NFPA 472
Standard for Professional Competence of Responders to Hazardous Materials Incidents

1997 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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Standard on

Professional Competence of Responders to Hazardous Materials Incidents

1997 Edition

This edition of NFPA 472, *Standard on Professional Competence of Responders to Hazardous Materials Incidents*, was prepared by the Technical Committee on Hazardous Materials Response Personnel and acted on by the National Fire Protection Association, Inc., at its Fall Meeting held November 18–20, 1996, in Nashville, TN. It was issued by the Standards Council on January 17, 1997, with an effective date of February 7, 1997, and supersedes all previous editions.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

This edition of NFPA 472 was approved as an American National Standard on February 7, 1997.

Origin and Development of NFPA 472

At the July 1985 NFPA Standards Council meeting, approval was given to the concept of a new project on Hazardous Materials Response Personnel. The Council directed that a proposed scope and start-up roster for the new Committee be prepared, taking into account the need to expand the Committee membership beyond the fire service and the people beyond "professional qualifications."

When establishment of the Committee was formally announced, many requests for membership were received, and similar requests continued to arrive during the first year of its existence. The first meeting of the Committee took place in October 1986.

Interest in the subject of hazardous materials, especially as it relates to the emergency responder, continues at a high level. Some of this is due to an increased awareness of the magnitude of the problem; much of it can be credited to federal regulations that have an impact on all responders.

In 1990 the Committee began reviewing the document for the purpose of revising it. The Committee established a task group that conducted a task analysis relating to hazardous materials response. Based on the task group's recommendations, the Committee revised the original document. The 1992 edition changed the original format and presented the competencies in a more complete manner.

Since 1992, several task groups have created two new levels, the Hazardous Materials Branch Officer and the Safety Officer. These new levels have been incorporated into the 1997 edition. Three new specialty levels, for tank cars, cargo tanks, and intermodal tanks, are also now included in the standard. The Committee found it necessary to make changes to clarify existing requirements, especially for the Technician level.

The gratitude of the Committee is extended to all who assisted in the development of this standard, and especially to those non-Committee members who participated so fully in this process.

Technical Committee on Hazardous Materials Response Personnel

Peter A. McMahon, *Chair*
Principal Financial Group, NY [U]
Rep. Grand Island Fire Dept.

Charles J. Wright, *Secretary*
Union Pacific Railroad Co., NE [SE]

Gerald L. Grey, *Vice Chair*
San Francisco Fire Dept., CA [U]
Rep. The Alliance for Fire & Emergency Mgmt.

Donald Beckering, Hennepin Technical College, MN [U]
Glenn P. Benarick, Fairfax County Fire & Rescue, VA [E]
Bud Berry, 3M, MN [M]
Rep. American Society of Safety Engr
Gene P. Carlson, Oklahoma State University, OK [U]
Rep. Int'l Fire Service Training Assn.
Don L. Crowson, Arlington Fire Dept., TX [U]
Thomas F. Dalton, Consulting Services Inc., NJ [U]
Rep. Spill Control Assn. of America
James L. Daneker, Los Angeles City Fire Dept., CA [C]
Jeffery C. Davis, Assn. of American Railroads, CO [RT]
Manuel A. Ehrlich, Jr., BASF Corp., NJ [M]
Rep. Chemical Mfrs. Assn.
James A. Engman, Ansul Inc., WI [M]
John M. Eversole, Chicago Fire Dept., IL [E]
Rep. Int'l Assn. of Fire Chiefs
Remmit P. R. Gaade, Toronto Fire Dept., Ontario, Canada [E]
Joseph P. Gallagher, New York City Fire Dept., NY [E]
Gerald L. Grey, San Francisco Fire Dept., CA [U]
Rep. The Alliance for Fire and Emergency Mgmt.
H. Dieter Heinz, Heinz Laboratories Int'l, CA [E]
Rep. California State Firefighters' Assn.
John T. Higgins, Dow Corning Corp., MI [U]
Rep. NFPA Industrial Fire Protection Section
Charles L. Keller, Assn. of American Railroads, DC [E]
Louis J. Klein, Volunteer Firemens Insurance Services, PA [I]
Jan D. Kuczma, U.S. Fire Administration, MD [SE]
M. Jo McMullen, Summit County Hazardous Materials Response Team, OH [SE]
Mary Beth Michos, Prince William County Dept. of Fire/Rescue, VA [E]
Gregory G. Noll, Hildebrand & Noll Assoc., Inc., PA [SE]
Irving Owens, Rhode Island State Fire Marshal, RI [E]
Rep. Fire Marshals Assn. of North America
Daniel Gary Snell, Houston Fire Dept., TX [U]
William H. Stringfield, William H. Stringfield & Assoc., Inc., FL [SE]
Bruno Mark Wilson, Salem, OR [SE]
Charlie S. Woodard, Ft. Worth Fire Dept., TX [E]

Alternates

William Lee Bullock, Fairfax County Fire and Rescue Dept., VA [E]
(Alt. to G. P. Benarick)
Michael E. Burns, Michael E. Burns & Assoc., MD [M]
(Alt. to B. Berry)
Michael L. Donahue, Hildebrand and Noll Assoc., Inc., MD [SE]
(Alt. to G. Noll)
Leslie D. English, MacMillan Bloedel Packaging Inc., AL [U]
(Alt. to J. T. Higgins)
Brian S. Geraci, Montgomery County Dept. of Fire & Rescue Services, MD [E]
(Alt. to M. B. Michos)
Wilmuth E. Hubbs, Rhone-Poulenc, NC [M]
(Alt. to M. A. Ehrlich, Jr.)
Danny G. Simpson, Assn. of American Railroads, CO [RT]
(Alt. to J. C. Davis)
Paul R. Spurlin, Wayne Township Fire Dept., IN [E]
(Alt. to I. Owens)
Robert C. Weiderhold, Nat'l Fire Academy, MD [SE]
(Alt. to J. D. Kuczma)

Nonvoting

Samuel Alecio, Sao Paulo Fire Dept., Brazil

L. Charles Smeby, Jr., NFPA Staff Liaison

This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the front of the book.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on the requirements for the professional competence, training, procedures, and equipment for emergency responders to hazardous materials incidents.

Contents

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Appendix A.

Information on referenced publications can be found in Chapter 12 and Appendix D.

Chapter 1 Administration

1-1 General.

1-1.1 Scope. This standard identifies the levels of competence required of responders to hazardous materials incidents. It specifically covers the competencies for first responders at the awareness level, first responders at the operational level, hazardous materials technicians, incident commanders, hazardous materials branch officers, hazardous materials branch safety officers, and other specialist employees.

1-1.2* Purpose. The purpose of this standard is to specify minimum competencies for those who will respond to hazardous materials incidents. It is not the intent of this standard to restrict any jurisdiction from exceeding these minimum requirements.

One purpose of the competencies contained herein is to reduce the numbers of accidents, injuries, and illnesses during response to hazardous materials incidents and to help prevent exposure to hazardous materials to reduce the possibility of fatalities, illness, and disabilities affecting emergency response personnel.

1-2 Definitions.

Approved.* Acceptable to the authority having jurisdiction.

Authority Having Jurisdiction.* The organization, office, or individual responsible for approving equipment, an installation, or a procedure.

CANUTEC. The Canadian Transport Emergency Center operated by Transport Canada. CANUTEC provides emergency response information and assistance on a 24-hour basis for responders to hazardous materials incidents.

Chemical. Regulated and nonregulated hazardous materials (solids, liquids, and gases, whether natural or man-made, including petroleum products) with the potential for creating harm to people, the environment, and property when released.

Chemical Protective Clothing. Items made from chemical-resistive materials, such as clothing, hood, boots, and gloves, that are designed and configured to protect the wearer's torso, head, arms, legs, hands, and feet from hazardous materials. Chemical-protective clothing (garments) can be constructed as a single- or multipiece garment. The garment can completely enclose the wearer either by itself or in combination with the wearer's respiratory protection, attached or detachable hood, gloves, and boots.

CHEMTREC. The Chemical Transportation Emergency Center, a public service of the Chemical Manufacturers Association. CHEMTREC provides emergency response information and assistance on a 24-hour basis for responders to hazardous materials incidents.

Cold Zone. The control zone of a hazardous materials incident that contains the command post and such other support functions as are deemed necessary to control the incident. This zone is also referred to as the clean zone or support zone in other documents.

Competence. Possessing knowledge, skills, and judgment needed to perform indicated objectives satisfactorily.

Confined Space. A space that by design has limited openings for entry and exit, that has unfavorable natural ventilation that could contain or produce dangerous concentrations of air contaminants, and that is not intended for continuous occupancy. Examples of confined spaces include, but are not limited to, storage tanks, compartments of ships, process vessels, pits, silos, vats, degreasers, reaction vessels, boilers, ventilation and exhaust ducts, sewers, tunnels, underground utility vaults, and pipelines.

Confinement. Those procedures taken to keep a material, once released, in a defined or local area.

Container. Any vessel or receptacle that holds material, including storage vessels, pipelines, and packaging (*see definition of "Packaging"*). Containers include the following:

(a) Nonbulk packaging, such as bags, bottles, boxes, carboys, cylinders, drums, jerricans, multicell packages, and wooden barrels

(b) Bulk packaging, such as bulk bags, bulk boxes, cargo tanks, covered hopper cars, freight containers, gondolas, pneumatic hopper trailers, portable tanks and bins, protective overpacks for radioactive materials, tank cars, ton containers, and van trailers

(c) Fixed containers, such as piping, reactors, storage bins, tanks, and storage vessels

Containment. The actions taken to keep a material in its container (e.g., stop a release of the material or reduce the amount being released).

Contaminant. A hazardous material that physically remains on or in people, animals, the environment, or equipment, thereby creating a continuing risk of direct injury or a risk of exposure.

Contamination. The process of transferring a hazardous material from its source to people, animals, the environment, and/or equipment, which may act as a carrier.

Control. The procedures, techniques, and methods used in the mitigation of a hazardous materials incident, including containment, extinguishment, and confinement.

Control Zones. The areas at hazardous materials incidents that are designated based upon the degree of hazard. Many terms are used to describe these control zones; however, for the purposes of this standard, these zones are defined as the hot, warm, and cold zones.

Coordination. The process used to get people, who might represent different agencies, to work together integrally and harmoniously in a common action or effort.

Decontamination. The physical or chemical process of reducing and preventing the spread of contaminants from persons and equipment used at a hazardous materials incident.

Decontamination Corridor. The area usually located within the warm zone where decontamination procedures take place. This area is also referred to as the decontamination area in other documents.

Degradation.

(a) A chemical action involving the molecular breakdown of a protective clothing material or equipment due to contact with a chemical.

(b) The molecular breakdown of the spilled or released material to render it less hazardous during control operations.

Demonstrate. To show by actual performance. This performance can be supplemented by simulation, explanation, illustration, or a combination of these.

Describe. To explain verbally or in writing using standard terms recognized in the hazardous materials response community.

Emergency Decontamination. The physical process of immediately reducing contamination of individuals in potentially life-threatening situations with or without the formal establishment of a decontamination corridor.

Emergency Response Plan. A plan that establishes guidelines for handling hazardous materials incidents as required by relevant legislation such as Title 29, *Code of Federal Regulations*, Part 1910.120 (q) (1).

Endangered Area. The actual or potential area of exposure from a hazardous material. This area is sometimes referred to as the engulfed area.

Exposure. The process by which people, animals, the environment, and equipment are subjected to or come in contact with a hazardous material. The magnitude of exposure is dependent primarily upon the duration of exposure and the concentration of the hazardous material. This term is also used to describe a person, animal, the environment, or a piece of equipment.

Gross Decontamination. The initial phase of the decontamination process during which the amount of surface contaminant is significantly reduced. This phase can include mechanical removal or initial rinsing.

Hazard/Hazardous. Capable of posing an unreasonable risk to health, safety, or the environment; capable of causing harm.

Hazardous Material.* A substance (solid, liquid, or gas) that when released is capable of creating harm to people, the environment, and property.

Hazardous Materials Branch. That function within an overall incident management system that deals with the mitigation of the hazardous materials portion of a hazardous materials incident. It is directed by a hazardous materials branch officer and deals principally with the technical aspects of the incident.

Hazardous Materials Branch Officer. The person responsible for the management of the hazardous materials branch.

Hazardous Materials Response Team. An organized group of trained response personnel operating under an emergency response plan and appropriate standard operating procedures who handle and control actual or potential leaks or spills of hazardous materials requiring possible close approach to the material. The team members respond to releases or potential releases of hazardous materials for the purpose of control or stabilization of the incident.

High Temperature-Protective Clothing. Protective clothing designed to protect the wearer for short-term high temperature exposures. This type of clothing is usually of limited use in dealing with chemical commodities.

Hot Zone. The control zone immediately surrounding a hazardous materials incident, which extends far enough to prevent adverse effects from hazardous materials releases to personnel outside the zone. This zone is also referred to as the exclusion zone or the restricted zone in other documents.

Identify. To select or indicate verbally or in writing using standard terms to establish the identity of; the fact of being the same as the one described.

Incident. An emergency involving the release or potential release of a hazardous material, with or without fire.

Incident Commander. The person responsible for all decisions relating to the management of the incident. The incident commander is in charge of the incident site. This is equivalent to the on-scene incident commander.

Incident Management System.* An organized system of roles, responsibilities, and standard operating procedures used to manage and direct emergency operations. Such systems are sometimes referred to as incident command systems (ICS).

