disposal (page 1084)
2. DOT Class 1—Explosives
 - Division 1.1 Explosives with a mass explosion hazard
 - Division 1.2 Explosives with a projection hazard
 - Division 1.3 Explosives with predominantly a fire hazard
 - Division 1.4 Explosives with no significant blast hazard
 - Division 1.5 Very insensitive explosives with a mass explosion hazard
 - Division 1.6 Extremely insensitive articles
- DOT Class 2—Gases
 - Division 2.1 Flammable gases
 - Division 2.2 Nonflammable, nontoxic gases
 - Division 2.3 Toxic gases
- DOT Class 3—Flammable liquids (and combustible liquids in the United States)
- DOT Class 4—Flammable solids, spontaneously combustible materials, and dangerous when wet materials/water-reactive substances
 - Division 4.1 Flammable solids
 - Division 4.2 Spontaneously combustible materials
 - Division 4.3 Water-reactive substances/dangerous when wet
- DOT Class 5—Oxidizing substances and organic peroxides
 - Division 5.1 Oxidizing substances
 - Division 5.2 Organic peroxides

DOT Class 6—Toxic substances and infectious substances

Division 6.1 Toxic substances

Division 6.2 Infectious substances

DOT Class 7—Radioactive materials

DOT Class 8—Corrosive substances

DOT Class 9—Miscellaneous hazardous materials/products, substances, or organisms (page 1096-1097)

3. **Yellow section:** More than 4000 chemicals are found in this section, listed numerically by their four-digit UN number/identification (ID) number.

Blue section: The same chemicals listed in the yellow section are found here, listed alphabetically by name. The entry will include the emergency action guide number and the identification number.

Orange section: This section is organized by guide number. The general hazard class, fire/explosion hazards, health hazards, and basic emergency actions, based on hazard class, are provided.

Green section: This section is organized numerically by UN/ID number and provides the initial isolation distances for certain materials. (pages 1094-1095)

4. The NFPA 704 hazard identification system uses a diamond-shaped symbol of any size, which is itself broken into four smaller diamonds, each representing a property or characteristic of a substance or group of substances. The blue, red, and yellow diamonds each contain a numerical rating in the range of 0–4, with 0 being the least hazardous, and 4 being the most hazardous. The blue diamond (at the nine o'clock position) indicates the health hazard posed by a material alone or perhaps within a group of other chemicals. Responders must understand that when an NFPA diamond represents a series of hazards posed by several different substances, the most severe characteristic of any of the substances may be used to represent the hazard within any of the four-colored diamonds. For example, if any one of the substances in a grouping of chemicals could be fatally toxic, that single substance causes a 4 to appear in the blue diamond. All other substances could be much less hazardous, but the one causing the 4 represents the health hazard for the group. The same logic holds true for the flammability and instability diamonds. The top red diamond indicates flammability. The yellow diamond (at the three o'clock position) indicates instability. The bottom white diamond will not have a number but may contain special symbols. Among examples of the symbols used are a burning OX (oxidizing capability), COR (corrosive), a three-bladed trefoil (radioactivity), and a W with a slash through it (water reactive). (pages 1084-1086)
5. Inhalation: Through the lungs
Absorption: By permeating the skin
Ingestion: Via the gastrointestinal tract
Injection: Through cuts or other breaches in the skin. (page 1099)

Hazardous Materials Alarms

1. Initial actions to protect the safety of responders include:
 - a. Stay upwind, uphill, and out of the problem
 - b. Obtain a briefing from those involved in the incident prior to acting
 - c. Understand the nature of the problem and the factors influencing the release
 - d. Attempt to make a positive identification of the released substance, including obtaining the correct SDS, shipping papers, and ERG or other reference source. (page 1078)
2. Actions to isolate and deny entry to the scene include:
 - a. Establish a hot zone. Your first priority, after ensuring your safety, is to separate the people from the problem.
 - b. Utilize methods such as evacuation, sheltering in place, decontamination, and rendering medical care as a means of protecting life safety.
 - c. Utilize Standard Operating Procedures, the emergency response plan, and the ERG to identify various protective actions and notifications.
 - d. Establish a command post.
 - e. Determine your response objectives and begin to formulate a basic incident action plan (IAP).
 - f. Identify and remotely secure potential ignition sources when flammable liquids or gases have been released. (page 1078)

Chapter 31: Properties and Effects

Matching

- | | | | | |
|------------------|------------------|------------------|------------------|-------------------|
| 1. E (page 1111) | 3. A (page 1118) | 5. B (page 1114) | 7. C (page 1120) | 9. G (page 1119) |
| 2. F (page 1113) | 4. H (page 1119) | 6. D (page 1116) | 8. I (page 1116) | 10. J (page 1111) |

Multiple Choice

- | | | | |
|------------------|-------------------|-------------------|-------------------|
| 1. A (page 1109) | 6. C (page 1116) | 11. A (page 1118) | 16. A (page 1121) |
| 2. C (page 1109) | 7. A (page 1116) | 12. D (page 1119) | 17. D (page 1123) |
| 3. D (page 1111) | 8. B (page 1117) | 13. B (page 1119) | 18. B (page 1126) |
| 4. C (page 1111) | 9. D (page 1118) | 14. C (page 1119) | 19. A (page 1123) |
| 5. B (page 1111) | 10. C (page 1118) | 15. A (page 1120) | 20. B (page 1123) |

Labeling



A. Rapid relief



B. Spill or leak



C. Violent rupture



D. Detonation (page 1110)

2.



A

A. Cloud



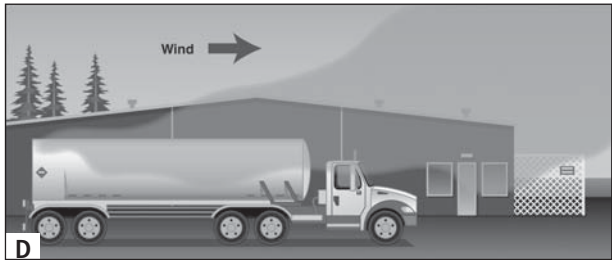
B

B. Cone



C

C. Hemispheric release



D

D. Plume



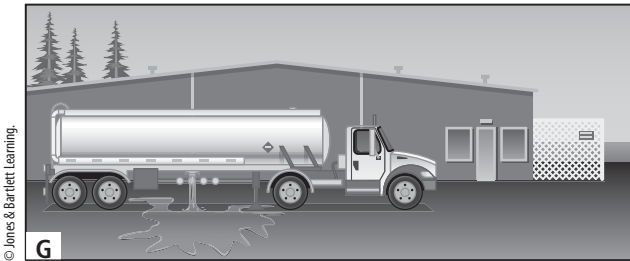
E

E. Pool



F

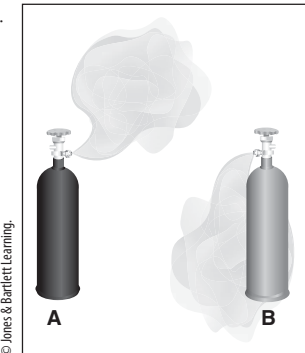
F. Stream



G

G. Irregular dispersion (page 1111)

3.



