

Note: Completion of this course does not meet the requirement for competency at the Hazmat Awareness and Operations Levels as set forth by OSHA 1910.120 and NFPA 472.

## Course Objectives for Hazardous Materials for EMS Responders

### At the completion of this course, the student

1. Shall be able to satisfy the knowledge competencies for First Responder Awareness and Operations Levels as set forth by OSHA 1910.120 and NFPA 472. Skill competencies are not included in this lesson.
2. Shall have the knowledge to complete the following tasks:
  - a. Analyze a hazardous materials incident to determine the magnitude of the problem in terms of outcomes by completing the following tasks:
    - i. Survey the hazardous materials incident to identify the containers and materials involved, determine whether hazardous materials have been released and evaluate the surrounding conditions
    - ii. Collect hazard and response information from MSDS; CHEMTREC/CANUTEC/SETIQ; local, state, and federal authorities; and shipper/manufacturer contacts
    - iii. Predict the likely behavior of a material as well as its container
    - iv. Estimate the potential harm at a hazardous materials incident
3. Plan an initial response within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by completing the following tasks:
  - a. Describe the response objectives for hazardous materials incidents
  - b. Describe the defensive options available for a given response objective
  - c. Determine whether the personal protective equipment provided is appropriate for implementing each defensive option
  - d. Identify the emergency decontamination procedures
4. Implement the planned response to favorably change the outcomes consistent with the local emergency response plan and the organization's standard operating procedures by completing the following tasks:
  - a. Establish and enforce scene control procedures including control zones, emergency decontamination, and communications
  - b. Initiate an incident management system (IMS) for hazardous materials incidents
  - c. Understand the limitations of the average EMS responder regarding limited manpower, equipment, resources, etc.
  - d. Perform defensive control functions identified in the local emergency response plan of action
5. Evaluate the progress of the actions taken to ensure that the response objectives are being met safely, effectively, and efficiently by completing the following tasks:
  - a. Evaluate the status of the defensive actions taken in accomplishing the response objectives
  - b. Communicate the status of the planned response

### Surveying the Hazardous Materials Incident.

Given examples of both facility and transportation scenarios involving hazardous materials, the student shall survey the incident to identify the containers and materials involved, determine whether hazardous materials have been released, and evaluate the surrounding conditions and also shall meet the following requirements:

1. Given three examples each of liquid, gas, and solid hazardous materials, including various hazard classes, the student shall identify the general shapes of containers in which the hazardous materials are typically found.
2. Given examples of the following tank cars, the student shall identify each tank car by type as follows:
  - a. Cryogenic liquid tank cars
  - b. High-pressure tube cars
  - c. Nonpressure tank cars
  - d. Pneumatically unloaded hopper cars
  - e. Pressure tank cars
3. Given examples of the following intermodal tanks, the student shall identify each intermodal tank by type and identify at least one material and its hazard class that is typically found in each tank as follows:
  - a. Nonpressure intermodal tanks, such as the following:
  - b. IM-101 (IMO Type 1 internationally) portable tank
  - c. IM-102 (IMO Type 2 internationally) portable tank
  - d. Pressure intermodal tanks
  - e. Specialized intermodal tanks, such as the following:
    - i. Cryogenic intermodal tanks
    - ii. Tube modules

4. Given examples of the following cargo tanks, the student shall identify each cargo tank by type as follows:
  - a. Nonpressure liquid tanks
  - b. Low pressure chemical tanks
  - c. Corrosive liquid tanks
  - d. High pressure tanks
  - e. Cryogenic liquid tanks
  - f. Dry bulk cargo tanks
  - g. Compressed gas tube trailers
5. Given examples of the following tanks, the student shall identify at least one material, and its hazard, that is typically found in each tank as follows:
  - a. Nonpressure tank
  - b. Pressure tank
  - c. Cryogenic liquid tank
6. Given examples of the following nonbulk packages, the student shall identify each package by type as follows:
  - a. Bags
  - b. Carboys
  - c. Cylinders
  - d. Drums
7. Given examples of the following radioactive material containers, the student shall identify each container/package by type as follows:
  - a. Type A
  - b. Type B
  - c. Industrial
  - d. Excepted
  - e. Strong, tight containers
8. Given examples of facility and transportation containers, the student shall identify the markings that differentiate one container from another.
9. Given examples of the following marked transport vehicles and their corresponding shipping papers, the student shall identify the vehicle or tank identification marking as follows:
  - a. Rail transport vehicles, including tank cars
  - b. Intermodal equipment including tank containers
  - c. Highway transport vehicles, including cargo tanks
10. Given examples of facility containers, the student shall identify the markings indicating container size, product contained, and/or site identification numbers.
11. Given examples of facility and transportation situations involving hazardous materials, the student shall identify the name(s) of the hazardous material(s) in each situation.
12. The student shall identify the following information on a pipeline marker:
  - a. Product
  - b. Owner
  - c. Emergency telephone number
13. Given a pesticide label, the student shall identify each of the following pieces of information, then match the piece of information to its significance in surveying the hazardous materials incident:
  - a. Name of pesticide
  - b. Signal word
  - c. Pest control product (PCP) number (in Canada)
  - d. Precautionary statement
  - e. Hazard statement
  - f. Active ingredient
14. Given a label for a radioactive material, the student shall identify vertical bars, contents, activity, and transport index.
15. The student shall identify and list the surrounding conditions that should be noted by the first responders when surveying hazardous materials incidents.
16. The student shall give examples of ways to verify information obtained from the survey of a hazardous materials incident.
17. The student shall identify at least three additional hazards that could be associated with an incident involving criminal or terrorist activity.