Individual Area of Specialization. The qualifications or functions of a specific job(s) associated with chemicals and/or containers used within an organization.

Liquid Splash-Protective Clothing. The garment portion of a chemical-protective clothing ensemble that is designed and configured to protect the wearer against chemical liquid splashes but not against chemical vapors or gases. Liquid splash-protective clothing must meet the requirements of NFPA 1992, *Standard on Liquid Splash-Protective Suits for Hazardous Chemical Emergencies.* This type of protective clothing is a component of EPA Level B chemical protection.

Listed.* Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets identified standards or has been tested and found suitable for a specified purpose.

Local Emergency Response Plan. The plan promulgated by the authority having jurisdiction, such as the local emergency planning committee for the community or a facility.

Match. To provide with a counterpart.

Material Safety Data Sheet (MSDS). A form, provided by manufacturers and compounders (blenders) of chemicals, containing information about chemical composition, physical and chemical properties, health and safety hazards, emergency response, and waste disposal of the material.

Monitoring Equipment. Instruments and devices used to identify and quantify contaminants.

North American Emergency Response Guidebook (NAERG). A reference book, written in plain language, to guide emergency responders in their initial actions at the incident scene.

Objective. A goal that is achieved through the attainment of a skill, knowledge, or both, that can be observed or measured.

Organization's Area of Specialization. Any chemicals and containers used by the private sector specialist employee's employer.

Packaging. Any container that holds a material (hazardous and nonhazardous). Packaging for hazardous materials includes bulk and nonbulk packaging.

Bulk Packaging. Any packaging, including transport vehicles, having a capacity meeting one of the criteria listed below. Bulk packaging can be either placed on or in a transport vehicle or vessel or constructed as an integral part of the transport vehicle.

(a) Liquid — internal volume of more than 119 gal (450 L)

(b) Solid — capacity of more than 882 lb (400 kg)

(c) Compressed gas — water capacity of more than 1,001lb (454 kg)

Nonbulk Packaging. Any packaging having a capacity meeting one of the following criteria:

(a) Liquid — internal volume of 119 gal (450 L) or less

(b) Solid — capacity of 882 lb (400 kg) or less

(c) Compressed gas — water capacity of 1,001 lb (454 kg) or less

Penetration. The movement of a material through a suit's closures, such as zippers, buttonholes, seams, flaps, or other design features of chemical-protective clothing, and through punctures, cuts, and tears.

Permeation. A chemical action involving the movement of a chemical, on a molecular level, through intact material.

Personal Protective Equipment. The equipment provided to shield or isolate a person from the chemical, physical, and thermal hazards that can be encountered at a hazardous materials incident. Personal protective equipment includes both personal protective clothing and respiratory protection. Adequate personal protective equipment should protect the respiratory system, skin, eyes, face, hands, feet, head, body, and hearing.

Planned Response.* The plan of action, with safety considerations, consistent with the local emergency response plan and an organization's standard operating procedures for a specific hazardous materials incident.

Protective Clothing. Equipment designed to protect the wearer from heat and/or hazardous materials contacting the skin or eyes. Protective clothing is divided into three types:

(a) Structural fire-fighting protective clothing

(b) Chemical protective clothing

1. Liquid splash-protective clothing
2. Vapor-protective clothing

(c) High temperature-protective clothing

Qualified. Having satisfactorily completed the learning objectives.

Radioactive Material. Any material that spontaneously emits ionizing radiation.

Respiratory Protection. Equipment designed to protect the wearer from the inhalation of contaminants. Respiratory protection is divided into three types:

(a) Positive pressure self-contained breathing apparatus

(b) Positive pressure airline respirators

(c) Air purifying respirators

Response. That portion of incident management in which personnel are involved in controlling a hazardous materials incident. The activities in the response portion of a hazardous materials incident include analyzing the incident, planning the response, implementing the planned response, evaluating progress, and terminating the emergency phase of the incident.

Safely. To perform the assigned tasks without injury to self or others, to the environment, or to property.

Secondary Contamination. The process by which a contaminant is carried out of the hot zone and contaminates people, animals, the environment, or equipment.

SETIQ. The Emergency Transportation System for the Chemical Industry in Mexico.

Shall. Indicates a mandatory requirement.

Should. Indicates a recommendation or that which is advised but not required.

Stabilization. The point in an incident at which the adverse behavior of the hazardous material is controlled.

State. Any outlying U.S. areas where this standard is in effect. Use of the noun "state" shall also imply "provinces and territories" in Canada.

Structural Fire-Fighting Protective Clothing. Often called turnout or bunker gear, the protective clothing normally worn by fire fighters during structural fire-fighting operations. It includes a helmet, coat, pants, boots, gloves, PASS device, and a hood to cover parts of the head not protected by the helmet and facepiece. Structural fire fighters' protective clothing provides limited protection from heat but might not provide adequate protection from the harmful gases, vapors, liquids, or dusts that are encountered during hazardous materials incidents.

Termination. That portion of incident management in which personnel are involved in documenting safety procedures, site operations, hazards faced, and lessons learned from the incident. Termination is divided into three phases: debriefing the incident, post-incident analysis, and critiquing the incident.

UN/NA Identification Number. Four-digit numbers assigned to a hazardous material. The number is used to identify and cross-reference products in the transportation mode.

Vapor-Protective Clothing. The garment portion of a chemical-protective clothing ensemble that is designed and configured to protect the wearer against chemical vapors or gases. Vapor-protective clothing must meet the requirements of NFPA 1991, *Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies*. This type of protective clothing is a component of EPA Level A chemical protection.

Warm Zone. The control zone at a hazardous materials incident site where personnel and equipment decontamination and hot zone support takes place. It includes control points for the decontamination corridor, thus helping to reduce the spread of contamination. This zone is also referred to as the decontamination zone or limited access zone in other documents.

Chapter 2 Competencies for the First Responder at the Awareness Level

2-1 General.

2-1.1 Introduction. First responders at the awareness level shall be trained to meet all competencies of this chapter. They also shall receive any additional training to meet applicable United States Department of Transportation (DOT), United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and other appropriate state, local, or provincial occupational health and safety regulatory requirements.

2-1.2 Definition. First responders at the awareness level are those persons who, in the course of their normal duties, could be the first on the scene of an emergency involving hazardous materials. First responders at the awareness level are expected to recognize the presence of hazardous materials, protect themselves, call for trained personnel, and secure the area.

2-1.3 Goal. The goal of the competencies at the awareness level shall be to provide first responders with the knowledge and skills to perform the following tasks safely. Therefore, when first on the scene of an emergency involving hazardous materials, the first responder at the awareness level shall be able to:

(a) Analyze the incident to determine both the hazardous materials present and the basic hazard and response information for each hazardous material by completing the following tasks:

1. Detect the presence of hazardous materials
2. Survey a hazardous materials incident from a safe location to identify the name, UN/NA identification number, or type placard applied for any hazardous materials involved
3. Collect hazard information from the current edition of the *North American Emergency Response Guidebook*

(b) Implement actions consistent with the local emergency response plan, the organization's standard operating procedures, and the current edition of the *North American Emergency Response Guidebook* by completing the following tasks:

1. Initiate protective actions
2. Initiate the notification process

2-2 Competencies — Analyzing the Incident.

2-2.1 Detecting the Presence of Hazardous Materials. Given various facility or transportation situations, or both, with and without hazardous materials present, the first responder at the awareness level shall identify those situations where hazardous materials are present. The first responder at the awareness level shall be able to:

2-2.1.1* Identify the definition of hazardous materials (or dangerous goods, in Canada).

2-2.1.2* Identify the DOT hazard classes and divisions of hazardous materials and identify common examples of materials in each hazard class or division.

2-2.1.3* Identify the primary hazards associated with each of the DOT hazard classes and divisions of hazardous materials by hazard class or division.

2-2.1.4 Identify the difference between hazardous materials incidents and other emergencies.

2-2.1.5 Identify typical occupancies and locations in the community where hazardous materials are manufactured, transported, stored, used, or disposed of.

2-2.1.6 Identify typical container shapes that can indicate hazardous materials.

2-2.1.7 Identify facility and transportation markings and colors that indicate hazardous materials, including the following:

(a) UN/NA identification numbers
(b) NFPA 704 markings
(c) Military hazardous materials markings
(d) Special hazard communication markings
(e) Pipeline markings
(f) Container markings

2-2.1.8 Given an NFPA 704 marking, describe the significance of the colors, numbers, and special symbols.

2-2.1.9 Identify U.S. and Canadian placards and labels that indicate hazardous materials.

2-2.1.10 Identify the basic information on material safety data sheets (MSDS) and shipping papers that indicates hazardous materials.

2-2.1.10.1 Identify where to find material safety data sheets (MSDS).

2-2.1.10.2 Identify entries on a material safety data sheet that indicate the presence of hazardous materials.

2-2.1.10.3 Identify the entries on shipping papers that indicate the presence of hazardous materials.

2-2.1.10.4 Match the name of the shipping papers found in transportation (air, highway, rail, and water) with the mode of transportation.

2-2.1.10.5 Identify the person responsible for having the shipping papers in each mode of transportation.

2-2.1.10.6 Identify where the shipping papers are found in each mode of transportation.

2-2.1.10.7 Identify where the papers can be found in an emergency in each mode of transportation.

2-2.1.11* Identify examples of clues (other than occupancy/location, container shape, markings/color, placards/labels, MSDS, and shipping papers) that use the senses of sight, sound, and odor to indicate hazardous materials.

2-2.1.12 Describe the limitations of using the senses in determining the presence or absence of hazardous materials.

2-2.2 Surveying the Hazardous Materials Incident from a Safe Location. Given examples of facility and transportation situations involving hazardous materials, the first responder at the awareness level shall identify the hazardous material(s) in each situation by name, UN/NA identification number, or type placard applied. The first responder at the awareness level shall be able to:

2-2.2.1 Identify difficulties encountered in determining the specific names of hazardous materials in both facilities and transportation.

2-2.2.2 Identify sources for obtaining the names of, UN/NA identification numbers for, or types of placard associated with hazardous materials in transportation.

2-2.2.3 Identify sources for obtaining the names of hazardous materials in a facility.

2-2.3* Collecting Hazard Information. Given the identity of various hazardous materials (name, UN/NA identification number, or type placard), the first responder at the awareness level shall identify the fire, explosion, and health hazard information for each material by using the current edition of the *North American Emergency Response Guidebook*. The first responder at the awareness level shall be able to:

2-2.3.1* Identify the three methods for determining the appropriate guide page for a hazardous material.

2-2.3.2 Identify the two general types of hazards found on each guide page.

2-3 Competencies — Planning the Response. (No competencies currently required at this level.)

2-4 Competencies — Implementing the Planned Response.

2-4.1* Initiating Protective Actions. Given examples of facility and transportation hazardous materials incidents, the local emergency response plan, the organization's standard operating procedures, and the current edition of the *North American Emergency Response Guidebook*, first responders at the awareness level shall be able to identify the actions to be taken to protect themselves and others and to control access to the scene. The first responder at the awareness level shall be able to:

2-4.1.1 Identify the location of both the local emergency response plan and the organization's standard operating procedures.

2-4.1.2 Identify the role of the first responder at the awareness level during a hazardous materials incident.

2-4.1.3 Identify the basic precautions to be taken to protect themselves and others in a hazardous materials incident.

2-4.1.3.1 Identify the precautions necessary when providing emergency medical care to victims of hazardous materials incidents.

2-4.1.3.2 Identify typical ignition sources found at the scenes of hazardous materials incidents.

2-4.1.3.3* Identify the ways hazardous materials are harmful to people, the environment, and property at hazardous materials incidents.

2-4.1.3.4* Identify the general routes of entry for human exposure to hazardous materials.

2-4.1.4* Given the identity of various hazardous materials (name, UN/NA identification number, or type placard), identify the following response information:

(a) Emergency action (fire, spill, or leak and first aid)
(b) Personal protective equipment necessary
(c) Initial isolation and protective action distances

2-4.1.4.1 Given the name of a hazardous material, identify the recommended personal protective equipment from the following list:

(a) Street clothing and work uniforms
(b) Structural fire-fighting protective clothing
(c) Positive pressure self-contained breathing apparatus
(d) Chemical-protective clothing and equipment

2-4.1.4.2 Identify the definitions for each of the following protective actions:

(a) Isolation of the hazard area and denial of entry
(b) Evacuation
(c) * Sheltering in-place protection

2-4.1.4.3 Identify the shapes of recommended initial isolation and protective action zones.

2-4.1.4.4 Describe the difference between small and large spills as found in the table of Initial Isolation and Protective Action Distances.

2-4.1.4.5 Identifying the circumstances under which the following distances are used at a hazardous materials incident:

(a) Table of initial isolation and protective action distances
(b) Isolation distances in the numbered guides

2-4.1.4.6 Describe the difference between the isolation distances in the orange-bordered guide pages and the protective action distances in the green-bordered pages in the document.

2-4.1.5 Identify the techniques used to isolate the hazard area and deny entry to unauthorized persons at hazardous materials incidents.

2-4.2 Initiating the Notification Process. Given either a facility or transportation scenario involving hazardous materials, the first responder at the awareness level shall identify the appropriate initial notifications to be made and how to make them, consistent with the local emergency response plan or the organization's standard operating procedures.

2-5 Competencies — Evaluating Progress. (No competencies currently required at this level.)

2-6 Competencies — Terminating the Incident. (No competencies currently required at this level.)

Chapter 3 Competencies for the First Responder at the Operational Level

3-1 General.