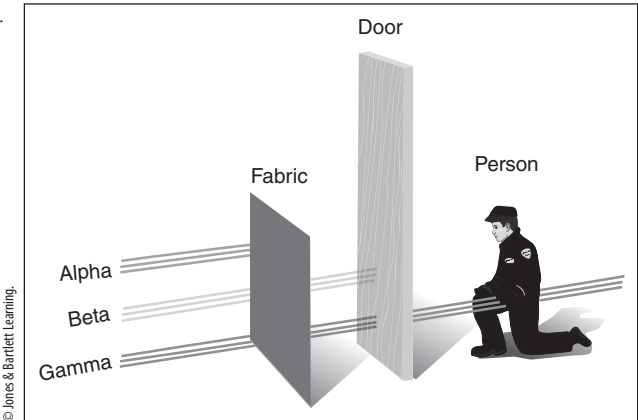
A

A. Vapor density less than 1

B

B. Vapor density greater than 1 (pages 1116-1117)

4.



Alpha

Beta

Gamma

Door

Fabric

Person

(page 1121)

Vocabulary

1. **Ignition temperature:** The minimum temperature at which a fuel, when heated, will ignite in the presence of air and continue to burn. (page 1113)
2. **Expansion ratio:** A description of the volume increase that occurs when a compressed liquefied gas changes to a gas. (page 1112)
3. **Radiation:** The energy transmitted through space in the form of electromagnetic waves or energetic particles. (page 1120)
4. **Contamination:** When a chemical has been released and physically comes in contact with people, the environment, and everything around it, either intentionally or unintentionally. The residue of that chemical is known as contamination. (page 1123)
5. **Specific gravity:** The comparison between the weight of a liquid chemical and the weight of water. (page 1117)

Fill-In

1. predict (page 1109)
2. physical (page 1110)
3. 14.7 (pages 1115-1116)
4. -45°F (-43°C) (page 1114)
5. flash point (page 1113)
6. ignition (page 1113)
7. float (page 1117)
8. elements (page 1120)
9. Beta (page 1121)
10. acute health effects (page 1123)

True/False

1. False (pages 1101-1111)
2. False (page 1116)
3. True (page 1114)
4. False (page 1112)
5. True (page 1114)
6. True (page 1120)
7. False (page 1120)
8. True (page 1123)
9. True (page 1126)
10. False (page 1122)

Short Answer

1. Thermal. Heat created from fire or cold generated by environmental factors or substances such as cryogenics.
 2. Chemical. The interaction of incompatible chemicals and/or the physical and chemical properties of a substance and how those substances interact inside or outside a container may lead to overpressure, disintegration, or other kinds of failure of any type of container.
 3. Mechanical. Falling debris, shrapnel, firearms, explosives, forklift puncture, and the like, are all examples of how mechanical means can cause container failure. (page 1110)
1. Pesticide name
 2. Active ingredients
 3. Hazard statement
 4. Total amount of product in the container
 5. Manufacturer's name and address
 6. Environmental Protection Agency (EPA) registration number, which provides proof that the product was registered with the EPA
 7. EPA establishment number, which shows where the product was manufactured
 8. Signal words to indicate the relative toxicity of the material
 9. Practical first-aid treatment description
 10. Directions for use

11. Agricultural use requirements
12. Precautionary statements
13. Storage and disposal information
14. Classification statement on who may use the product. (pages 1108-1109)
3.
 1. The amount of radiation absorbed by the body, which has a direct relation to the degree of damage done.
 2. The exposure time to the radiation, which ultimately affects the extent of the injury. (page 1120)
4.
 1. Soot
 2. Carbon monoxide
 3. Carbon dioxide
 4. Polycyclic aromatic hydrocarbons
 5. Benzene
 6. Cyanide compounds
 7. Chlorine compounds
 8. Water vapor
 9. Formaldehyde
10. Oxides of nitrogen (page 1119)
5. 4H MEDIC ANNA
 - H: Hydrogen
 - H: Helium
 - H: Hydrogen cyanide
 - H: Hydrogen fluoride
 - M: Methane
 - E: Ethylene
 - D: Diborane
 - I: Illuminating gas (methane/ethane mixture)
 - A: Ammonia
 - N: Neon
 - N: Nitrogen
 - A: Acetylene (page 1117)

Hazardous Materials Alarms

1. Make every effort to reduce or eliminate the ability of the substance to enter your body, and keep the duration of the exposure to an absolute minimum. This requires you to reduce the time you are exposed to the material, to stay far enough away so that you are not directly exposed, and/or to shield yourself with personal protective equipment or solid objects. Time, distance, and shielding are methods used to protect fire fighters from the adverse effects of radiation. If you suspect a radiation incident at a fixed facility, you should initially ask for the radiation safety officer of the facility. This person is responsible for maintaining the use, handling, and storage procedures of all the radioactive material at the site. This person will likely be a tremendous resource to you and will know exactly what is being used at the facility. (pages 1120-1122)
2. BLEVE stands for Boiling Liquid Expanding Vapor Explosion. In this scenario, the fire will cause the liquid in the tank to boil, creating large volumes of vapor within the tank. If the tank is not able to relieve the pressure through the safety valve, a catastrophic failure of the tank can occur. The resulting explosion can throw fragments in all directions, and if the pressurized liquefied material is flammable, it can create a large fireball. In addition, an overpressure blast wave is created by the rapidly expanding vapor released by the tank failure. (page 1112)

Chapter 32: Understanding the Hazards

Matching

- | | | |
|------------------------|------------------|-------------------|
| 1. B (page 1150) | 5. A (page 1154) | 9. H (page 1151) |
| 2. J (page 1153) | 6. D (page 1160) | 10. G (page 1153) |
| 3. E (page 1153) | 7. C (page 1152) | |
| 4. I (pages 1154-1155) | 8. F (page 1147) | |

Multiple Choice

- | | | | |
|------------------------|-------------------|-------------------|-------------------|
| 1. D (page 1132) | 6. C (page 1153) | 11. D (page 1133) | 16. A (page 1139) |
| 2. D (page 1132) | 7. B (page 1139) | 12. B (page 1133) | 17. C (page 1147) |
| 3. C (page 1138) | 8. A (page 1142) | 13. A (page 1136) | 18. B (page 1148) |
| 4. B (page 1140) | 9. C (page 1133) | 14. C (page 1137) | 19. D (page 1149) |
| 5. A (pages 1140-1141) | 10. D (page 1133) | 15. D (page 1139) | 20. A (page 1158) |

Labeling

1.



Courtesy of Polar Tank Trailer L.L.C.

A. The MC-306/DOT 406 flammable liquid tank (page 1138)



Courtesy of Polar Tank Trailer L.L.C.

B. The MC-307/DOT 407 chemical hauler (page 1138)



Courtesy of National Tank Truck Carriers Association.

C. The MC-312/DOT 412 corrosives tanker (page 1138)



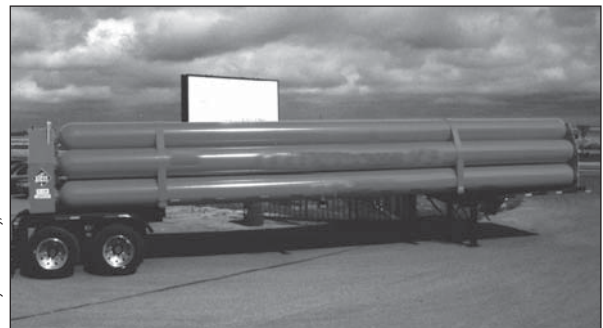
Courtesy of Rob Schnepf.

D. The MC-331 high-pressure cargo tank (page 1139)



Courtesy of Jack B. Kelly, Inc.

E. The MC-338 cryogenic tank (page 1139)



Courtesy of Jack B. Kelly, Inc.

F. A tube trailer (page 1139)



Courtesy of Polar Tank Trailer L.L.C.

G. A dry bulk cargo tank (page 1140)



Courtesy of private source.