#### **Collecting Hazard and Response Information.**

Given known hazardous materials, the student shall collect hazard and response information using MSDS; CHEMTREC/CANUTEC/SETIQ; local, state, and federal authorities; and contacts with the shipper/manufacturer and also shall meet the following requirements:

1. Match the definitions associated with the UN/DOT hazard classes and divisions of hazardous materials, including refrigerated liquefied gases and cryogenic liquids, with the class or division.
2. Identify two ways to obtain an MSDS in an emergency.
3. Using an MSDS for a specified material, identify the following hazard and response information:
  - a. Physical and chemical characteristics
  - b. Physical hazards of the material
  - c. Health hazards of the material
  - d. Signs and symptoms of exposure
  - e. Routes of entry
  - f. Permissible exposure limits
  - g. Responsible party contact
  - h. Precautions for safe handling (including hygiene practices, protective measures, procedures for cleanup of spills or leaks)
  - i. Applicable control measures including personal protective equipment
  - j. Emergency and first aid procedures
4. Identify the following:
  - a. Type of assistance provided by CHEMTREC/CANUTEC/SETIQ and local, state, and federal authorities
  - b. Procedure for contacting CHEMTREC/CANUTEC/SETIQ and local, state, and federal authorities
  - c. Information to be furnished to CHEMTREC/CANUTEC/SETIQ and local, state, and federal authorities
5. Identify two methods of contacting the manufacturer or shipper to obtain hazard and response information.
6. Identify the type of assistance provided by local, state, and federal authorities with respect to criminal or terrorist activities involving hazardous materials.
7. Identify the procedure for contacting local, state, and federal authorities as specified in the local emergency response plan (ERP) or the organization's standard operating procedures.
8. Describe the properties and characteristics of the following:
  - a. Alpha particles
  - b. Beta particles
  - c. Gamma rays
  - d. Neutrons

#### **Predicting the Behavior of a Material and its Container.**

Given an incident involving a single hazardous material, the student shall predict the likely behavior of the material and its container and also shall meet the following requirements:

1. Given two examples of scenarios involving known hazardous materials, interpret the hazard and response information obtained from the current edition of the *Emergency Response Guidebook*; MSDS; CHEMTREC/CANUTEC/SETIQ; local, state, and federal authorities; and shipper/manufacturer contacts as follows:
  - a. Match the following chemical and physical properties with their significance and impact on the behavior of the container and/or its contents:
  - b. Boiling point
  - c. Chemical reactivity
  - d. Corrosivity (pH)
  - e. Flammable (explosive) range (LEL and UEL)
  - f. Flash point
  - g. Ignition (autoignition) temperature
  - h. Physical state (solid, liquid, gas)
  - i. Specific gravity
  - j. Toxic products of combustion
  - k. Vapor density
  - l. Vapor pressure
  - m. Water solubility
  - n. Radiation (ionizing and non-ionizing)
2. Identify the differences between the following pairs of terms:
  - a. Exposure and hazard
  - b. Exposure and contamination
  - c. Contamination and secondary contamination
  - d. Radioactive material exposure (internal and external) and radioactive contamination
3. Identify three types of stress that could cause a container system to release its contents.