3-1.1 Introduction. First responders at the operational level shall be trained to meet all competencies at the first responder

awareness levels and the competencies of this chapter. First responders at the operational level also shall receive any additional training to meet applicable United States Department of Transportation (DOT), United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and other appropriate state, local, or provincial occupational health and safety regulatory requirements.

3-1.2 Definition. First responders at the operational level are those persons who respond to releases or potential releases of hazardous materials as part of the initial response to the incident for the purpose of protecting nearby persons, the environment, or property from the effects of the release. First responders at the operational level are expected to respond in a defensive fashion to control the release from a safe distance and keep it from spreading.

3-1.3 Goal. The goal of the competencies at the operational level shall be to provide first responders with the knowledge and skills to perform the following tasks safely. Therefore, in addition to being competent at the awareness level, the first responder at the operational level shall be able to:

(a) Analyze a hazardous materials incident to determine the magnitude of the problem in terms of outcomes by completing the following tasks:

1. Survey the hazardous materials incident to identify the containers and materials involved, determine whether hazardous materials have been released, and evaluate the surrounding conditions

2. Collect hazard and response information from material safety data sheets (MSDS), CHEMTREC/CANUTEC/SETIQ, and shipper/manufacturer contacts

3. Predict the likely behavior of a material as well as its container

4. Estimate the potential harm at a hazardous materials incident

(b) Plan an initial response within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by completing the following tasks:

1. Describe the response objectives for hazardous materials incidents

2. Describe the defensive options available for a given response objective

3. Determine whether the personal protective equipment provided is appropriate for implementing each defensive option

4. Identify the emergency decontamination procedures

(c) 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:

1. Establish and enforce scene control procedures including control zones, emergency decontamination, and communications

2. Initiate an incident management system (IMS) for hazardous materials incidents

3. Don, work in, and doff personal protective equipment provided by the authority having jurisdiction

4. Perform defensive control functions identified in the plan of action

(d) 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:

1. Evaluate the status of the defensive actions taken in accomplishing the response objectives

2. Communicate the status of the planned response

3-2 Competencies — Analyzing the Incident.

3-2.1* Surveying the Hazardous Materials Incident. Given examples of both facility and transportation scenarios involving hazardous materials, the first responder at the operational level shall survey the incident to identify the containers and materials involved, determine whether hazardous materials have been released, and evaluate the surrounding conditions. The first responder at the operational level shall be able to:

3-2.1.1* Given three (3) examples each of liquid, gas, and solid hazardous materials, identify the general shapes of containers in which the hazardous materials are typically found.

3-2.1.1.1 Given examples of the following tank cars, identify each tank car by type:

(a) Nonpressure tank cars with and without expansion domes

(b) Pressure tank cars

(c) Cryogenic liquid tank cars

3-2.1.1.2 Given examples of the following intermodal tank containers, identify each intermodal tank container by type:

(a) Nonpressure intermodal tank containers

(b) Pressure intermodal tank containers

3-2.1.1.3 Given examples of the following cargo tanks, identify each cargo tank by type:

(a) MC-306/DOT 406 cargo tanks

(b) MC-307/DOT-407 cargo tanks

(c) MC-312/DOT-412 cargo tanks

(d) MC-331 cargo tanks

(e) MC-338 cargo tanks

(f) Dry bulk cargo tanks

3-2.1.1.4 Given examples of the following facility tanks, identify each fixed facility tank by type:

(a) Nonpressure facility tanks

(b) Pressure facility tanks

(c) Cryogenic liquid tanks

3-2.1.1.5 Given examples of the following nonbulk packages, identify each package by type:

(a) Bags

(b) Carboys

(c) Cylinders

(d) Drums

3-2.1.2 Given examples of facility and transportation containers, identify the markings that differentiate one container from another.

3-2.1.2.1 Given examples of the following marked transport vehicles and their corresponding shipping papers, identify the vehicle or tank identification marking:

(a) Rail transport vehicles, including tank cars

(b) Intermodal equipment including tank containers

(c) Highway transport vehicles, including cargo tanks

3-2.1.2.2 Given examples of facility containers, identify the markings indicating container size, product contained, and/or site identification numbers.

3-2.1.3 Given examples of facility and transportation situations involving hazardous materials, identify the name(s) of the hazardous material(s) in each situation.

3-2.1.3.1 Identify the following information on a pipeline marker:

(a) Product

(b) Owner

(c) Emergency telephone number

3-2.1.3.2 Given a pesticide label, 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

3-2.1.4* Identify and list the surrounding conditions that should be noted by the first responders when surveying hazardous materials incidents.

3-2.1.5 Give examples of ways to verify information obtained from the survey of a hazardous materials incident.

3-2.2 Collecting Hazard and Response Information. Given known hazardous materials, the first responder at the operational level shall collect hazard and response information using material safety data sheets (MSDS), CHEMTREC/CANUTEC/SETIQ, and contacts with the shipper/manufacturer. The first responder at the operational level shall be able to:

3-2.2.1 Match the definitions associated with the DOT hazard classes and divisions of hazardous materials, including refrigerated liquefied gases and cryogenic liquids, with the class or division.

3-2.2.2 Identify two ways to obtain a material safety data sheet (MSDS) in an emergency.

3-2.2.3 Using a material safety data sheet (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

3-2.2.4 Identify the following:

(a) Type of assistance provided by CHEMTREC/CANUTEC/SETIQ

(b) Procedure for contacting CHEMTREC/CANUTEC/SETIQ

(c) Information to be furnished to CHEMTREC/CANUTEC/SETIQ

3-2.2.5 Identify two methods of contacting the manufacturer or shipper to obtain hazard and response information.

3-2.3* Predicting the Behavior of a Material and its Container. Given an incident involving a single hazardous material, the first responder at the operational level shall predict the likely behavior of the material and its container. The first responder at the operational level shall be able to:

3-2.3.1 Given two examples of scenarios involving known hazardous materials, interpret the hazard and response information obtained from the current edition of the *North American Emergency Response Guidebook*, material safety data sheets (MSDS), CHEMTREC/CANUTEC/SETIQ, and shipper/manufacturer contacts.

3-2.3.1.1 Match the following chemical and physical properties with their significance and impact on the behavior of the container and/or its contents:

(a) Boiling point

(b) Chemical reactivity

(c) Corrosivity (pH)

(d) Flammable (explosive) range (LEL & UEL)

(e) Flash point

(f) Ignition (autoignition) temperature

(g) Physical state (solid, liquid, gas)

(h) Specific gravity

(i) Toxic products of combustion

(j) Vapor density

(k) Vapor pressure

(l) Water solubility

3-2.3.1.2 Identify the differences among the following terms:

(a) Exposure and hazard

(b) Exposure and contamination

(c) Contamination and secondary contamination

3-2.3.2* Identify three types of stress that could cause a container system to release its contents.

3-2.3.3* Identify five ways in which containers can breach.

3-2.3.4* Identify four ways in which containers can release their contents.

3-2.3.5* Identify at least four dispersion patterns that can be created upon release of a hazardous material.

3-2.3.6* 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.

3-2.3.7* Identify the health and physical hazards that could cause harm.

3-2.3.8* Identify the health hazards associated with the following terms:

(a) Asphyxiant
(b) * Chronic health hazard
(c) Convulsant
(d) Irritant/corrosive
(e) Sensitizer/allergen

3-2.4* Estimating the Potential Harm. The first responder at the operational level shall estimate the potential harm within the endangered area at a hazardous materials incident. The first responder at the operational level shall be able to:

3-2.4.1* Identify a resource for determining the size of an endangered area of a hazardous materials incident.

3-2.4.2 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.

3-2.4.3 Identify resources available for determining the concentrations of a released hazardous material within an endangered area.

3-2.4.4* 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.

3-3 Competencies — Planning the Response.

3-3.1 Describing Response Objectives for Hazardous Materials Incidents. Given at least two scenarios involving hazardous materials incidents (one facility and one transportation), the first responder at the operational level shall describe the first responder's response objectives for each problem. The first responder at the operational level shall be able to:

3-3.1.1 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.

3-3.1.2 Given an analysis of a hazardous materials incident, describe the steps for determining defensive response objectives.

3-3.2 Identifying Defensive Options. Given simulated facility and transportation hazardous materials problems, the first responder at the operational level shall identify the defensive options for each response objective. The first responder at the operational level shall be able to:

3-3.2.1 Identify the defensive options to accomplish a given response objective.

3-3.2.2 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

3-3.3 Determining Appropriateness of Personal Protective Equipment. Given the name of the hazardous material involved and the anticipated type of exposure, the first responder at the operational level shall determine whether available personal protective equipment is appropriate for implementing a defensive option. The first responder at the operational level shall be able to:

3-3.3.1* Identify the appropriate respiratory protection required for a given defensive option.

3-3.3.1.1 Identify the three types of respiratory protection and the advantages and limitations presented by the use of each at hazardous materials incidents.

3-3.3.1.2 Identify the required physical capabilities and limitations of personnel working in positive pressure self-contained breathing apparatus.

3-3.3.2 Identify the appropriate personal protective clothing required for a given defensive option.

3-3.3.2.1 Identify skin contact hazards encountered at hazardous materials incidents.

3-3.3.2.2 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
    1. Liquid splash-protective clothing
    2. Vapor-protective clothing

3-3.4* Identifying Emergency Decontamination Procedures. The first responder at the operational level shall identify emergency decontamination procedures. The first responder at the operational level shall be able to:

3-3.4.1 Identify ways that personnel, personal protective equipment, apparatus, and tools and equipment become contaminated.

3-3.4.2 Describe how the potential for secondary contamination determines the need for emergency decontamination procedures.

3-3.4.3 Identify the purpose of emergency decontamination procedures at hazardous materials incidents.

3-3.4.4 Identify the advantages and limitations of emergency decontamination procedures.

3-4 Competencies — Implementing the Planned Response.

3-4.1 Establishing and Enforcing Scene Control Procedures. Given scenarios for facility and/or transportation hazardous materials incidents, the first responder at the operational level shall identify how to establish and enforce scene control including control zones, emergency decontamination, and communications. The first responder at the operational level shall be able to:

3-4.1.1 Identify the procedures for establishing scene control through control zones.

3-4.1.2 Identify the criteria for determining the locations of the control zones at hazardous materials incidents.

3-4.1.3 Identify the basic techniques for the following protective actions at hazardous materials incidents:

(a) Evacuation
(b) Sheltering in-place protection

3-4.1.4 Identify the considerations associated with locating emergency decontamination areas.

3-4.1.5* Demonstrate the ability to perform emergency decontamination.

3-4.1.6* Identify the items to be considered in a safety briefing prior to allowing personnel to work on a hazardous materials incident.

3-4.2* Initiating the Incident Management System (IMS). Given simulated facility and/or transportation hazardous materials incidents, the first responder at the operational level shall initiate the incident management system (IMS) specified in the local emergency response plan and the organization's standard operating procedures. The first responder at the operational level shall be able to:

3-4.2.1 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.

3-4.2.2 Identify the levels of hazardous materials incidents as defined in the local emergency response plan.

3-4.2.3 Identify the purpose, need, benefits, and elements of an incident management system (IMS) at hazardous materials incidents.

3-4.2.4 Identify the considerations for determining the location of the command post for a hazardous materials incident.

3-4.2.5 Identify the procedures for requesting additional resources at a hazardous materials incident.

3-4.2.6* Identify the authority and responsibilities of the safety officer.

3-4.3 Using Personal Protective Equipment. The first responder at the operational level shall demonstrate the ability to don, work in, and doff the personal protective equipment provided by the authority having jurisdiction. The first responder at the operational level shall be able to:

3-4.3.1 Identify the importance of the buddy system in implementing the planned defensive options.

3-4.3.2 Identify the importance of the backup personnel in implementing the planned defensive options.

3-4.3.3 Identify the safety precautions to be observed when approaching and working at hazardous materials incidents.

3-4.3.4 Identify the symptoms of heat and cold stress.

3-4.3.5 Identify the physical capabilities required for, and the limitations of, personnel working in the personal protective equipment as provided by the authority having jurisdiction.

3-4.3.6 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.

3-4.3.7 Identify the procedures for cleaning, disinfecting, and inspecting respiratory protective equipment.

3-4.3.8 Identify the procedures for donning, working in, and doffing positive pressure self-contained breathing apparatus.

3-4.3.9 Demonstrate donning, working in, and doffing positive pressure self-contained breathing apparatus.

3-4.4 Performing Defensive Control Actions. Given a plan of action for a hazardous materials incident within their capabilities, the first responder at the operational level shall demonstrate defensive control actions set out in the plan. The first responder at the operational level shall be able to:

3-4.4.1 Using the type of fire-fighting foam or vapor suppressing agent and foam equipment furnished by the authority having jurisdiction, demonstrate the proper application of the fire-fighting foam(s) or vapor suppressing agent(s) on a spill or fire involving hazardous materials.

3-4.4.2 Identify the characteristics and applicability of the following foams:

(a) Protein
(b) Fluoroprotein
(c) Special purpose
    1. Polar solvent alcohol-resistant concentrates
    2. Hazardous materials concentrates
(d) Aqueous film-forming foam (AFFF)
(e) High expansion

3-4.4.3 Given the appropriate tools and equipment, demonstrate 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

3-4.4.4 Identify the location and describe the use of the mechanical, hydraulic, and air emergency remote shutoff devices as found on cargo tanks.

3-4.4.5 Describe the objectives and dangers of search and rescue missions at hazardous materials incidents.

3-5 Competencies — Evaluating Progress.