H. Low-pressure tank cars (page 1141)

Vocabulary

- Plague:** An infectious disease caused by the bacterium *Yersinia pestis*, which is commonly found on rodents. (page 1154)
- Radiation dispersal device:** Any device that causes the purposeful dissemination of radioactive material without a nuclear detonation. A dirty bomb. (page 1159)
- Anthrax:** An infectious disease caused by the bacterium *Bacillus anthracis*. The bacteria is typically found around farm animals such as cows and sheep. (page 1153)
- Biological agents:** Organisms that cause disease and attack the body. They include bacteria and viruses. (page 1153)

Fill-In

- 312 (page 1138)
- tube (page 1139)
- low-pressure (page 1140)
- Cryogenic (page 1141)
- ammonia (page 1141)
- nerve agents (pages 1150–1151)
- SLUDGEM (page 1151)
- incubation period (page 1153)
- National Response Center (page 1142)
- trip devices (page 1160)

True/False

- False (pages 1133)
- True (page 1138)
- True (page 1139)
- False (page 1140)
- False (pages 1140–1141)
- True (page 1152)
- True (page 1153)
- False (page 1153)
- True (page 1155)
- False (page 1155)

Short Answer

- The possibility exists for terrorist incidents to occur in communities of any size. These incidents can include the release of chemical substances, biological agents, or an attack on buildings or people using explosives. Potential targets include both natural landmarks and human-made structures. These can be classified into three broad categories: infrastructure targets, symbolic targets, and civilian targets. (page 1147)
- “Dirty bomb” is a term used to describe radiation dispersal devices (RDDs). An RDD is defined as “any device that causes the purposeful dissemination of radioactive material across an area without a nuclear detonation.” There are only a select number of radioactive sources that can be used effectively in an RDD. It is possible for a criminal to construct a nonexplosive RDD, using pressurized sprayers or air-handling systems in buildings, for example. Radioactive materials are widely used in industry and health care, and a criminal could potentially construct a dirty bomb with only a small quantity of stolen material. (pages 1159–1160)

Hazardous Materials Alarms

1. They should approach the incident as they would a hazardous materials incident, including approaching the scene from uphill and upwind, and have later-arriving units stage at an appropriate distance. Responders should wear full protective equipment including SCBA. First units should establish an outer perimeter, and Incident Command should be established at a safe location, possibly up to 3000 ft from the actual incident.

An initial reconnaissance team should be sent out to examine the involved area and determine how many people are involved. Reconnaissance should begin from a safe distance and work inward toward the scene. A process of elimination may be required to determine the nature of the situation. Occupants and witnesses will need to be interviewed. When approaching the scene, responders must be vigilant for secondary explosive devices. Responders must also rely on their own agency's standard operating procedures, their training, and their experience to take the appropriate actions. (pages 1148–1149)

2. When a person is exposed to a nerve agent, symptoms will become evident within minutes. Symptoms can include pinpoint pupils, runny nose, drooling, difficulty breathing, tearing, twitching, diarrhea, convulsions or seizures, and loss of consciousness. These same symptoms are seen in people who have been exposed to pesticides. The mnemonic SLUDGEM can be used to help remember the symptoms of nerve agent exposure (salivation, lacrimation, urination, defecation, gastric upset, emesis, miosis). While the mnemonic is helpful, an exposure will affect both the sympathetic and parasympathetic nervous systems, and each will have its own unique set of signs and symptoms. (pages 1151–1152)

Chapter 33: Estimating Potential Harm and Planning a Response

Matching

- | | | | | |
|------------------|------------------|------------------|------------------|-------------------|
| 1. A (page 1167) | 3. C (page 1167) | 5. D (page 1168) | 7. F (page 1171) | 9. B (page 1179) |
| 2. I (page 1174) | 4. E (page 1168) | 6. H (page 1171) | 8. J (page 1178) | 10. G (page 1179) |

Multiple Choice

- | | | | | |
|------------------|------------------|------------------|------------------|-------------------|
| 1. D (page 1173) | 3. A (page 1173) | 5. D (page 1182) | 7. B (page 1172) | 9. B (page 1171) |
| 2. B (page 1173) | 4. A (page 1174) | 6. D (page 1173) | 8. C (page 1174) | 10. A (page 1174) |

Labeling

1.



© Jones & Bartlett Learning. Photographed by Glen E. Ellman.

Level A ensemble (page 1179)

2.



© Jones & Bartlett Learning. Courtesy of MIEMSS.

The Level D ensemble (page 1180)

3.



© Jones & Bartlett Learning. Photographed by Glen E. Ellman.

A Level C ensemble (page 1180)

4.



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Level B ensemble (page 1179)

Vocabulary

- 1. Defensive objectives:** Actions that do not involve actual stopping of the leak, release of a hazardous material, or contact of responders with the material. These actions take place outside the hot zone or some distance away from the point of release. (page 1174)
- 2. Isolation of the hazard zone:** Steps taken to identify the perimeter around a contaminated atmosphere for the purpose of separating the people from the problem. Isolating an area is driven largely by the nature of the released chemicals and the environmental conditions that exist at the time of the release. (page 1169)
- 3. Decontamination corridor:** A controlled area within the warm zone where decontamination is performed. (page 1185)
- 4. Chemical resistant materials:** Clothing (suit fabrics) specifically designed to inhibit or resist the passage of chemicals into and through the material by the processes of penetration, permeation, or degradation. (page 1178)
- 5. Supplied-air respirator (SAR):** An atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user. Also known as an air-line respirator (NFPA 1989). (page 1183)

Fill-In

- | | |
|--------------------------------|------------------------------------|
| 1. resources (page 1169) | 6. Litmus (page 1173) |
| 2. Alkaline (page 1173) | 7. High-temperature (page 1176) |
| 3. OSHA (page 1167) | 8. defensive (page 1174) |
| 4. Skin absorption (page 1173) | 9. Sheltering in place (page 1171) |
| 5. secondary (page 1188) | 10. Permeation (page 1178) |

True/False

- | | |
|----------------------------|-----------------------|
| 1. False (pages 1176–1178) | 6. True (page 1172) |
| 2. True (page 1168) | 7. False (page 1175) |
| 3. True (page 1179) | 8. True (page 1174) |
| 4. False (page 1180) | 9. True (page 1173) |
| 5. False (page 1183) | 10. False (page 1171) |

Short Answer

- (1) The exact address and specific location of the leak or spill; (2) identification of indicators and markers of hazardous materials; (3) all color or class information obtained from placards; (4) four-digit United Nations/North American Hazardous Materials Code numbers for the hazardous materials; (5) hazardous material identification obtained from shipping papers or MSDS and the potential quantities of hazardous materials involved; (6) description of the container, including its size, capacity, type, and shape; (7) the amount of chemical that could leak and the amount that has already leaked; (8) exposures of people and the presence of special populations (children or elderly); (9) the environment in the immediate area; (10) current weather conditions, including wind direction and speed; (11) a contact or callback telephone number and two-way radio frequency or channel. (pages 1173–1174)
1. Safe atmosphere: No harmful hazardous materials effects exist, so personnel can handle routine emergencies without donning specialized PPE.
 2. Unsafe atmosphere: A hazardous material that is no longer contained has created an unsafe condition or atmosphere. A person who is exposed to the material for long enough may experience some form of acute or chronic injury.
 3. Dangerous atmosphere: Serious, irreversible injury or death may occur in the environment without PPE. (page 1168)

3. Level A: The Level A ensemble consists of a fully encapsulating garment that completely envelops both the wearer and the respiratory protection, as well as gloves, boots, and communications equipment. The Level A ensemble should be used when the hazardous material identified requires the highest level of protection for the skin, eyes, and respiratory tract. Typically, this level is indicated when the operating environment is above IDLH values for skin absorption. The Level A ensemble is effective against vapors, gases, mists, and even dusts.