4. Identify five ways in which containers can breach.
5. Identify four ways in which containers can release their contents.
6. Identify at least four dispersion patterns that can be created upon release of a hazardous material.
7. Identify the three general time frames for predicting the length of time that exposures can be in contact with hazardous materials in an endangered area.
8. Identify the health and physical hazards that could cause harm.
9. Identify the health hazards associated with the following terms:
  - a. Asphyxiant
  - b. Chronic health hazard
  - c. Convulsant
  - d. Irritant/corrosive
  - e. Sensitizer/allergen
  - f. Alpha, beta, gamma, and neutron radiation
10. Given the following types of warfare agents, identify the corresponding UN/DOT hazard class and division:
  - a. Nerve agents
  - b. Vesicants (blister agents)
  - c. Blood agents
  - d. Choking agents
  - e. Irritants (riot control agents)
  - f. Biological agents and toxins

#### **Estimating the Potential Harm.**

1. The student shall estimate the potential harm within the endangered area at a hazardous materials incident and also shall meet the following requirements:
  - a. Identify a resource for determining the size of an endangered area of a hazardous materials incident.
  - b. Given the dimensions of the endangered area and the surrounding conditions at a hazardous materials incident, estimate the number and type of exposures within that endangered area.
  - c. Identify resources available for determining the concentrations of a released hazardous material within an endangered area.
2. Given the concentrations of the released material, identify the factors for determining the extent of physical, health, and safety hazards within the endangered area of a hazardous materials incident.
3. Describe the impact that time, distance, and shielding have on exposure to radioactive materials specific to the expected dose rate.
4. Describe the prioritization of emergency medical care and removal of victims from the hazard area relative to exposure and contamination concerns.

#### **Planning the Response.**

##### **Describing Response Objectives for Hazardous Materials Incidents.**

Given at least two scenarios involving hazardous materials incidents (one facility and one transportation), the student shall describe the first responder's response objectives for each problem and also shall meet the following requirements:

1. Given an analysis of a hazardous materials problem and the exposures already lost, identify the steps for determining the number of exposures that could be saved by the first responder with the resources provided by the authority having jurisdiction and operating in a defensive fashion.
2. Given an analysis of a hazardous materials incident, describe the steps for determining defensive response objectives.
3. Describe how to assess the risk to a responder for each hazard class in rescuing injured persons at a hazardous materials incident.

##### **Identifying Defensive Options.**

Given simulated facility and transportation hazardous materials problems, the student shall identify the defensive options for each response objective and shall meet the following requirements:

1. Identify the defensive options to accomplish a given response objective. Identify the purpose for, and the procedures, equipment, and safety precautions used with, each of the following control techniques:
  - a. Absorption
  - b. Dike, dam, diversion, retention
  - c. Dilution
  - d. Remote valve shutoff
  - e. Vapor dispersion
  - f. Vapor suppression

### **Determining Appropriateness of Personal Protective Equipment.**

Given the name of the hazardous material involved and the anticipated type of exposure, the student shall determine whether available personal protective equipment is appropriate for implementing a defensive option and also shall meet the following requirements:

1. Identify the respiratory protection required for a given defensive option and the following:
  - a. Identify the three types of respiratory protection and the advantages and limitations presented by the use of each at hazardous materials incidents.
  - b. Identify the required physical capabilities and limitations of personnel working in positive pressure self contained breathing apparatus.
2. Identify the personal protective clothing required for a given defensive option and the following:
  - a. Identify skin contact hazards encountered at hazardous materials incidents.
3. Identify the purpose, advantages, and limitations of the following levels of protective clothing at hazardous materials incidents:
  - a. Structural fire-fighting protective clothing
  - b. High temperature-protective clothing
  - c. Chemical-protective clothing
  - d. Liquid splash-protective clothing
  - e. Vapor-protective clothing

### **Identifying Emergency Decontamination Procedures.**

The student shall identify emergency decontamination procedures and shall meet the following requirements:

1. Identify ways that personnel, personal protective equipment, apparatus, tools, and equipment become contaminated.
2. Describe how the potential for secondary contamination determines the need for emergency decontamination procedures.
3. Identify the purpose of emergency decontamination procedures at hazardous materials incidents.
4. Identify the advantages and limitations of emergency decontamination procedures.
5. Describe the procedure listed in the local emergency response plan or the organization's standard operating procedures for decontamination of a large number of people exposed to hazardous materials.
6. Describe procedures, such as those listed in the local emergency response plan or the organization's standard operating procedures, to preserve evidence at hazardous materials incidents involving suspected criminal or terrorist acts.