3-5.1 Evaluating the Status of Defensive Actions. Given simulated facility and/or transportation hazardous materials incidents, the first responder at the operational level shall evaluate the status of the defensive actions taken in accomplishing the response objectives. The first responder at the operational level shall be able to:

3-5.1.1 Identify the considerations for evaluating whether defensive options are effective in accomplishing the objectives.

3-5.1.2 Describe the circumstances under which it would be prudent to withdraw from a hazardous materials incident.

3-5.2 Communicating the Status of the Planned Response. The first responder at the operational level shall communicate the status of the planned response to the incident commander and other response personnel. The first responder at the operational level shall be able to:

3-5.2.1 Identify the methods for communicating the status of the planned response to the incident commander through the normal chain of command.

3-5.2.2 Identify the methods for immediate notification of the incident commander and other response personnel about critical emergency conditions at the incident.

3-6 Competencies — Terminating the Incident. (No competencies currently required at this level.)

Chapter 4 Competencies for the Hazardous Materials Technician

4-1 General.

4-1.1 Introduction. Hazardous materials technicians shall be trained to meet all competencies at the first responder awareness and operational levels and the competencies of this chapter. Hazardous materials technicians also shall receive any additional training to meet applicable United States Department of Transportation (DOT), United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and other appropriate state, local, or provincial occupational health and safety regulatory requirements.

4-1.2 Definition. Hazardous materials technicians are those persons who respond to releases or potential releases of hazardous materials for the purpose of controlling the release. Hazardous materials technicians are expected to use specialized chemical protective clothing and specialized control equipment.

4-1.3* Goal. The goal of this chapter shall be to provide the hazardous materials technician with the knowledge and skills to perform the following tasks safely. Therefore, in addition to being competent at both the first responder awareness and operational levels, the hazardous materials technician shall be able to:

(a) Analyze a hazardous materials incident to determine the magnitude of the problem in terms of outcomes by completing the following tasks:

1. Survey the hazardous materials incident to identify special containers involved, to identify or classify unknown materials, and to verify the presence and concentrations of hazardous materials through the use of monitoring equipment

2. Collect and interpret hazard and response information from printed resources, technical resources, computer data bases, and monitoring equipment

3. Determine the extent of damage to containers

4. Predict the likely behavior of released materials and their containers when multiple materials are involved

5. Estimate the size of an endangered area using computer modeling, monitoring equipment, or specialists in this field

(b) Plan a response within the capabilities of available personnel, personal protective equipment, and control equipment by completing the following tasks:

1. Identify the response objectives for hazardous materials incidents

2. Identify the potential action options available by response objective

3. Select the personal protective equipment required for a given action option

4. Select the appropriate decontamination procedures

5. Develop a plan of action, including safety considerations, consistent with the local emergency response plan and the organization's standard operating procedures, and within the capability of the available personnel, personal protective equipment, and control equipment

(c) Implement the planned response to favorably change the outcomes consistent with the organization's standard operating procedures and safety considerations by completing the following tasks:

1. Perform the duties of an assigned hazardous materials branch position within the local incident management system (IMS)

2. Don, work in, and doff appropriate personal protective clothing, including, but not limited to, both liquid splash- and vapor-protective clothing with appropriate respiratory protection

3. Perform the control functions identified in the plan of action

(d) Evaluate the progress of the planned response by evaluating the effectiveness of the control functions

(e) Terminate the incident by completing the following tasks:

1. Assist in the incident debriefing

2. Assist in the incident critique

3. Provide reports and documentation of the incident

4-2 Competencies — Analyzing the Incident.

4-2.1 Surveying the Hazardous Materials Incident. The hazardous materials technician shall identify special containers involved and, given the appropriate equipment, identify or classify unknown materials, verify the identity of the hazardous materials, and determine the concentration of hazardous materials. The hazardous materials technician shall be able to:

4-2.1.1 Given examples of various specialized containers, identify each container by name and identify the material, and its hazard class, that is typically found in the container.

4-2.1.1.1 Given examples of the following railroad cars, identify each car by type and identify at least one material, and its hazard class, that is typically found in each car:

(a) Cryogenic liquid tank cars

(b) High-pressure tube cars

(c) Nonpressure tank cars

(d) Pneumatically unloaded hopper car

(e) Pressure tank cars

4-2.1.1.2 Given examples of the following intermodal tanks, identify each intermodal tank by type and identify at least one material, and its hazard class, that is typically found in each tank:

(a) Nonpressure intermodal tanks:

1. IM-101 (IMO Type 1 internationally) portable tank
2. IM-102 (IMO Type 2 internationally) portable tank

(b) Pressure intermodal tanks (DOT 51) (IMO Type 5 internationally)

(c) Specialized intermodal tanks:

1. Cryogenic intermodal tanks (IMO Type 7 internationally)
2. Tube modules

4-2.1.1.3 Given examples of the following cargo tanks, identify at least one material, and its hazard class, that is typically found in each tank:

(a) Dry bulk cargo tanks
(b) MC306/DOT-406 cargo tanks
(c) MC307/DOT-407 cargo tanks
(d) MC312/DOT-412 cargo tanks
(e) MC331 cargo tanks
(f) MC-338 cargo tanks

4-2.1.1.4 Given examples of the following facility tanks, identify at least one material, and its hazard class, that is typically found in each tank:

(a) Nonpressure tank
(b) Pressure tank

4-2.1.1.5 Given examples of the following nonbulk containers, identify at least one material, and its hazard class, that is typically found in each container:

(a) Bags
(b) Carboys
(c) Cylinders
(d) Drums

4-2.1.1.6 Given examples of the following radioactive materials packages, identify each package by type and identify at least one typical material found in each package:

(a) Type A
(b) Type B

4-2.1.2 Given three examples of facility and transportation containers, identify the approximate capacity of each container.

4-2.1.2.1 Using the markings on the container, identify the capacity (by weight and/or volume) of the following examples of transportation vehicles:

(a) Cargo tanks
(b) Tank cars
(c) Tank containers

4-2.1.2.2 Using the markings on the container and other available resources, identify the capacity (by weight and/or volume) of each of the following facility containers:

(a) Nonpressure tank
(b) Pressure tank
(c) Cryogenic liquid tank

4-2.1.3* Given at least three unknown materials, one of which is a solid, one a liquid, and one a gas, identify or classify by hazard each unknown material.

4-2.1.3.1 Identify the steps in an analysis process for identifying unknown solid and liquid materials.

4-2.1.3.2 Identify the steps in an analysis process for identifying an unknown atmosphere.

4-2.1.3.3 Identify the type(s) of monitoring equipment, test strips, and reagents used to determine the following hazards:

(a) Corrosivity (pH)
(b) Flammability
(c) Oxidation potential
(d) Oxygen deficiency
(e) Radioactivity
(f) Toxic levels

4-2.1.3.4* Identify the capabilities and limiting factors associated with the selection and use of the following monitoring equipment, test strips, and reagents:

(a) Carbon monoxide meter
(b) Colorimetric tubes
(c) Combustible gas indicator
(d) Oxygen meter
(e) Passive dosimeter
(f) Photoionization detectors
(g) pH indicators and/or pH meters
(h) Radiation detection instruments
(i) Reagents
(j) Test strips

4-2.1.3.5* Given three hazardous materials, one of which is a solid, one a liquid, and one a gas, and the following monitoring equipment, test strips, and reagents, select the appropriate equipment and demonstrate the proper techniques to identify and quantify the materials:

(a) Carbon monoxide meter
(b) Colorimetric tubes
(c) Combustible gas indicator
(d) Oxygen meter
(e) pH indicators and/or pH meters
(f) Radiation detection instruments
(g) Reagents
(h) Test strips

4-2.1.3.6 Demonstrate the field maintenance and testing procedures for the monitoring equipment, test strips, and reagents provided by the authority having jurisdiction.

4-2.1.4 Given a label for a radioactive material, identify vertical bars, contents, activity, and transport index, then describe the labeled item and its significance in surveying a radioactive materials incident.

4-2.2 Collecting and Interpreting Hazard and Response Information. Given access to printed resources, technical resources, computer data bases, and monitoring equipment, the hazardous materials technician shall collect and interpret hazard and response information not available from the current edition of the *North American Emergency Response Guidebook* or a material safety data sheet (MSDS). The hazardous materials technician shall be able to:

4-2.2.1* Identify and interpret the types of hazard and response information available from each of the following resources and explain the advantages and disadvantages of each resource:

(a) Hazardous materials data bases
(b) Maps and diagrams
(c) Monitoring equipment
(d) Reference manuals
(e) Technical information centers (i.e., CHEMTREC/CANUTEC/SETIQ)
(f) Technical information specialists

4-2.2.2 Describe the following terms and explain their significance in the risk assessment process:

(a) Acid, caustic
(b) Air reactivity
(c) Boiling point
(d) Catalyst
(e) Chemical interactions
(f) Chemical reactivity
(g) Compound, mixture
(h) Concentration
(i) Corrosivity (pH)
(j) Critical temperatures and pressure
(k) Expansion ratio
(l) Flammable (explosive) range (LEL & UEL)
(m) Fire point
(n) Flash point
(o) Halogenated hydrocarbon
(p) Ignition (autoignition) temperature
(q) Inhibitor
(r) Instability
(s) Ionic & covalent compounds
(t) Maximum safe storage temperature (MSST)
(u) Melting point/freezing point
(v) Miscibility
(w) Organic and inorganic
(x) Oxidation potential
(y) pH
(z) Physical state (solid, liquid, gas)
(aa) Polymerization
(bb) Radioactivity
(cc) Saturated, unsaturated, and aromatic hydrocarbons
(dd) Self-accelerating decomposition temperature (SADT)
(ee) Solution, slurry
(ff) Specific gravity
(gg) Strength
(hh) Sublimation
(ii) Temperature of product
(jj) Toxic products of combustion
(kk) Vapor density
(ll) Vapor pressure
(mm) Viscosity
(nn) Volatility
(oo) Water reactivity
(pp) Water solubility

4-2.2.3 Describe the heat transfer processes that occur as a result of a cryogenic liquid spill.

4-2.2.4* Given five hazardous material scenarios and the appropriate reference materials, identify the signs and symptoms of exposure to each material and the target organ effects of exposure to that material.

4-2.2.5 Given the scenario of a domestic gas line break and the readings from a combustible gas indicator, determine the area of evacuation.

4-2.2.6 Identify two methods for determining the pressure in bulk packaging or facility containers.

4-2.2.7 Identify one method for determining the amount of lading remaining in damaged bulk packaging or facility containers.

4-2.3* Describing the Condition of the Container Involved in the Incident. Given simulated facility and transportation container damage, the hazardous materials technician shall describe the damage. The hazardous materials technician shall be able to:

4-2.3.1* Given three examples of containers, DOT specification markings for nonbulk and bulk packaging, and the appropriate reference guide, identify the basic design and construction features of each container.

4-2.3.1.1 Identify the basic design and construction features, including closures, of the following bulk containers:

(a) Cargo tanks:
  1. Dry bulk cargo tanks
  2. MC-306/DOT-406 cargo tanks
  3. MC-307/ DOT-407 cargo tanks
  4. MC-312/DOT-412 cargo tanks
  5. MC-331 cargo tanks
  6. MC-338 cargo tanks
(b) Fixed facility tanks:
  1. Nonpressure tank
  2. Pressure tank
(c) Intermodal tanks:
  1. Nonpressure intermodal tanks:
    a. IM- 101 portable tank
    b. IM-102 portable tank
  2. Pressure intermodal tanks (specification 51)
  3. Specialized intermodal tanks:
    a. Cryogenic intermodal tanks
    b. Tube modules
(d) One-ton containers
(e) Pipelines
(f) Railroad cars:
  1. Cryogenic liquid tank cars

2. High-pressure tube cars
3. Nonpressure tank cars
4. Pneumatically unloaded hopper cars
5. Pressure tank cars

(g) Intermediate bulk containers (also known as tote tanks)

4-2.3.1.2 Identify the basic design and construction features including closures of the following nonbulk containers:

(a) Carboys

(b) Drums

(c) Pressurized cylinders

4-2.3.1.3 Identify the basic design and construction features of the following radioactive materials containers:

(a) Type A package

(b) Type B package

4-2.3.2 Describe how a liquid pipeline can carry different products.

4-2.3.3 Given an example of a pipeline, identify the following:

(a) Ownership of the line

(b) Procedures for checking for gas migration

(c) Procedure for shutting down the line or controlling the leak

(d) Type of product in the line

4-2.3.4* Identify the types of damage that a pressure container could incur.

4-2.3.5 Given examples of tank car damage, identify the type of damage in each example by name.

4-2.4 Predicting Likely Behavior of Materials and Their Containers When Multiple Materials are Involved. Given examples of both facility and transportation incidents involving multiple hazardous materials, the hazardous materials technician shall predict the likely behavior of the material in each case. The hazardous materials technician shall be able to:

4-2.4.1 Identify at least three resources available that indicate the effects of mixing various hazardous materials.

4-2.4.2 Identify the impact of the following fire and safety features on the behavior of the products during an incident at a bulk storage facility and explain their significance in the risk assessment process:

(a) Fire protection systems

(b) Monitoring and detection systems

(c) Product spillage and control (impoundment and diking)

(d) Tank spacing

(e) Tank venting and flaring systems

(f) Transfer operations

4-2.5 Estimating the Likely Size of an Endangered Area. Given various facility and transportation hazardous materials incidents, the hazardous materials technician shall estimate the likely size, shape, and concentrations associated with the release of materials involved in the incident by using computer modeling, monitoring equipment, or specialists in this field. The hazardous materials technician shall be able to:

4-2.5.1 Identify local resources for dispersion pattern prediction and modeling including computers, monitoring equipment, or specialists in the field.