Level B: The Level B ensemble consists of chemical-protective clothing, boots, gloves, and SCBA. This type of PPE should be used when the type and atmospheric concentration of identified substances require a high level of respiratory protection but less skin protection. To that end, the defining piece of equipment with Level B ensembles is an SCBA or some other type of SAR.

Level C: The Level C ensemble consists of standard work clothing, plus chemical-protective clothing, chemical-resistant gloves, and a form of respiratory protection. Typically, Level C ensembles are worn with an air-purifying respirator (APR) or a powered air-purifying respirator (PAPR); both are discussed in more detail later in this chapter. The APR could be a half-face mask (with eye protection) or a full-face mask. A Level C ensemble is appropriate when the type of airborne substance is known, its concentration is measured, the criteria for using APRs are met, and skin and eye exposure are unlikely.

Level D: The Level D ensemble is the lowest level of protection. This type of ensemble typically comprises coveralls, work shoes, hard hat, gloves, and standard work clothing. It should be used only when the atmosphere contains no known hazard and when work functions preclude splashes, immersion, or the potential for unexpected inhalation of, or contact with, hazardous levels of chemicals. A Level D ensemble should be used for nuisance contamination (such as dust) only; it should not be worn on any site where respiratory or skin hazards are known to exist.

(pages 1179–1181)

Hazardous Materials Alarms

- Emergency decontamination usually involves removing contaminated clothing and dousing the victim(s) with large quantities of water. Actions to accomplish this include isolating the victims in a contained area; establishing an appropriate location for decontamination; and trying to prevent runoff from getting into drains, streams, etc. A fire engine can be used by pulling a handline, maneuvering it into a circle, throwing a tarp over the middle of the circle, and using a booster line or other handline to accomplish the decontamination. (page 1185)
- Sheltering-in-place is used to safeguard people located near or in a hazardous area by temporarily keeping them in a cleaner atmosphere. Considerations include the following: this method is desirable only when the population being protected in place can care for themselves, the air (including HVAC) can be controlled, and the structure or area can be sealed off. (page 1171)

Chapter 34: Implementing the Planned Response

Matching

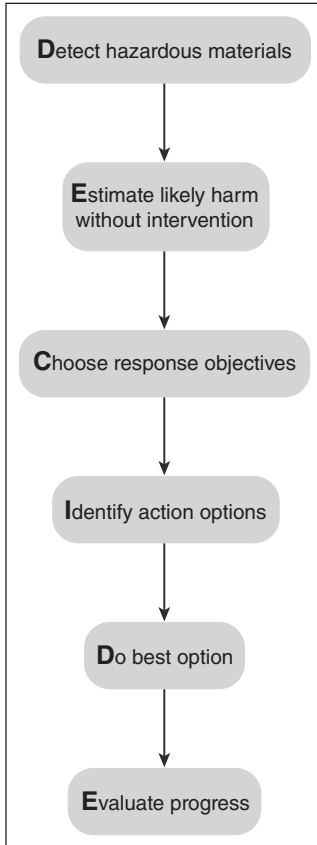
- | | | | | |
|------------------|------------------|------------------|------------------|-------------------|
| 1. A (page 1198) | 3. B (page 1208) | 5. J (page 1198) | 7. G (page 1208) | 9. H (page 1194) |
| 2. D (page 1208) | 4. I (page 1198) | 6. C (page 1205) | 8. F (page 1209) | 10. E (page 1209) |

Multiple Choice

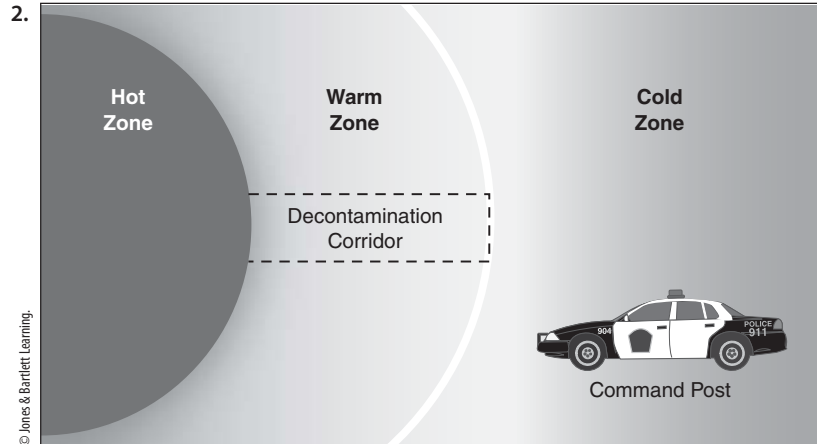
- | | | | | |
|------------------|------------------|------------------|------------------|-------------------|
| 1. D (page 1199) | 3. C (page 1200) | 5. C (page 1200) | 7. A (page 1197) | 9. C (page 1198) |
| 2. A (page 1199) | 4. B (page 1200) | 6. B (page 1195) | 8. B (page 1198) | 10. D (page 1198) |

Labeling

1. The DECIDE Model



(page 1195)



Control zones (page 1197)

Vocabulary

- Shelter-in-place:** A method of safeguarding people in a hazardous area by keeping them in a safe atmosphere, usually inside structures. (page 1200)
- Safety briefing:** Before significant actions begin at a hazardous materials incident, the IC should ensure that a verbal safety briefing is performed. The purpose of the safety briefing is to inform all responders of the health hazards that are known or anticipated, the incident objectives, emergency medical procedures, radio channels, emergency signals, a description of the site, and the PPE to be worn. (page 1200)
- Heat exhaustion:** A mild form of shock caused when the circulatory system begins to fail as a result of the body's inadequate effort to give off excessive heat. (page 1203)
- Heat stroke:** A severe and sometimes fatal condition resulting from the failure of the temperature-regulating capacity of the body. It is caused by prolonged exposure to the sun or high temperatures. (page 1203)
- Logistics section:** The logistics section can be viewed as the support side of an incident management structure. This section within the ICS is responsible for providing facilities, services, and materials for the incident. (page 1210)

Fill-In

- life (page 1198)
- safe area (page 1199)
- mobility (page 1199)
- safety officer (page 1206)
- buddy system (page 1202)
- defensive (page 1194)
- 240 (page 1203)
- Size-up (page 1194)
- socks (page 1203)
- ERG (page 1198)

True/False

- | | |
|----------------------|----------------------|
| 1. True (page 1200) | 6. False (page 1208) |
| 2. True (page 1198) | 7. True (page 1197) |
| 3. True (page 1198) | 8. True (page 1198) |
| 4. False (page 1195) | 9. False (page 1201) |
| 5. False (page 1202) | 10. True (page 1198) |

Short Answer

- Key benefits include common terminology, consistent organizational structure, consistent position titles, and common incident facilities. (page 1204)
- Operations: The operations section carries out the objectives developed by the IC and is responsible for all tactical operations at the incident.
 Planning: The planning section is responsible for the collection, evaluation, dissemination, and use of information relevant to the incident.
 Logistics: The logistics section can be viewed as the support side of an incident management structure and is responsible for providing facilities, services, and materials for the incident.
 Finance: The finance/administration section tracks the costs related to the incident, handles procurement issues, records the time that responders are on the incident for billing purposes, and keeps a running cost of the incident. (pages 1208–1210)
- Hot zone: The area immediately surrounding a hazardous materials spill/incident site that is directly dangerous to life and health.
 Warm zone: The area located between the hot zone and cold zone at the incident. The decontamination corridor is located in the warm zone.
 Cold zone: A safe area at a hazardous materials incident for those agencies involved in the operations. (pages 1197–1198)
- Safety Officer: Designated by the IC, the Safety Officer is responsible for identifying and evaluating hazards and providing direction with respect to the safety of operations at the incident.
 Liaison Officer: A member of the command staff responsible for coordinating with representatives from cooperating and assisting agencies. (NFPA 1561)
 Public Information Officer: The PIO typically functions as the point of contact for the media and other entities that are seeking information about the incident. (pages 1206–1208)