### **Implementing the Planned Response.**

#### **Establishing and Enforcing Scene Control Procedures.**

Given scenarios for facility and/or transportation hazardous materials incidents, the student shall identify how to establish and enforce scene control including control zones, emergency decontamination, and communications and shall meet the following requirements:

1. Identify the procedures for establishing scene control through control zones.
2. Identify the criteria for determining the locations of the control zones at hazardous materials incidents.
3. Identify the basic techniques for the following protective actions at hazardous materials incidents:
  - a. Evacuation
  - b. Sheltering in-place protection
  - c. Identify the considerations associated with locating emergency decontamination areas.
4. Explain how to perform emergency decontamination.
4. Identify the items to be considered in a safety briefing prior to allowing personnel to work at the following:
  - a. Hazardous materials incident
  - b. Hazardous materials incident involving criminal or terrorist activities

#### **Initiating the Incident Management System.**

Given simulated facility and/or transportation hazardous materials incidents, the student shall initiate the incident management system specified in the local emergency response plan and the organization's standard operating procedures and shall meet the following related requirements:

1. Identify the role of the first responder at the operational level during hazardous materials incidents as specified in the local emergency response plan and the organization's standard operating procedures.
2. Identify the levels of hazardous materials incidents as defined in the local emergency response plan.
3. Identify the purpose, need, benefits, and elements of an incident management system at hazardous materials incidents.
4. Identify the considerations for determining the location of the command post for a hazardous materials incident.
5. Identify the procedures for requesting additional resources at a hazardous materials incident.
6. Identify the authority and responsibilities of the safety officer.

#### **Using Personal Protective Equipment.**

The student shall have working knowledge of the personal protective equipment provided by the authority having jurisdiction, and shall meet the following related requirements:

1. Identify the importance of the buddy system in implementing the planned defensive options.
2. Identify the importance of the backup personnel in implementing the planned defensive options.
3. Identify the safety precautions to be observed when approaching and working at hazardous materials incidents.
4. Identify the symptoms of heat and cold stress.
5. Identify the physical capabilities required for, and the limitations of, personnel working in the personal protective equipment as provided by the authority having jurisdiction.
6. Match the function of the operational components of the positive pressure self-contained breathing apparatus provided to the hazardous materials responder with the name of the component.
7. Identify the procedures for cleaning, disinfecting, and inspecting respiratory protective equipment.
8. Identify the procedures for donning, working in, and doffing positive pressure self-contained breathing apparatus.

#### **Performing Defensive Control Actions.**

Given a plan of action for a hazardous materials incident within their capabilities, the student shall demonstrate an understanding of defensive control actions set out in the plan and demonstrate an understanding of the following related requirements:

1. Using the type of fire-fighting foam or vapor suppressing agent and foam equipment furnished by the authority having jurisdiction, demonstrate an understanding of the effective application of the fire-fighting foam(s) or vapor suppressing agent(s) on a spill or fire involving hazardous materials.
2. Identify the characteristics and applicability of the following foams:
  - a. Protein
  - b. Fluoroprotein
  - c. Special purpose
  - d. Polar solvent alcohol-resistant concentrates
  - e. Hazardous materials concentrates
    - i. Aqueous film-forming foam (AFFF)
    - ii. High expansion
3. Given the required tools and equipment, demonstrate an understanding of how to perform the following defensive control activities:
  - a. Absorption
  - b. Damming
  - c. Diking
  - d. Dilution
  - e. Diversion
  - f. Retention
  - g. Vapor dispersion
  - h. Vapor suppression
4. Identify the location and describe the use of the mechanical, hydraulic, and air emergency remote shutoff devices as found on cargo tanks.
5. Describe the objectives and dangers of search and rescue missions at hazardous materials incidents.
6. Describe methods for controlling the spread of contamination to limit impacts of radioactive materials.

#### **Evaluating Progress.**

##### **Evaluating the Status of Defensive Actions.**

Given simulated facility and/or transportation hazardous materials incidents, the student shall evaluate the status of the defensive actions taken in accomplishing the response objectives and shall meet the following related requirements:

1. Identify the considerations for evaluating whether defensive options are effective in accomplishing the objectives.
2. Describe the circumstances under which it would be prudent to withdraw from a hazardous materials incident.

##### **Communicating the Status of the Planned Response.**

The student shall communicate the status of the planned response to the incident commander and other response personnel and shall meet the following related requirements:

1. Identify the methods for communicating the status of the planned response to the incident commander through the normal chain of command.
2. Identify the methods for immediate notification of the incident commander and other response personnel about critical emergency conditions at the incident.