4-2.5.2 Given the concentrations of the released material, identify the steps for determining the extent of the hazards (e.g., physical, safety, and health) within the endangered area of a hazardous materials incident.

4-2.5.2.1 Describe the following toxicological terms and exposure values and explain their significance in the risk assessment process:

(a) Parts per million (ppm)

(b) Parts per billion (ppb)

(c) Lethal dose (LD_{50})

(d) Lethal concentrations (LC_{50})

(e) Permissible exposure limit (PEL)

(f) Threshold limit value time-weighted average (TLV-TWA)

(g) Threshold limit value short-term exposure limit (TLV-STEL)

(h) Threshold limit value ceiling (TLV-C)

(i) Immediately dangerous to life and health value (IDLH)

4-2.5.2.2* Describe the following radiological terms and explain their significance in predicting the extent of health hazards and environmental impact in a hazardous materials incident:

(a) Types

(b) Measurement

(c) Protection

4-2.5.2.3 Identify two methods for predicting the areas of potential harm within the endangered area of a hazardous materials incident.

4-2.5.3* Identify a method for estimating the outcomes within an endangered area of a hazardous materials incident.

4-3 Competencies — Planning the Response.

4-3.1 Identifying Response Objectives. Given simulated facility and transportation problems, the hazardous materials technician shall describe the response objectives for each problem. The hazardous materials technician shall be able to describe the steps for determining response objectives (defensive, offensive, nonintervention) given an analysis of a hazardous materials incident.

4-3.2 Identifying the Potential Action Options. Given simulated facility and transportation hazardous materials incidents, the hazardous materials technician shall identify the possible action options (defensive, offensive, and nonintervention) by response objective for each problem. The hazardous materials technician shall be able to identify the possible action options to accomplish a given response objective.

4-3.3 Selecting Personal Protective Equipment. Given situations with known and unknown hazardous materials, the hazardous materials technician shall determine the appropriate personal protective equipment for the action options specified in the plan of action in each situation. The hazardous materials technician shall be able to:

4-3.3.1 Identify the four levels of personal protective equipment (EPA/NIOSH or NFPA 471) and describe the equipment for each level and the condition under which each level is used.

4-3.3.2 Identify the factors to be considered in selecting the proper respiratory protection for a specified action option.

4-3.3.2.1 Describe the advantages, limitations, and proper use of the following types of respiratory protection at hazardous materials incidents:

(a) Positive pressure self-contained breathing apparatus

(b) Positive pressure air line respirators with required escape unit

(c) Air purifying respirators

4-3.3.2.2 Identify the process for selecting the proper respiratory protection at hazardous materials incidents.

4-3.3.2.3 Identify the operational components of air purifying respirators and air line respirators by name and describe their functions.

4-3.3.3 Identify the factors to be considered in selecting the proper chemical-protective clothing for a specified action option.

4-3.3.3.1 Describe the following terms and explain their impact and significance on the selection of chemical-protective clothing:

(a) Degradation

(b) Penetration

(c) Permeation

4-3.3.3.2 Identify at least three indications of material degradation of chemical-protective clothing.

4-3.3.3.3* Identify the three types of vapor-protective and splash-protective clothing and describe the advantages and disadvantages of each type.

4-3.3.3.4 Identify the relative advantages and disadvantages of the following heat exchange units used for the cooling of personnel in chemical-protective clothing:

(a) Air cooled

(b) Ice cooled

(c) Water cooled

4-3.3.3.5 Identify the process for selecting the proper protective clothing at hazardous materials incidents.

4-3.3.3.6 Given three examples of various hazardous materials, determine the appropriate protective clothing construction materials for a given action option using chemical compatibility charts.

4-3.3.3.7 Identify the physical and psychological stresses that can affect users of specialized protective clothing.

4-3.4 Developing Appropriate Decontamination Procedures. Given a simulated hazardous materials incident, the hazardous materials technician shall select an appropriate decontamination procedure and determine the equipment required to implement that procedure. The hazardous materials technician shall be able to:

4-3.4.1 Identify the advantages and limitations and describe an example where each of the following decontamination methods would be used:

(a) Absorption

(b) Adsorption

(c) Chemical degradation

(d) Dilution

(e) Disposal

(f) Evaporation

(g) Neutralization

(h) Solidification

(i) Vacuuming

(j) Washing

4-3.4.2 Identify three sources of technical information for selecting appropriate decontamination procedures and identify how to contact those sources in an emergency.

4-3.5 Developing a Plan of Action. Given simulated hazardous materials incidents in facility and transportation settings, the hazardous materials technician shall develop a plan of action, including safety considerations. The plan shall be consistent with the local emergency response plan and the organization's standard operating procedures and be within the capability of available personnel, personal protective equipment, and control equipment for that incident. The hazardous materials technician shall be able to:

4-3.5.1 Describe the purpose of, procedures for, equipment required, and safety precautions used with the following techniques for hazardous materials control:

(a) Adsorption

(b) Neutralization

(c) Overpacking

(d) Patching

(e) Plugging

4-3.5.2 Given MC-306/DOT-406, MC-307/DOT-407, MC-312/DOT-412, MC-331, and MC-338 cargo tanks, identify the common methods for product transfer from each type of cargo tank.

4-3.5.3 Given a simulated hazardous materials incident, develop the safety considerations that must be included in the plan of action.

4-3.5.3.1 List and describe the safety considerations to be included.

4-3.5.3.2 Identify the points that should be made in a safety briefing prior to working at the scene.

4-3.5.4* Identify the atmospheric and physical safety hazards associated with hazardous materials incidents involving confined spaces.

4-3.5.5 Identify the pre-entry activities to be performed.

4-4 Competencies — Implementing the Planned Response.

4-4.1 Performing Incident Management Duties. Given the local emergency response plan or organization's standard operating procedures and a simulated hazardous materials incident, the hazardous materials technician shall demonstrate the duties of an assigned hazardous materials branch position within the local incident management system (IMS). The hazardous materials technician shall be able to:

4-4.1.1 Identify the role of the hazardous materials technician during an incident involving hazardous materials.

4-4.1.2 Identify the duties and responsibilities of the following hazardous materials branch functions within the incident management system:

(a) Backup
(b) Decontamination
(c) Entry
(d) Hazardous Materials Branch Management
(e) Hazardous Materials Branch Safety
(f) Information/research
(g) Reconnaissance
(h) Resources

4-4.1.3 Demonstrate setup of the decontamination corridor as specified in the planned response.

4-4.1.4 Demonstrate the decontamination process specified in the planned response.

4-4.2 Using Protective Clothing and Respiratory Protection. The hazardous materials technician shall demonstrate the ability to don, work in, and doff both liquid splash- and vapor-protective chemical-protective clothing and any other specialized personal protective equipment provided by the authority having jurisdiction, including the appropriate respiratory protection. The hazardous materials technician shall be able to:

4-4.2.1 Describe three safety procedures for personnel wearing vapor-protective clothing.

4-4.2.2* Describe three emergency procedures for personnel wearing vapor-protective clothing.

4-4.2.3* Identify the procedures for donning, working in, and doffing the following types of respiratory protection:

(a) Air line respirator with required escape unit
(b) Air purifying respirator

4-4.2.4 Demonstrate donning, working in, and doffing chemical-protective clothing in addition to any other specialized protective equipment provided by the authority having jurisdiction.

4-4.2.5 Demonstrate the ability to record the use, repair, and testing of chemical-protective clothing according to manufacturer's specifications and recommendations.

4-4.2.6 Describe the maintenance, testing, inspection, and storage procedures for personal protective equipment provided by the authority having jurisdiction according to the manufacturer's specifications and recommendations.

4-4.3 Performing Control Functions Identified in Plan of Action. Given various simulated hazardous materials incidents involving nonbulk and bulk packaging and facility containers, the hazardous materials technician shall select the tools, equipment, and materials for the control of hazardous materials incidents and identify the precautions for controlling releases from those packaging/containers. The hazardous materials technician shall be able to:

4-4.3.1* Given a pressure vessel, select the appropriate material or equipment and demonstrate a method(s) to contain leaks from the following locations:

(a) Fusible metal of plug
(b) Fusible plug threads
(c) Side wall of cylinder
(d) Valve blowout
(e) Valve gland
(f) Valve inlet threads
(g) Valve seat
(h) Valve stem assembly blowout

4-4.3.2* Given the fittings on a pressure container, demonstrate the ability to perform the following:

(a) Close valves that are open
(b) Replace missing plugs
(c) Tighten loose plugs

4-4.3.3 Given a 55-gal (208-L) drum, demonstrate the ability to contain the following types of leaks using appropriate tools and materials:

(a) Bung leak
(b) Chime leak
(c) Forklift puncture
(d) Nail puncture

4-4.3.4 Given a 55-gal (208-L) drum and an overpack drum, demonstrate the ability to place the 55-gal drum into the overpack drum using the following methods:

(a) Rolling slide-in
(b) Slide-in
(c) Slip-over

4-4.3.5 Identify the maintenance and inspection procedures for the tools and equipment provided for the control of hazardous materials releases according to the manufacturer's specifications and recommendations.

4-4.3.6 Identify three considerations for assessing a leak or spill inside a confined space without entering the area.

4-4.3.7* Identify three safety considerations for product transfer operations.

4-4.3.8 Given an MC-306/DOT-406 cargo tank and a dome cover clamp, demonstrate the ability to install the clamp on the dome properly.

4-4.3.9 Identify the methods and precautions used when controlling a fire involving an MC-306/DOT-406 aluminum shell cargo tank.

4-4.3.10 Describe at least one method for containing each of the following types of leaks in MC-306/DOT-406, MC-307/DOT-407, and MC-312/DOT- 412 cargo tanks:

(a) Dome cover leak
(b) Irregular-shaped hole
(c) Puncture
(d) Split or tear

4-4.3.11* Describe three product removal and transfer considerations for overturned MC-306/DOT-406, MC-307/DOT-407, MC-312/DOT-412, MC-331, and MC-338 cargo tanks.

4-5 Competencies - Evaluating Progress.

4-5.1 Evaluating the Effectiveness of the Control Functions. Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging and the plan of action, the hazardous materials technician shall evaluate the effectiveness of any control functions identified in the plan of action.

4-6 Competencies — Terminating the Incident.

4-6.1 Assisting in the Debriefing. Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, the hazardous materials technician shall participate in the debriefing of the incident. The hazardous materials technician shall be able to:

4-6.1.1 Describe three components of an effective debriefing.

4-6.1.2 Describe the key topics of an effective debriefing.

4-6.1.3 Describe when a debriefing should take place.

4-6.1.4 Describe who should be involved in a debriefing.

4-6.2 Assisting in the Incident Critique. Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, the hazardous materials technician shall provide operational observations of the activities that were performed in the hot and warm zones during the incident. The hazardous materials technician shall be able to:

4-6.2.1 Describe three components of an effective critique.

4-6.2.2 Describe who should be involved in a critique.

4-6.2.3 Describe why an effective critique is necessary after a hazardous materials incident.

4-6.2.4 Describe which written documents should be prepared as a result of the critique.

4-6.3 Providing Reports and Documentation. Given a simulated hazardous materials incident, the hazardous materials technician shall complete the reporting and documentation requirements consistent with the organization's emergency response plan and standard operating procedures. The hazardous materials technician shall be able to:

4-6.3.1 Identify the reports and supporting documentation required by the local emergency response plan and the organization's standard operating procedures.

4-6.3.2 Demonstrate the proper completion of the reports required by the local emergency response plan and the organization's standard operating procedures.

4-6.3.3 Describe the importance of personnel exposure records.

4-6.3.4 Describe the importance of debriefing records.

4-6.3.5 Describe the importance of critique records.

4-6.3.6 Identify the steps in keeping an activity log and exposure records.

4-6.3.7 Identify the steps to be taken in compiling incident reports that meet federal, state, local, and organizational requirements.

4-6.3.8 Identify the requirements for compiling hot zone entry and exit logs.

4-6.3.9 Identify the requirements for compiling personal protective equipment logs.

4-6.3.10 Identify the requirements for filing documents and maintaining records.

Chapter 5 Competencies for the Incident Commander

5-1 General.

5-1.1 Introduction. The incident commander shall be trained to meet all the competencies for the first responder awareness and operational levels and the competencies of this chapter. Incident commanders also shall receive any additional training to meet applicable United States Department of Transportation (DOT), United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and other appropriate state, local, or provincial occupational health and safety regulatory requirements.

5-1.2 Definition. The incident commander is that person who is responsible for all decisions relating to the management of the incident. The incident commander is in charge of the incident site.