Hazardous Materials Alarms

- Control zones are established based on the chemical and physical properties of the released material, the environmental factors at the time of the release, and the general layout of the scene. Each situation is different and requires flexibility about how the scene is secured.
 If the incident is inside a structure, the best place to control access is at the normal points of ingress and egress: the doors. Once the doors are secured, response crews can begin to isolate other areas as appropriate.
 The same concept applies to outdoor incidents. The goal is to secure logical access points around the hazard. This should begin by controlling intersections, on/off ramps, service roads, or other access points.
 Law enforcement personnel should be used to block off streets and close intersections. Highway transportation or public works employees can be used to set up traffic barricades. (page 1197)
- The ICP is where the Incident Commander is located and where coordination, control, and communications are centralized. The ICP should be located in an area that is not threatened by the incident and has the necessary infrastructure (communications, technology support, bathrooms, meeting space, etc.) to support sustained operations if required. The ICP should be established uphill and upwind of the incident, keeping in mind the potential for predicted changes in wind direction based on the time of day. (pages 1205–1206)

Chapter 35: Hazardous Materials Responder Health and Safety

Matching

- | | | | | |
|------------------|------------------|------------------|------------------|-------------------|
| 1. D (page 1223) | 3. A (page 1219) | 5. I (page 1224) | 7. G (page 1228) | 9. H (page 1221) |
| 2. F (page 1222) | 4. B (page 1223) | 6. C (page 1229) | 8. E (page 1219) | 10. J (page 1224) |

Multiple Choice

- | | | | | |
|------------------|------------------|------------------|------------------|-------------------|
| 1. A (page 1219) | 3. C (page 1226) | 5. B (page 1216) | 7. A (page 1220) | 9. B (page 1226) |
| 2. C (page 1219) | 4. D (page 1229) | 6. D (page 1216) | 8. C (page 1222) | 10. D (page 1226) |

Vocabulary

- Hypoxia:** A state of inadequate oxygenation of the blood and tissue sufficient to cause impairment of function. (page 1223)
- Pyrolysis:** A process in which material is decomposed or broken down into simpler molecular compounds by the effects of heat alone. Pyrolysis often precedes combustion. (pages 1222 and 1274)
- Anaerobic metabolism:** The creation of energy through the breakdown of glucose. Without oxygen, this metabolic process results in the production of lactic acid. (page 1223)
- Aerobic metabolism:** The creation of energy through the breakdown of nutrients in the presence of oxygen. (page 1222)

Fill-In

- | | |
|------------------------|--------------------------------|
| 1. Smoke (page 1220) | 6. red blood cells (page 1223) |
| 2. cyanide (page 1221) | 7. cyanide (page 1224) |
| 3. Oxygen (page 1224) | 8. estimated (page 1226) |
| 4. fast (page 1219) | 9. 35 (page 1227) |
| 5. soot (page 1220) | 10. sulfuric acid (page 1228) |

True/False

- | | |
|----------------------|----------------------|
| 1. False (page 1223) | 6. False (page 1224) |
| 2. True (page 1219) | 7. True (page 1224) |
| 3. False (page 1216) | 8. False (page 1225) |
| 4. True (page 1219) | 9. True (page 1226) |
| 5. True (page 1223) | 10. True (page 1229) |

Short Answer

- Carbon monoxide (CO) is a colorless and odorless gas that is produced during incomplete combustion. CO affects the oxygen-carrying capacity of the red blood cells, resulting in hypoxia. (pages 1223–1224)
- Signs and symptoms of CO exposure include headache, dizziness, irritability, confusion/memory loss, disorientation, nausea and vomiting, difficulty in breathing, chest pain, convulsions, coma, and potentially death. (page 1223)
- Actions that can be taken include the following: wearing SCBA (even during overhaul), keeping structural firefighting protective gear clean, taking a shower after working at a fire scene, using post-fire detection and monitoring, locating RICs and other companies on the exterior of the structure away from smoke, locating the command post away from smoke, and training personnel to understand the benefits and limitations of detection and monitoring at the fire scene. (page 1217)
- The three primary types of exposure levels are:
 - IDLH – immediately dangerous to life and health: This means an atmospheric concentration of any toxic, corrosive, or asphyxiant substance that poses an immediate threat to life or would interfere with an individual's ability to escape unaided from a dangerous atmosphere.
 - SEL – short-term exposure limit: This represents a 15-minute exposure, no more than four times per day.
 - REL – recommended exposure limits: This is the exposure limit for a 10-hour exposure. (page 1226)

Hazardous Materials Alarms

1. Other personnel on the fire scene that are potentially exposed to fire smoke include pump operators working in proximity to the fire building, the Incident Commander and other command officers working on the exterior, personnel operating exterior hose lines for extended periods, and RICs that are set up at the front of the building. (page 1225)

Chapter 36: Hazardous Materials Operations Mission-Specific: Personal Protective Equipment

Matching

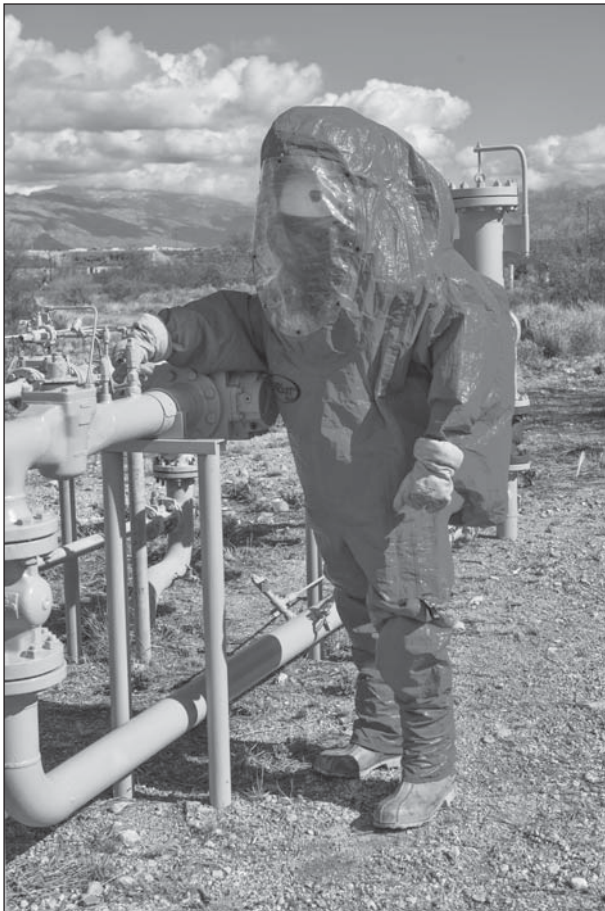
- | | | | | |
|------------------|------------------|------------------|------------------|-------------------|
| 1. D (page 1242) | 3. A (page 1255) | 5. B (page 1241) | 7. H (page 1245) | 9. G (page 1255) |
| 2. C (page 1261) | 4. F (page 1242) | 6. E (page 1255) | 8. I (page 1244) | 10. J (page 1239) |

Multiple Choice

- | | | | |
|------------------|------------------|------------------|-------------------|
| 1. C (page 1263) | 4. D (page 1241) | 7. A (page 1243) | 10. D (page 1264) |
| 2. A (page 1241) | 5. D (page 1245) | 8. B (page 1243) | 11. C (page 1262) |
| 3. B (page 1242) | 6. D (page 1241) | 9. A (page 1242) | |

Labeling

1.