5-1.3* Goal. The goal of this chapter shall be to provide the incident commander with the knowledge and skills to perform the following tasks safely. Therefore, in addition to being competent at the awareness and operational levels, the incident commander shall be able to:

(a) Analyze a hazardous materials incident to determine the magnitude of the problem in terms of outcomes by completing the following tasks:

1. Collect and interpret hazard and response information from printed resources, technical resources, computer data bases, and monitoring equipment

2. Estimate the potential outcomes within the endangered area at a hazardous materials incident

(b) Plan response operations within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by completing the following tasks:

1. Identify the response objectives for hazardous materials incidents

2. Identify the potential action options (defensive, offensive, and nonintervention) available by response objective

3. Approve the level of personal protective equipment required for a given action option

4. Develop a plan of action, including safety considerations, consistent with the local emergency response plan and the organization's standard operating procedures and within the capability of available personnel, personal protective equipment, and control equipment

(c) Implement a response to favorably change the outcome consistent with the local emergency response plan and the organization's standard operating procedures by completing the following tasks:

1. Implement an incident management system (IMS), including the specified procedures for notification and utilization of nonlocal resources, e.g., private, state, and federal government personnel

2. Direct resources (private, governmental, and others) with expected task assignments and on-scene activities and provide management overview, technical review, and logistical support to private and governmental sector personnel

3. Provide a focal point for information transfer to media and local elected officials through the IMS structure

(d) Evaluate the progress of the planned response to ensure the response objectives are being met safely, effectively, and efficiently and adjust the plan of action accordingly by evaluating the effectiveness of the control functions

(e) Terminate the incident by completing the following tasks:

1. Transfer command (control) when appropriate
2. Conduct an incident debriefing
3. Conduct a multi-agency critique
4. Report and document the hazardous materials incident and submit the report to the proper entity

5-2 Competencies — Analyzing the Incident.

5-2.1 Collecting and Interpreting Hazard and Response Information. Given access to printed and technical resources, computer data bases, and monitoring equipment, the incident commander shall collect and interpret hazard and response information not available from the current edition of the *North American Emergency Response Guidebook* or a material safety data sheet (MSDS). The incident commander shall be able to identify and interpret the types of hazard and response information available from each of the following resources and explain the advantages and disadvantages of each resource:

(a) Reference manuals
(b) Hazardous materials data bases
(c) Technical information centers
(d) Technical information specialists
(e) Monitoring equipment

5-2.2 Estimating Potential Outcomes. Given simulated facility or transportation incidents involving hazardous materials, the surrounding conditions, and the predicted behavior of the container and its contents, the incident commander shall estimate the potential outcomes within the endangered area. The incident commander shall be able to:

5-2.2.1 Identify the steps for estimating the number of exposures within the endangered area.

5-2.2.2 Describe the following toxicological terms and exposure values and explain their significance in the risk assessment process:

(a) Parts per million (ppm)
(b) Parts per billion (ppb)
(c) Lethal dose (LD_{50})
(d) Lethal concentrations (LC_{50})
(e) Permissible exposure limit (PEL)
(f) Threshold limit value time-weighted average (TLV-TWA)
(g) Threshold limit value short-term exposure limit (TLV-STEL)
(h) Threshold limit value ceiling (TLV-C)
(i) Immediately dangerous to life and health value (IDLH)

5-2.2.3* Describe the following radiological materials terms and explain their significance in predicting the extent of health hazards and environmental impact in a hazardous materials incident:

(a) Types
(b) Measurement
(c) Protection

5-2.2.4 Identify two methods for predicting the areas of potential harm within the endangered area of a hazardous materials incident.

5-2.2.5 Identify the methods available to the organization for obtaining local weather conditions and predictions for short-term future weather changes.

5-2.2.6 Explain the basic toxicological principles relative to assessment and treatment of personnel exposed to hazardous materials, including the following:

(a) Acute and delayed toxicity (chronic)
(b) Routes of exposure to toxic materials
(c) Local and systemic effects
(d) Dose response
(e) Synergistic effects

5-3 Competencies — Planning the Response.

5-3.1 Identifying Response Objectives. Given simulated facility and transportation hazardous materials incidents, the incident commander shall identify the possible action options (defensive, offensive, and nonintervention) by response objectives for each problem. The incident commander shall be able to describe the steps for determining response objectives (defensive, offensive, and nonintervention) given an analysis of a hazardous materials incident.

5-3.2 Identifying the Potential Action Options. Given simulated facility and transportation hazardous materials incidents, the incident commander shall identify the possible action options (defensive, offensive, and non-intervention) by response objective for each problem. The incident commander shall be able to:

5-3.2.1 Identify the possible action options to accomplish a given response objective.

5-3.2.2 Identify the purpose of each of the following techniques for hazardous materials control:

(a) Adsorption
(b) Neutralization
(c) Overpacking
(d) Patching
(e) Plugging

5-3.3 Approving the Level of Personal Protective Equipment. Given situations with known and unknown hazardous materials, the incident commander shall approve the appropriate personal protective equipment for the action options specified in the plan of action in each situation. The incident commander shall be able to:

5-3.3.1 Identify the four levels of chemical protection (EPA/NIOSH) and describe the equipment required for each level with the conditions under which each level is used.

5-3.3.2 Describe the following terms and explain their impact and significance on the selection of chemical- protective clothing:

(a) Degradation

(b) Penetration

(c) Permeation

5-3.3.3 Describe three safety considerations for personnel wearing vapor-protective, liquid splash-protective, and high temperature-protective clothing.

5-3.3.4 Identify the physical and psychological stresses that can affect users of personal protective equipment.

5-3.4 Developing a Plan of Action. Given simulated facility and transportation hazardous materials incidents, the incident commander shall develop a plan of action consistent with the local emergency response plan and the organization's standard operating procedures that is within the capability of the available personnel, personal protective equipment, and control equipment. The incident commander shall be able to:

5-3.4.1 Identify the steps for developing a plan of action.

5-3.4.2 Identify the factors to be evaluated in selecting public protective actions including evacuation and sheltering in-place.

5-3.4.3 Given the local emergency response plan and/or the organization's standard operating procedures, identify which agency will perform the following:

(a) Receive the initial notification

(b) Provide secondary notification and activation of response agencies

(c) Make ongoing assessments of the situation

(d) Command on-scene personnel (incident management system)

(e) Coordinate support and mutual aid

(f) Provide law enforcement and on-scene security (crowd control)

(g) Provide traffic control and rerouting

(h) Provide resources for public safety protective action (evacuation or shelter in-place)

(i) Provide fire suppression services when appropriate

(j) Provide on-scene medical assistance (ambulance) and medical treatment (hospital)

(k) Provide public notification (warning)

(l) Provide public information (news media statements)

(m) Provide on-scene communications support

(n) Provide emergency on-scene decontamination when appropriate

(o) Provide operational-level hazard control services

(p) Provide technician-level hazard mitigation services

(q) Provide environmental remedial action ("cleanup") services

(r) Provide environmental monitoring

5-3.4.4 Identify the process for determining the effectiveness of an action option on the potential outcomes.

5-3.4.5 Identify the safe operating practices/procedures that are required to be followed at a hazardous materials incident.

5-3.4.5.1 Identify the importance of pre-incident planning relating to safety during responses to specific sites.

5-3.4.5.2 Identify the procedures for presenting a safety briefing prior to allowing personnel to work on a hazardous materials incident.

5-3.4.5.3* Identify at least three safety precautions associated with search and rescue missions at hazardous materials incidents.

5-3.4.5.4 Identify the advantages and limitations and describe an example where each of the following decontamination methods would be used:

(a) Absorption

(b) Adsorption

(c) Chemical degradation

(d) Dilution

(e) Disposal

(f) Evaporation

(g) Neutralization

(h) Solidification

(i) Vacuuming

(j) Washing

5-3.4.5.5* Identify the atmospheric and physical safety hazards associated with hazardous materials incidents involving confined spaces.

5-4 Competencies — Implementing the Planned Response.

5-4.1 Implementing the Incident Management System. Given a copy of the local emergency response plan, the incident commander shall identify the requirements of the plan, including the required procedures for notification and utilization of nonlocal resources (private, state, and federal government personnel). The incident commander shall be able to:

5-4.1.1 Identify the role of the incident commander during an incident involving hazardous materials.

5-4.1.2 Identify the duties and responsibilities of the following hazardous materials branch functions within the incident management system:

(a) Backup

(b) Decontamination

(c) Entry

(d) Hazardous Materials Branch Management

(e) Hazardous Materials Branch Safety

(f) Information/research

(g) Reconnaissance

(h) Resources

5-4.1.3 Identify the steps for implementing the local and related emergency response plans as required under SARA Title III (EPCRA) Section 303 of the federal regulations or other state and local emergency response planning legislation.

5-4.1.4 Given the local emergency response planning documents, identify the elements of each of the documents.

5-4.1.5 Identify the elements of the incident management system necessary to coordinate response activities at hazardous materials incidents.

5-4.1.6 Identify the primary local, state, regional, and federal government agencies and identify the scope of their regulatory authority (including the regulations) pertaining to the production, transportation, storage, and use of hazardous materials and the disposal of hazardous wastes.

5-4.1.7 Identify the government agencies and private sector resources offering assistance during a hazardous materials incident and identify their role and the type of assistance or resources available.

5-4.2* Directing Resources (Private and Governmental). Given a simulated hazardous materials incident and the necessary resources to implement the planned response, the incident commander shall demonstrate the ability to direct the resources in a safe and efficient manner consistent with the capabilities of those resources.

5-4.3 Providing a Focal Point for Information Transfer to Media and Elected Officials. Given a simulated hazardous materials incident, the incident commander shall identify appropriate information to provide to the media and local, state, and federal officials. The incident commander shall be able to:

5-4.3.1 Identify the local policy for providing information to the media.

5-4.3.2 Identify the responsibilities of the public information officer at a hazardous materials incident.

5-5 Competencies — Evaluating Progress.

5-5.1 Evaluating Progress of the Plan of Action. Given simulated facility and transportation hazardous materials incidents, the incident commander shall evaluate the progress of the plan of action to determine whether the efforts are accomplishing the response objectives. The incident commander shall be able to:

5-5.1.1 Identify the procedures for evaluating whether the action options are effective in accomplishing the objectives.

5-5.1.2 Identify the steps for comparing actual behavior of the material and the container to that predicted in the analysis process.

5-5.1.3 Determine the effectiveness of the following:

(a) Personnel being used

(b) Personal protective equipment

(c) Established control zones

(d) Decontamination process

5-6 Competencies — Terminating the Incident.

5-6.1 Transfering Command/Control. Given the details of a simulated incident, the local emergency response plan, and the organization's standard operating procedures, the incident commander shall be able to:

5-6.1.1* Identify the appropriate steps to be taken to transfer command/control of the incident.

5-6.1.2 Demonstrate the transfer of command/control.

5-6.2 Conducting a Debriefing. Given the details of a simulated hazardous materials incident, the incident commander shall conduct a debriefing of the incident. The incident commander shall be able to:

5-6.2.1 Describe three components of an effective debriefing.

5-6.2.2 Describe the key topics in an effective debriefing.

5-6.2.3 Describe when a debriefing should take place.

5-6.2.4 Describe who should be involved in a debriefing.

5-6.2.5 Identify the procedures for conducting incident debriefings at a hazardous materials incident.

5-6.3 Conducting a Multi-Agency Critique. Given details of a simulated multi-agency hazardous materials incident, the incident commander shall conduct a critique of the incident. The incident commander shall be able to:

5-6.3.1 Describe three components of an effective critique.

5-6.3.2 Describe who should be involved in a critique.

5-6.3.3 Describe why an effective critique is necessary after a hazardous materials incident.

5-6.3.4 Describe what written documents should be prepared as a result of the critique.

5-6.3.5 Implement the procedure for conducting a critique of the incident.

5-6.4 Reporting and Documenting the Hazardous Materials Incident. Given a simulated hazardous materials incident, the incident commander shall demonstrate the ability to report and document the incident consistent with the local, state, and federal requirements. The incident commander shall be able to:

5-6.4.1 Identify the reporting requirements of the federal, state, and local agencies.

5-6.4.2 Identify the importance of documentation for a hazardous materials incident, including training records, exposure records, incident reports, and critique reports.

5-6.4.3 Identify the steps in keeping an activity log and exposure records for hazardous materials incidents.

5-6.4.4 Identify the requirements for compiling hazardous materials incident reports found in the local emergency response plan as well as the organization's standard operating procedures.

5-6.4.5 Identify the requirements for filing documents and maintaining records found in the local emergency response plan and the organization's standard operating procedures.

Chapter 6 Competencies for Private Sector Specialist Employees

6-1 General.

6-1.1 Introduction. Private sector specialist employees are those persons who, in the course of their regular job duties, work with or are trained in the hazards of specific chemicals or containers within their organization's area of specialization. In response to emergencies involving hazardous materials in their organization's area of specialization, they could be called upon to provide technical advice or assistance to the incident commander relative to specific chemicals or containers for chemicals. Private sector specialist employees shall receive training or demonstrate competency in their area of specialization annually. Private sector specialist employees also shall receive any additional training to meet applicable United States Department of Transportation (DOT), Occupational

Safety and Health Administration (OSHA), United States Environmental Protection Agency (EPA), and other appropriate state, local, or provincial occupational health and safety regulatory requirements.

Private sector specialist employees respond to hazardous materials incidents under different circumstances. They respond to incidents within their facility, in and outside their assigned work area, and outside their facility. Persons responding away from the facility or within the facility outside their assigned work area respond as a member of a hazardous materials response team or as a private sector specialist employee as outlined in this chapter. When responding to incidents away from their assigned work area, private sector specialist employees shall be permitted to perform only at the response level at which they have been trained.

Persons responding to a hazardous materials incident within their work area are not required to be trained to the levels specified by this chapter. Persons within their work area who have informed the incident management structure of an emergency as defined in the facility's emergency response plan; who have adequate personal protective equipment and adequate training in the procedures they are to perform; and who have employed the buddy system can take limited action in the danger area (e.g., turning a valve) before the emergency response team arrives. The limited action taken must be addressed in the emergency response plan. Once the emergency response team arrives, these persons shall be restricted to the actions that their training level allows and must operate under the incident command structure.

6-1.2 Scope. This chapter will address competencies for the following private sector specialist employees:

(a) Private sector specialist employee C

(b) Private sector specialist employee B

(c) Private sector specialist employee A

6-2 Private Sector Specialist Employee C.

6-2.1 General.

6-2.1.1 Introduction. The private sector specialist employee C shall meet the competencies at the first responder awareness level (Chapter 2) relative to their organization's area of specialization and the additional competencies in Section 6-2 of this chapter.

6-2.1.2 Definition. The private sector specialist employee C is that person who responds to emergencies involving chemicals and/or containers within his or her organization's area of specialization. Consistent with the organization's emergency response plan and standard operating procedures, the private sector specialist employees C can be called upon to gather and record information, provide technical advice, and/or arrange for technical assistance. A private sector specialist employee C does not enter the hot or warm zone at an emergency.

6-2.1.3 Goal. The private sector specialist employee C shall be competent at the first responder awareness level relative to their organization's area of specialization. The private sector specialist employee C shall have the knowledge and skills to perform the following duties and tasks safely:

(a) Assist the incident commander in analyzing the magnitude of an emergency involving chemicals or containers for chemicals by completing the following tasks:

1. Provide information on the hazards and harmful effects of specific chemicals

2. Provide information on the characteristics of specific containers for chemicals

(b) Assist the incident commander in planning a response to an emergency involving chemicals or containers for chemicals by completing the following tasks:

1. Provide information on the potential response options for chemicals or containers for chemicals

6-2.2 Competencies — Analyzing the Incident.

6-2.2.1 Providing Information on the Hazards and Harmful Effects of Specific Chemicals. Given a specific chemical(s) used in his or her organization's area of specialization and the appropriate material safety data sheet (MSDS) or other appropriate resource, the private sector specialist employee C shall advise the incident commander of the chemical's hazards and harmful effects. The private sector specialist employee C shall be able to:

6-2.2.1.1 Identify the following hazard information from the material safety data sheet (MSDS) or other appropriate resource:

(a) Physical and chemical characteristics

(b) Physical hazards of the chemical (including fire and explosion hazards)

(c) Health hazards of the chemical

(d) Signs and symptoms of exposure

(e) Routes of entry

(f) Permissible exposure limits

(g) Reactivity hazards

(h) Environmental concerns

6-2.2.1.2 Identify how to contact CHEMTREC/CANUTEC/SETIQ.

6-2.2.1.3 Identify the resources available from CHEMTREC/CANUTEC/SETIQ.

6-2.2.1.4 Given their organization's emergency response plan and standard operating procedures, identify additional resources of hazard information, including a method of contact.

6-2.2.2 Providing Information on Characteristics of Specific Containers. Given examples of facility and transportation containers for chemicals in their organization's area of specialization, the private sector specialist employee C shall advise the incident commander of the characteristics of the containers. The private sector specialist employee C shall be able to:

6-2.2.2.1 Identify each container by name.

6-2.2.2.2 Identify the markings that differentiate one container from another.

6-2.2.2.3 Given their organization's emergency response plan and standard operating procedures, identify the resources available that can provide information about the characteristics of the container.

6-2.3 Competencies — Planning the Response.

6-2.3.1 Providing Information on Potential Response Options for Specific Chemicals. Given a specific chemical used in their organization's area of specialization and an appropriate material safety data sheet (MSDS) or other appropriate resource, the private sector specialist employee C shall advise the incident commander of the response information for that chemical by being able to:

6-2.3.1.1 Obtain the following response information:

(a) Precautions for safe handling, including hygiene practices, protective measures, and procedures for cleanup of spills/leaks

(b) Applicable control measures, including personal protective equipment

(c) Emergency and first aid procedures

6-2.3.1.2 Identify additional resources for obtaining response information.

6-3 Private Sector Specialist Employee B.

6-3.1 General.

6-3.1.1 Introduction. The private sector specialist employee B shall be trained to meet the competencies at the private sector specialist employee C level and the additional competencies in Section 6-3 of this chapter.

6-3.1.2* Definition. The level B private sector specialist employee is that person who, in the course of their regular job duties, works with or is trained in the hazards of specific chemicals or containers within their individual area of specialization. Because of their education, training, or work experience, the private sector specialist employee B can be called upon to respond to incidents involving these chemicals or containers. The private sector specialist employee B can be used to gather and record information, provide technical advice, and provide technical assistance (including work within the hot zone) at the incident consistent with their organization's emergency response plan and standard operating procedures and the local emergency response plan.

6-3.1.3* Goal. The goal of these competencies is to ensure that the private sector specialist employee B has the knowledge and skills to safely perform the duties and responsibilities assigned in their organization's emergency response plan and standard operating procedures. Therefore, within their individual area of specialization, the private sector specialist employee B shall be able to:

(a) Assist the incident commander in analyzing the magnitude of an incident involving chemicals or containers for chemicals by completing the following tasks:

1. Provide and interpret information on the hazards and harmful effects

2. Provide and interpret information on the characteristics of specific containers

3. Provide information on concentrations of chemicals from exposure monitoring, dispersion modeling, or any other predictive method

(b) Assist the incident commander in planning a response to an incident involving chemicals or containers for chemicals by completing the following tasks:

1. Provide information on the potential response options and their consequences for specific chemicals or containers for chemicals

2. Provide information on the personal protective equipment requirements for a specific chemical

3. Provide information on the decontamination methods for a specific chemical

4. Provide information on the federal/provincial regulations that relate to the handling and disposal of a specific chemical

5. Develop a plan of action (within the capabilities of the available resources), including safety considerations, for handling chemicals or containers for chemicals consistent with their organization's emergency response plan and standard operating procedures

(c) Implement the planned response, as developed with the incident commander, for chemicals or containers for chemicals, consistent with their organization's emergency response plan and standard operating procedures and within the capabilities of the available resources, by completing the following tasks:

1. Perform response options specified in the plan of action, as agreed upon with the incident commander and consistent with their organization's emergency response plan and standard operating procedures (within the capabilities of the available resources)

2. Don, work in, and doff personal protective equipment needed to implement the response options

(d) Assist the incident commander to evaluate the results of implementing the planned response by completing the following tasks:

1. Provide feedback on the effectiveness of the response options taken

2. Provide reporting and subsequent documentation of the incident involving chemicals as required

6-3.2 Competencies – Analyzing the Incident.

6-3.2.1 Providing and Interpreting Information on Hazards of Specific Chemicals. Given a specific chemical within their individual area of specialization and an appropriate material safety data sheet (MSDS) or other appropriate resource, the private sector specialist employee B shall advise the incident commander of the chemical's hazards and harmful effects and the potential consequences based on the incident. The private sector specialist employee B shall be able to:

6-3.2.1.1 Given a specific chemical, identify and interpret the following hazard information:

(a) Physical and chemical characteristics

(b) Physical hazards of the chemical (including fire and explosion hazards)

(c) Health hazards of the chemical

(d) Signs and symptoms of exposure

(e) Routes of entry

(f) Permissible exposure limits

(g) Reactivity hazards

(h) Environmental concerns

6-3.2.1.2 Given examples of specific chemicals and the appropriate resources (as identified in their organization's emergency response plan and standard operating procedures),

predict the potential behavior of the chemicals based on the damage found, including the consequences of that behavior.

6-3.2.1.3 Identify the general types of hazard information available from the other resources identified in their organization's emergency response plan and standard operating procedures.

6-3.2.2 Providing Information on Characteristics of Specific Containers. Given a container for specific chemicals, the private sector specialist employee B shall advise the incident commander of the characteristics and potential behavior of that container. The private sector specialist employee B shall be able to:

6-3.2.2.1 Given examples of containers for specific chemicals, identify the purpose and operation of the closures found on those containers.

6-3.2.2.2 Given a chemical container, list the types of damage that could occur.

6-3.2.2.3 Given examples of containers for specific chemicals and the appropriate resources (as identified in their organization's emergency response plan and standard operating procedures), predict the potential behavior of the containers and the consequences, based on the damage found.

6-3.2.2.4 Given their organization's emergency response plan and standard operating procedures, identify resources (including a method of contact) knowledgeable in the design, construction, and damage assessment of containers for chemicals.

6-3.2.3 Providing Information on Concentrations of Chemicals. Given a chemical and the applicable monitoring equipment provided by their organization for that chemical or the available predictive capabilities (e.g., dispersion modeling, exposure modeling), the private sector specialist employee B shall advise the incident commander of the concentrations of the released chemical and the implications of that information to the incident. The private sector specialist employee B shall be able to:

6-3.2.3.1 Identify the appropriate monitoring equipment.

6-3.2.3.2 Use the appropriate monitoring equipment provided by their organization to determine the actual concentrations of a specific chemical.

6-3.2.3.3 Given information on the concentrations of a chemical, interpret the significance of that concentration information to the incident relative to the hazards and harmful effects of the chemical.

6-3.2.3.4 Demonstrate field calibration and testing procedures, as necessary, for the monitoring equipment provided by their organization.

6-3.2.3.5 Given their organization's emergency response plan and standard operating procedures, identify the resources (including a method of contact) capable of providing monitoring equipment, dispersion modeling, or monitoring services.

6-3.3 Competencies – Planning the Response.

6-3.3.1 Providing Information on Potential Response Options and Consequences for Specific Chemicals. Given specific chemicals or containers within their individual area of specialization and the appropriate resources, the private sector specialist employee B shall advise the incident commander of the potential response options and their consequences. The private sector specialist employee B shall be able to:

6-3.3.1.1 Given a specific chemical and an appropriate material safety data sheet (MSDS), identify and interpret the following response information:

(a) Precautions for safe handling, including hygiene practices, protective measures, and procedures for cleanup of spills or leaks

(b) Applicable control measures, including personal protective equipment

(c) Emergency and first aid procedures

6-3.3.1.2 Given their organization's emergency response plan and standard operating procedures, identify additional resources for interpreting response information for a chemical.

6-3.3.1.3 Describe the advantages and limitations of the potential response options for a specific chemical.

6-3.3.1.4 Given their organization's emergency response plan and standard operating procedures, identify resources (including a method of contact) capable of:

(a) Repairing containers for chemicals

(b) Removing the contents of containers for chemicals

(c) Cleanup and disposal of chemicals or containers for chemicals

6-3.3.2 Providing Information on Personal Protective Equipment Requirements. Given specific chemicals or containers for chemicals within their individual area of specialization and the appropriate resources, the private sector specialist employee B shall advise the incident commander of the appropriate personal protective equipment necessary for various response options. The private sector specialist employee B shall be able to:

6-3.3.2.1 Given a specific chemical and an appropriate material safety data sheet (MSDS), identify personal protective equipment, including the materials of construction, that will be compatible with that chemical.

6-3.3.2.2 Given their organization's emergency response plan and standard operating procedures, identify other appropriate resources (including a method of contact) capable of identifying the personal protective equipment that is compatible with a specific chemical.

6-3.3.2.3 Given an incident involving a specific chemical and the response options for that problem, determine whether the personal protective equipment provided by the organization is appropriate for the options presented.

6-3.3.3 Providing Information on Decontamination Methods. Given a specific chemical within their individual area of specialization and the available resources, the private sector specialist employee B shall identify appropriate decontamination methods for various response options. The private sector specialist employee B shall be able to:

6-3.3.3.1 Given a specific chemical and a material safety data sheet (MSDS) or other resource, obtain the potential methods for removing or neutralizing that chemical.

6-3.3.3.2 Given a specific chemical and a material safety data sheet (MSDS) or other resource, identify the circumstances under which disposal of contaminated equipment would be necessary.

6-3.3.3.3 Given their organization's emergency response plan and standard operating procedures, identify resources (including a method of contact) capable of identifying potential decontamination methods.

6-3.3.4 Providing Information on Handling and Disposal Regulations. Given a specific chemical within their area of specialization and the available resources, the private sector specialist employee B shall advise the incident commander of the federal or provincial regulations that relate to the handling, transportation, and disposal of that chemical. The private sector specialist employee B shall be able to:

6-3.3.4.1 Given a specific chemical and a material safety data sheet (MSDS) or other resource, identify federal or provincial regulations that apply to the handling, transportation, and disposal of that chemical.

6-3.3.4.2 Given a specific chemical and a material safety data sheet (MSDS) or other resource, identify the agencies (including a method of contact) responsible for compliance with the federal or provincial regulations that apply to the handling, transportation, and disposal of a specific chemical.

6-3.3.4.3 Given their organization's emergency response plan and standard operating procedures, identify resources for information pertaining to federal or provincial regulations relative to the handling and disposal of a specific chemical.

6-3.3.5 Developing a Plan of Action. Given a simulated incident involving chemicals or containers used in their individual area of specialization, the private sector specialist employee B shall (in conjunction with the incident commander) develop a plan of action, consistent with their organization's emergency response plan and standard operating procedures, for handling chemicals or containers in that incident. The plan of action developed shall be within the capabilities of the available resources and shall include safety considerations. The private sector specialist employee B shall be able to:

6-3.3.5.1 Given the organization's emergency response plan and standard operating procedures, identify the process for development of a plan of action, including safety considerations.

6-3.4 Competencies — Implementing the Planned Response.

6-3.4.1 Performing Response Options Specified in the Plan of Action. Given an assignment by the incident commander in their individual area of specialization, the private sector specialist employee B shall perform the assigned actions consistent with their organization's emergency response plan and standard operating procedures. The private sector specialist employee B shall be able to:

6-3.4.1.1 Perform assigned tasks consistent with their organization's emergency response plan and standard operating procedures and the available personnel, tools, and equipment (including personal protective equipment), including the following:

(a) Confinement activities

(b) Containment activities

(c) Product removal activities

6-3.4.1.2* Identify factors that can affect an individual's ability to perform the assigned tasks.