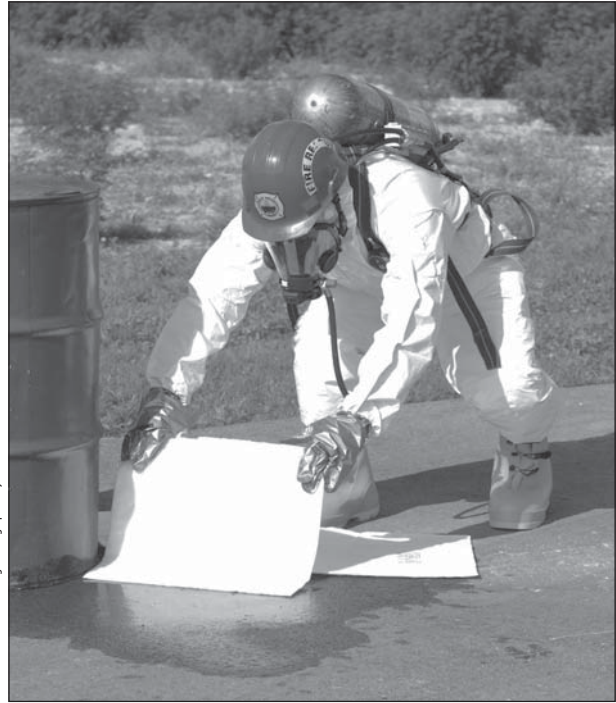
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A. Vapor-protective clothing (page 1243)



© Photodisc.

B. High temperature–protective clothing (page 1241)



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C. Liquid splash–protective clothing (page 1244)

2.



Courtesy of Rob Schmepp.

A. A hand on top of the head making a tapping motion indicates, “I’m okay.”



Courtesy of Rob Schnepp.

B. Hands across the throat indicate “air problems.”



Courtesy of Rob Schnepp.

C. Hands over the head in a waving motion or both hands tapping the head is a signal for “trouble.” This could indicate a suit problem or that something is amiss with the task or situation on the part of the responder or responders. (page 1260)

Vocabulary

1. **Level A ensemble:** Personal protective equipment that is used when the type and atmospheric concentration of substances requires the highest level of protection against vapors, gases, mists, and dusts. (page 1244)
2. **Dehydration:** An excessive loss of body water. Signs and symptoms of dehydration may include increasing thirst, dry mouth, weakness or dizziness, a darkening of the urine, or a decrease in the frequency of urination. (page 1266)
3. **Donning:** The process of putting on an ensemble of PPE. (page 1266)
4. **High-temperature-protective equipment:** A type of personal protective equipment that shields the wearer during short-term exposures to high temperatures. (page 1241)
5. **Powered air-purifying respirator (PAPR):** An air-purifying respirator that uses a powered blower to force the ambient air through one or more air-purifying components to the respiratory inlet covering. (page 1266)

Fill-In

1. least (page 1240)
2. Chemical (page 1241)
3. single (page 1243)
4. in-suit cooling technology (page 1262)
5. TRACEMP (page 1239)
6. 16 ounces or 500 ml (page 1262)
7. HAZWOPER (pages 1255, 1258)
8. the Incident Commander (page 1261)
9. dehydration (pages 1261, 1263)
10. ice or gel-packed vests (pages 1264–1265)

True/False

1. True (page 1240)
2. False (pages 1243, 1261)
3. False (page 1243)
4. False (page 1242)
5. True (page 1238)
6. True (page 1238)
7. True (page 1242)
8. True (page 1242)
9. False (page 1241)
10. True (page 1263)

Short Answer

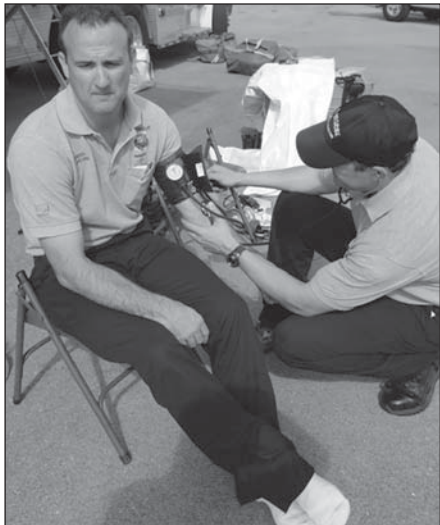
1. **TRACEMP:** Thermal; Radiological; Asphyxiating; Chemical; Etiological/Biological; Mechanical; Psychogenic. (page 1239)
2. **Level A protection:** Personal protective equipment provides protection against vapors, gases, mists, and even dusts. The highest level of protection, it requires a totally encapsulating suit that includes a self-contained breathing apparatus.
Level B protection: Personal protective equipment is used when the type and atmospheric concentration of substances have been identified. It generally requires a high level of respiratory protection but less skin protection (chemical-protective coveralls and clothing, chemical protection for shoes and gloves, and self-contained breathing apparatus outside a nonencapsulating chemical-protective suit).
Level C protection: Personal protective equipment is used when the type of airborne substance is known, the concentration is measured, the criteria for using air-purifying respirators are met, and skin and eye exposure is unlikely. It consists of standard work clothing with the addition of chemical-protective clothing, chemically resistant gloves, and a form of respirator protection.
Level D protection: Personal protective equipment is used when the atmosphere contains no known hazard, and work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of chemicals. It is primarily a work uniform that includes coveralls and affords minimal protection. (pages 1243–1255)
3. **CBRN:** chemical, biological, radiological, nuclear. (page 1243)

Hazardous Materials Alarms

1. The recommended PPE for Level B protection includes the following components:
SCBA
Chemical-resistant clothing, boots, and gloves. (page 1245)
2. a) Heat illness/dehydration. (page 1263)
b) Proper hydration; use of cooling technology. (page 1263)

Skill Drills

Skill Drill 36-1: Donning a Level A Ensemble NFPA 1072:6.2.1, NFPA 472:6.2.1.2.1, 6.2.4.1



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1. Conduct a pre-entry briefing, medical monitoring, and equipment inspection.



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2. While seated, pull on the suit to waist level; pull on the chemical boots over the top of the chemical suit. Fold the suit boot covers over the tops of the boots.



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3. Stand up and don the SCBA frame and SCBA face piece, but do not connect the regulator to the face piece.



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4. Place the helmet on your head.



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5. Don the inner gloves.



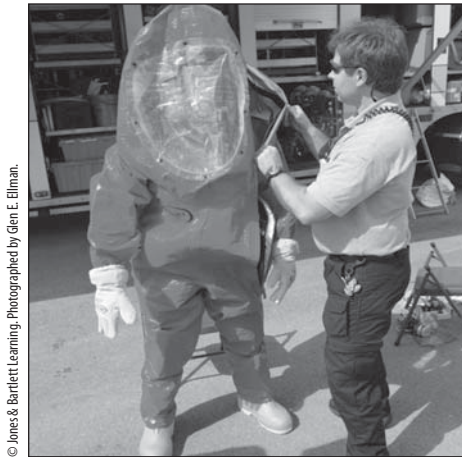
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6. Don the outer chemical gloves (if required). With assistance, complete donning the suit by placing both arms in the suit, pulling the expanded back piece over the SCBA, and placing the chemical suit over your head.



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7. Instruct the assistant to connect the regulator to the SCBA face piece and ensure air flow.



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- Instruct the assistant to close the chemical suit by closing the zipper and sealing the splash flap.



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- Review hand signals, and indicate that you are okay. (pages 1246–1247)

Skill Drill 36-2: Doffing a Level A Ensemble NFPA 1072: 6.2.1, NFPA 472: 6.2.1.2.1, 6.2.4.1

Test your knowledge of this skill drill by filling in the correct words in the photo captions.

- After completing decontamination, proceed to the **clean area** for suit doffing. Pull your hands out of the outer gloves and your arms from the sleeves, and cross your arms in front inside the suit.
- Instruct the assistant to open the **chemical splash** flap and suit zipper.
- Instruct the assistant to begin at the head and roll the suit **down** and **away** until the suit is below waist level.
- Instruct the assistant to complete rolling the suit from the waist to the **ankles**; step out of the attached chemical boots and suit.
- Doff the SCBA frame. The **face piece** should be kept in place while the SCBA frame is doffed.
- Take a deep breath and doff the SCBA face piece; carefully peel off the inner gloves, and walk away from the clean area. Go to the rehabilitation area for **medical monitoring**, rehydration, and a personal decontamination shower. (pages 1248–1249)

Skill Drill 36-3: Donning a Level B Nonencapsulated Chemical-Protective Clothing Ensemble NFPA 1072: 6.2.1, NFPA 472: 6.2.1.2.1, 6.2.4.1



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- Conduct a pre-entry briefing, medical monitoring, and equipment inspection.



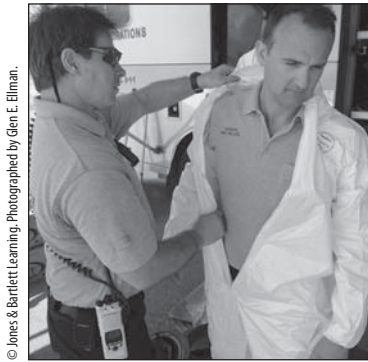
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- Sit down, and pull on the suit to waist level; pull on the chemical boots over the top of the chemical suit.



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- Don the inner gloves.



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4. With assistance, complete donning the suit by placing both arms in the suit and pulling the suit over your shoulders. Instruct the assistant to close the chemical suit by closing the zipper and sealing the splash flap.



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5. Don the SCBA frame and SCBA face piece, but do not connect the regulator to the face piece.



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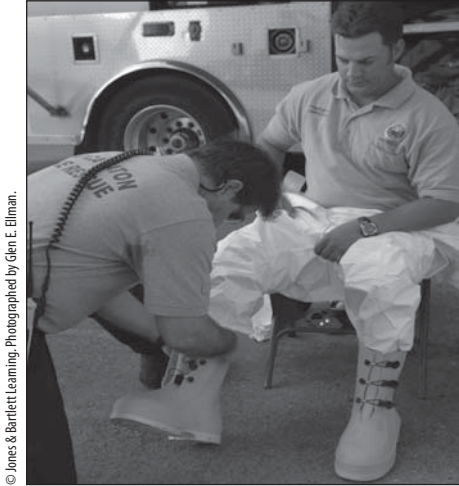
6. With assistance, pull the hood over your head and the SCBA face piece. Place the helmet on your head. Put on the outer gloves (over or under the sleeves, depending on the AHJ requirements for the incident). Instruct the assistant to connect the regulator to the SCBA face piece, and ensure you have air flow. Review hand signals, and indicate that you are okay. (pages 1251–1252)

Skill Drill 36-4: Doffing a Level B Nonencapsulated Chemical-Protective Clothing Ensemble NFPA 1072:6.2.1, NFPA 472:6.2.1.2.1, 6.2.4.1

1. After completing the **wash/rinse** cycle, proceed to the clean area for PPE doffing. The SCBA frame is removed first. The unit may remain attached to the regulator while the assistant helps the responder out of the PPE, or the air supply may be detached from the regulator, leaving the face piece in place to provide for face and eye protection while the rest of the doffing process is completed.
2. Instruct the assistant to open the **chemical** splash flap and suit zipper.
3. Remove your hands from the outer gloves and your arms from the sleeves of the suit. **Cross your arms** in front, inside the suit. Instruct the assistant to begin at the head and roll the suit down and away until the suit is below waist level.
4. Sit down and instruct the assistant to complete rolling down the suit to the ankles; step out of the attached chemical boots and **suit**.
5. Stand and doff the SCBA face piece and **helmet**.
6. Carefully peel off the inner gloves, and go to the rehabilitation area for medical monitoring, rehydration, and **personal decontamination shower**. (pages 1253–1254)

Skill Drill 36-5: Donning a Level C Chemical-Protective Clothing Ensemble NFPA 1072:6.2.1,NFPA 472:6.2.1.2.1,6.2.4.1

Test your knowledge of this skill drill by placing the following photos in the correct order. Number the first step with a "1"; the second step with a "2"; and so on.



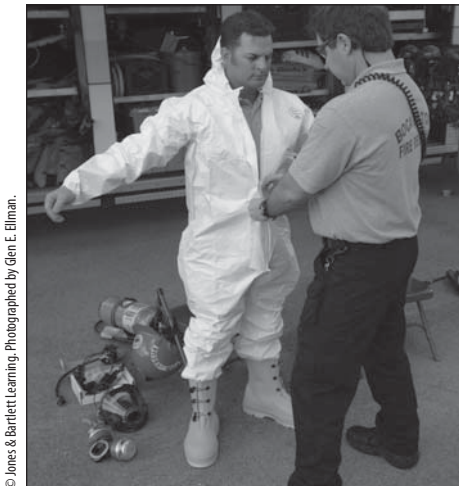
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1. Conduct a pre-entry briefing, medical monitoring, and equipment inspection. While seated, pull on the suit to waist level; pull on the chemical boots over the top of the chemical suit.



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2. Don the inner gloves.



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3. With assistance, complete donning the suit by placing both arms in the suit and pulling the suit over your shoulders. Instruct the assistant to close the chemical suit by closing the zipper and sealing the splash flap.



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4. Don the APR/PAPR face piece. With assistance, pull the hood over your head and the PAR/PAPR face piece. Place the helmet on your head. Pull on the outer gloves. Review hand signals, and indicate that you are okay. (pages 1255–1256)

Skill Drill 36-6: Doffing a Level C Chemical-Protective Clothing Ensemble NFPA 1072:6.2.1, NFPA 472:6.2.1.2.1, 6.2.4.1

Test your knowledge of this skill drill by filling in the correct words in the photo captions.

1. After completing decontamination, proceed to the clean area. As with Level B, the assistant opens the chemical splash flap and suit zipper. Remove your hands from the gloves and your arms from the sleeves. Instruct the assistant to begin at the head and roll the suit down below waist level. Instruct the assistant to complete rolling down the suit and to take the outer boots and suit away. The assistant helps remove the inner gloves. Remove the APR/PAPR. Remove the helmet.
2. Go to the rehabilitation area for medical monitoring, rehydration, and a personal decontamination shower. (page 1257)

Skill Drill 36-7: Donning a Level D Chemical-Protective Clothing Ensemble NFPA 1072:6.2.1, NFPA 472:6.2.1.2.1, 6.2.4.1

Test your knowledge of this skill drill by filling in the correct words in the photo caption.

1. Conduct a pre-entry briefing, medical monitoring, and equipment inspection. Don the Level D suit. Don boots. Don safety glasses or chemical goggles. Don a hard hat. Don gloves, a face shield, and any other required equipment. (page 1258)

Chapter 37: Hazardous Materials Operations Mission-Specific: Product Control

Matching

- | | | | | |
|------------------|------------------|------------------|------------------|-------------------|
| 1. C (page 1283) | 3. B (page 1273) | 5. E (page 1279) | 7. J (page 1280) | 9. H (page 1279) |
| 2. A (page 1273) | 4. F (page 1280) | 6. D (page 1283) | 8. I (page 1279) | 10. G (page 1275) |

Multiple Choice

- | | | | | |
|------------------|------------------|------------------|-------------------|-------------------|
| 1. A (page 1275) | 4. A (page 1284) | 7. C (page 1284) | 10. A (page 1280) | 13. C (page 1286) |
| 2. C (page 1280) | 5. D (page 1279) | 8. C (page 1281) | 11. B (page 1279) | 14. B (page 1286) |
| 3. B (page 1286) | 6. A (page 1273) | 9. D (page 1275) | 12. D (page 1283) | 15. B (page 1286) |

Vocabulary

1. **Alcohol-resistant concentrate:** Foam that is formulated so that alcohol and other polar solvents will not dissolve the foam. (page 1284)
2. **Underflow dam:** A method of containing materials that are lighter than water. (page 1279)
3. **Recovery phase:** The stage of a hazardous materials incident after the imminent danger has passed and clean-up begins. (page 1286)

Fill-In

- | | |
|-------------------------------------|-----------------------------|
| 1. vapor dispersion (page 1283) | 6. Retention (page 1280) |
| 2. disperse (page 1283) | 7. complete dam (page 1279) |
| 3. evaporate (page 1275) | 8. dissolve (page 1284) |
| 4. remote valve shutoff (page 1280) | 9. liquid fires (page 1284) |
| 5. remote shutoffs (page 1281) | 10. Containment (page 1273) |

True/False

- | | |
|-----------------------------|----------------------------|
| 1. True (page 1273) | 6. True (page 1286) |
| 2. True (page 1276) | 7. False (page 1282) |
| 3. False (page 1279) | 8. True (pages 1280, 1283) |
| 4. False (pages 1284, 1286) | 9. True (pages 1279–1280) |
| 5. True (page 1274) | 10. False (page 1280) |

Short Answer

1. Aqueous film-forming foam (AFFF); fluoroprotein foam; protein foam; high-expansion foam; alcohol-resistant concentrates. (page 1284)

Hazardous Material Alarms

1. Decide which material is best suited for use with the spilled product, and assess the location of the spill. Stay clear of any spilled product. Use detection and monitoring devices to determine whether airborne contaminants are present. Apply the appropriate material to control and contain the spilled material. Maintain control of the materials and take appropriate steps for their disposal. (page 1278)
2. (a) AFFF, protein foam, fluoroprotein foam. (page 1284)
(b) Apply the foam using the rain-down, roll-in, or bounce-off method. (pages 1284–1286)

Skill Drills

Skill Drill 37-1: Using Absorption/Adsorption to Manage a Hazardous Materials Incident NFPA 1072: 6.6.1, NFPA 472: 6.6.1.2.2, 6.6.3.1

Test your knowledge of this skill drill by filling in the correct words in the photo captions.

1. Decide which material is best suited for use with the spilled product. Assess the location of the spill and stay clear of any spilled product. Use detection and monitoring devices, as well as reference sources to identify the product. Apply the appropriate material to control the spilled product.
2. Apply the appropriate material to the spilled product.
3. Maintain control of the absorbent/adsorbent materials and take appropriate steps for their disposal. (page 1276)

Skill Drill 37-2: Constructing an Overflow Dam NFPA 1072: 6.6.1, NFPA 472: 6.6.1.2.2, 6.6.3.1

Test your knowledge of this skill drill by filling in the correct words in the photo captions.

1. Determine the need for, and location of, an overflow dam. Build a dam with sandbags or other available materials.
2. Install the appropriate number of 3- to 4-inch plastic pipes horizontally on top of the dam, and then add more sandbags on top of the dam. Complete the dam installation, and ensure that the piping allows the proper flow of water without allowing the heavier-than-water material to pass through the pipes. (page 1278)

Skill Drill 37-3: Constructing an Underflow Dam NFPA 1072: 6.6.1, NFPA 472: 6.6.1.2.2, 6.6.3.1

Test your knowledge of this skill drill by filling in the correct words in the photo captions.

1. Determine the need for, and location of, an underflow dam. Build a dam with sandbags or other available materials.
2. Install two to three lengths of 3- to 4-inch plastic pipes at a 20- to 30-degree angle on top of the dam, and add more sandbags on top of the dam. Complete the dam installation, and ensure that the size will allow the proper flow of water underneath the lighter-than-water liquid. (page 1278)

Skill Drill 37-4: Constructing a Dike NFPA 1072: 6.6.1, NFPA 472: 6.6.1.2.2, 6.6.3.1

Test your knowledge of this skill drill by filling in the correct words in the photo captions.

1. Determine the best location for the dike. If necessary, dig a depression in the ground 6" to 8" (15 cm to 20 cm) deep. Ensure that plastic will not react adversely with the spilled chemical. Use plastic to line the bottom of the depression, and allow for sufficient plastic to cover the dike wall.
2. Build a short wall with sandbags or other available materials.
3. Complete the dike installation, and ensure that its size will contain the spilled product. (page 1279)

Skill Drill 37-5: Using Dilution to Manage a Hazardous Materials Incident NFPA 1072: 6.6.1, NFPA 472: 6.6.1.2.2, 6.6.3.1

Test your knowledge of this skill drill by filling in the correct word in the photo caption.

1. Determine the viability of a dilution operation. Obtain guidance from a hazardous materials technician, specialist, or professional. Ensure that the water used will not overflow and affect other product-control activities. Add small

amounts of water from a distance to dilute the product. Contact the hazardous materials technician, specialist, or other qualified professional if additional issues arise. (page 1280)

Skill Drill 37-6: Constructing a Diversion NFPA 1072:6.6.1, NFPA 472:6.6.1.2.2, 6.6.3.1

Test your knowledge of this skill drill by filling in the correct words in the photo captions.

1. Determine the best location for the diversion. Use sandbags or other materials to divert the product flow to an area with **fewer hazards**. Stay clear of the product flow. Monitor the diversion channel to ensure the integrity of the system. (page 1281)

Skill Drill 37-8: Using Vapor Dispersion to Manage a Hazardous Materials Incident NFPA 1072:6.6.1, NFPA 472:6.6.1.2.2, 6.6.3.1

Test your knowledge of this skill drill by filling in the correct words in the photo captions.

1. Determine the viability of a dispersion operation. Use the appropriate monitoring instrument to determine the boundaries of a safe work area. Ensure that **ignition sources** in the area have been removed or controlled.
2. Apply **water** from a distance to disperse vapors. Monitor the environment until the vapors have been adequately dispersed. (page 1284)

Skill Drill 37-10: Performing the Rain-Down Method of Applying Foam NFPA 1072:6.6.1, NFPA 472:6.6.1.2.2, 6.6.3.1

Test your knowledge of this skill drill by placing the photos below in the correct order. Number the first step with a "1"; the second step with a "2"; and so on.



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1. Open the nozzle to ensure that foam is being produced. Move within a safe range of the product and open the nozzle.

2. Direct the stream of foam into the air so that the foam gently falls onto the pool of the product.



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3. Allow the foam to flow across the top of the pool of the product until it is completely covered. (page 1286)