6-3.4.2 Using Personal Protective Equipment. Given an assignment within their individual area of specialization that is consistent with their organization's emergency response plan and standard operating procedures, the private sector specialist employee B shall be able to:

6-3.4.2.1 Don, work in, and doff the appropriate respiratory protection and protective clothing for the assigned tasks.

6-3.4.2.2 Identify the safety considerations for personnel wearing personal protective equipment, including:

(a) Buddy system

(b) Backup personnel

(c) Symptoms of heat and cold stress

(d) Limitations of personnel working in personal protective equipment

(e) Indications of material degradation of chemical-protective clothing

(f) Physical and psychological stresses on the wearer

(g) Emergency procedures and hand signals

6-3.4.2.3 Identify the procedures for cleaning, sanitizing, and inspecting personal protective equipment provided by the organization.

6-3.5 Competencies — Evaluating Progress.

6-3.5.1 Providing an Evaluation of the Effectiveness of Selected Response Options. Given an incident involving specific chemicals or containers for chemicals within their individual area of specialization, the private sector specialist employee B shall advise the incident commander of the effectiveness of the selected response options. The private sector specialist employee B shall be able to:

6-3.5.1.1 Identify the criteria for evaluating whether or not the selected response options are effective in accomplishing the objectives.

6-3.5.1.2 Identify the circumstances when it would be prudent to withdraw from a chemical incident.

6-3.5.2 Reporting and Documenting the Incident. Given a simulated incident involving chemicals or containers for chemicals used in their individual area of specialization, the private sector specialist employee B shall complete the reporting and subsequent documentation requirements consistent with their organization's emergency response plan and standard operating procedures. The private sector specialist employee B shall be able to:

6-3.5.2.1 Identify the importance of documentation (including training records, exposure records, incident reports, and critique reports) for an incident involving chemicals.

6-3.5.2.2 Identify the steps used in keeping an activity log and exposure records.

6-3.5.2.3 Identify the requirements for compiling incident reports.

6-3.5.2.4 Identify the requirements for compiling hot zone entry and exit logs.

6-3.5.2.5 Identify the requirements for compiling personal protective equipment logs.

6-3.5.2.6 Identify the requirements for filing documents and maintaining records.

6-4 Private Sector Specialist Employee A.

6-4.1 General.

6-4.1.1 Introduction. The private sector specialist employee A shall be trained to meet the competencies at the private sector specialist employee C level (Section 6-2 in this chapter) and hazardous materials technician level (Chapter 4) relative to the chemicals and containers used in their organization's area of specialization.

6-4.1.2 Definition. The private sector specialist employee A is that person who is specifically trained to handle incidents involving chemicals or containers for chemicals used in their organization's area of specialization. Consistent with their organization's emergency response plan and standard operating procedures, the private sector specialist employee A shall be able to analyze an incident involving chemicals within their organization's area of specialization, plan a response to that incident, implement the planned response within the capabilities of the resources available, and evaluate the progress of the planned response.

6-4.1.3 Goal. The goal of this level of competence is to ensure that the private sector specialist employee A has the knowledge and skills to safely perform the duties and responsibilities assigned in their organization's emergency response plan and standard operating procedures. Therefore, in addition to being competent at the private sector specialist employee C and the hazardous materials technician levels, the private sector specialist employee A shall be able to, in conjunction with the incident commander:

(a) Analyze an incident involving chemicals and containers for chemicals used in their organization's area of specialization to determine the magnitude of the incident by completing the following tasks:

1. Survey an incident involving chemicals and containers for chemicals, including the following:
   a. Identify the containers involved
   b. Identify or classify unknown materials
   c. Verify the identity of the chemicals

2. Collect and interpret hazard and response information from printed resources, technical resources, computer data bases, and monitoring equipment for chemicals

3. Determine the extent of damage to containers of chemicals

4. Predict the likely behavior of the chemicals and containers for chemicals

5. Estimate the potential outcomes of an incident involving chemicals and containers for chemicals

(b) Plan a response (within the capabilities of available resources) to an incident involving chemicals and containers for chemicals used in their organization's area of specialization by completing the following tasks:

1. Identify the response objectives for an incident involving chemicals and containers for chemicals

2. Identify the potential action options for each response objective for an incident involving chemicals and containers for chemicals

3. Select the personal protective equipment required for a given response option for an incident involving chemicals and containers for chemicals

4. Select the appropriate decontamination procedures, as necessary, for an incident involving chemicals and containers for chemicals

5. Develop a plan of action (within the capabilities of the available resources), including safety considerations, for handling an incident involving chemicals and containers for chemicals consistent with their organization's emergency response plan and standard operating procedures

(c) Implement the planned response (as developed with the incident commander) to an incident involving chemicals and containers for chemicals used in their organization's area of specialization consistent with their organization's emergency response plan and standard operating procedures by completing the following tasks:

1. Don, work in, and doff appropriate personal protective equipment provided by their organization for use with chemicals

2. Perform control functions, as agreed upon with the incident commander, for chemicals and containers for chemicals

(d) Evaluate the results of implementing the planned response to an incident involving chemicals and containers for chemicals used in their organization's area of specialization

Chapter 7 Competencies for the Hazardous Materials Branch Officer

7-1 General.

7-1.1 Introduction. The hazardous materials branch officer shall be trained to meet all competencies for the first responder at the awareness, operational, and technician levels and the competencies of this chapter. The hazardous materials branch officer also shall receive any additional training to meet applicable United States Department of Transportation (DOT), United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and other appropriate state, local, or provincial occupational health and safety regulatory requirements.

7-1.2 Definition. The hazardous materials branch officer is that person who is responsible for directing and coordinating all operations assigned to the hazardous materials branch by the incident commander.

7-1.3 Goal. The goal of this chapter shall be to provide the hazardous materials branch officer with the knowledge and skills to perform the following tasks safely. Therefore, in addition to being competent at the awareness, operational, and technician levels, the hazardous materials branch officer shall be able to:

(a) Analyze a hazardous materials incident to determine the magnitude of the problem by estimating the potential outcomes within the endangered area

(b) Plan a response within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by completing the following tasks:

1. Identify the response objectives for hazardous materials incidents

2. Identify the potential action options (defensive, offensive, and nonintervention) available by response objective

3. Determine the level of personal protective equipment required for a given action option

4. Provide recommendations to the incident commander for the development of a plan of action for the hazardous materials branch consistent with the local emergency response plan and the organization's standard operating procedures and within the capability of available personnel, personal protective equipment, and control equipment

(c) Implement a 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:

1. Implement the incident management system as it directly relates to the specified procedures for hazardous materials branch operations

2. Direct hazardous materials branch resources (private, governmental, and others) with expected task assignments and on-scene activities and provide management overviews, technical review, and logistical support to hazardous materials branch resources

(d) Evaluate the progress of the planned response to ensure that the response objectives are being met safely, effectively, and efficiently and adjust the plan of action accordingly by evaluating the progress of the plan of action

(e) Terminate the incident by completing the following:

1. Conduct a debriefing for hazardous materials branch personnel

2. Conduct a critique for hazardous materials branch personnel

3. Report and document the hazardous materials branch operations

7-2 Competencies — Analyzing the Incident.

7-2.1 Estimating Potential Outcomes. Given simulated facility or transportation incidents involving hazardous materials, the surrounding conditions, and the predicted behavior of the container and its contents, the hazardous materials branch officer shall estimate the potential outcomes within the endangered area.

7-3 Competencies — Planning the Response.

7-3.1 Selecting the Level of Personal Protective Equipment. Given situations with known and unknown hazardous materials, the hazardous materials branch officer shall select the appropriate personal protective equipment for the action options specified in the plan of action in each situation.

7-3.2 Developing a Plan of Action. Given simulated facility and transportation hazardous materials incidents, the hazardous materials branch officer shall develop a plan of action consistent with the local emergency response plan and the organization's standard operating procedures that is within the capability of the available personnel, personal protective equipment, and control equipment. The hazardous materials branch officer shall be able to:

7-3.2.1 Identify the order of the steps for developing a plan of action.

7-3.2.2 Identify the factors to be evaluated in selecting public protective actions, including evacuation and shelter in-place.

7-3.2.3 Given the local emergency response plan or the organization's standard operating procedure, identify procedures to accomplish the following tasks:

(a) Make ongoing assessments of the situation

(b) Command on-scene personnel (incident management system) assigned to the hazardous materials branch

(c) Coordinate hazardous materials support and mutual aid

(d) Provide resources for public protection action (evacuation or shelter in-place)

(e) Coordinate with fire suppression services as it relates to hazardous materials incidents

(f) Coordinate hazardous materials branch control, containment, or confinement operations

(g) Coordinate with the medical branch to ensure proper medical assistance (ambulance) and medical treatment (hospital)

(h) Coordinate on-scene decontamination when appropriate

(i) Coordinate activities with those of the environmental remedial action ("cleanup") services

7-3.2.4 Identify the process for determining the effectiveness of an action option on the potential outcomes.

7-3.2.5 Identify the procedures for presenting a safety briefing prior to allowing personnel to work on a hazardous materials incident.

7-4 Competencies — Implementing the Planned Response.

7-4.1 Implementing the Incident Management System. Given a copy of the local emergency response plan, the hazardous materials branch officer shall identify the requirements of the plan, including the required procedures for notification and utilization of nonlocal resources (private, state, and federal government personnel). The hazardous materials branch officer shall be able to:

7-4.1.1 Identify the process and procedures for obtaining cleanup and restoration services in the local emergency response plan or organization's standard operating procedures.

7-4.1.2 Identify the steps for implementing the local and related emergency response plans as required under SARA Title III Section 303 of the federal regulations or other local emergency response planning legislation.

7-4.1.3 Given the local emergency planning documents, identify the elements of each of the documents.

7-4.1.4 Identify the elements of the incident management system necessary to coordinate response activities at hazardous materials incidents.

7-4.1.5 Identify the primary local, state, regional, and federal government agencies and identify the scope of their regulatory authority (including the regulations) pertaining to the production, transportation, storage, and use of hazardous materials and the disposal of hazardous wastes.

7-4.1.6 Identify the governmental agencies and private sector resources offering assistance to the hazardous materials branch during a hazardous materials incident and identify their role and type of assistance or resources available.

7-4.2* Directing Resources (Private and Governmental). Given a simulated hazardous materials incident and the necessary resources to implement the planned response, the hazardous materials branch officer shall demonstrate the ability to direct the hazardous materials branch resources in a safe and efficient manner consistent with the capabilities of those resources.

7-4.3 Providing a Focal Point for Information Transfer to Media and Elected Officials. Given a simulated hazardous materials incident, the hazardous materials branch officer shall demonstrate the ability to act as a resource to provide information to the incident commander or the public information officer for distribution to the media and local, state, and federal officials. The hazardous materials branch officer shall be able to:

7-4.3.1 Identify the local policy for providing information to the media.

7-4.3.2 Identify the responsibilities of the public information officer at a hazardous materials incident.

7-5 Competencies — Evaluating Progress.

7-5.1 Evaluating Progress of the Plan of Action. Given simulated facility and transportation hazardous materials incidents, the hazardous materials branch officer shall evaluate the progress of the plan of action to determine whether the efforts are accomplishing the response objectives. The hazardous materials branch officer shall be able to:

7-5.1.1 Identify the procedures for evaluating whether the action options are effective in accomplishing the objectives.

7-5.1.2 Identify the steps for comparing actual behavior of the material and the container to that predicted in the analysis process.

7-5.1.3 Determine the effectiveness of the following:

(a) Hazardous materials response personnel being used

(b) Personal protective equipment

(c) Established control zones

(d) Control, containment, or confinement operations

(e) Decontamination process

7-6 Competencies — Terminating the Incident.

7-6.1 Terminating the Emergency Phase of the Hazardous Materials Incident. Given a simulated hazardous materials incident, the hazardous materials branch officer shall demonstrate the ability to terminate the emergency phase of the incident consistent with the local emergency response plan and the organization's standard operating procedures. The hazardous materials branch officer shall be able to:

7-6.1.1 Identify the steps required in terminating the emergency phase of a hazardous materials incident.

7-6.1.2 Identify the procedures for conducting incident debriefings at a hazardous materials incident.

7-6.1.3 Identify the steps in transferring authority as prescribed in the local emergency response plan or the organization's standard operating procedures.

7-6.2 Conducting a Debriefing. Given the details of a simulated hazardous materials incident, the hazardous materials branch officer shall demonstrate the ability to conduct a debriefing of the incident for all units assigned to the hazardous materials branch. The hazardous materials branch officer shall be able to:

7-6.2.1 Describe three components of an effective debriefing.

7-6.2.2 Describe the key topics in an effective debriefing.

7-6.2.3 Describe when a debriefing should take place.

7-6.2.4 Describe who should be involved in a debriefing.

7-6.2.5 Identify the procedures for conducting incident debriefings at a hazardous materials incident.

7-6.3 Conducting a Critique. Given the details of a simulated hazardous materials incident, the hazardous materials branch officer shall demonstrate the ability to conduct a critique of the incident for all units assigned to the hazardous materials branch. The hazardous materials branch officer shall be able to:

7-6.3.1 Describe three components of an effective critique.

7-6.3.2 Describe who should be involved in a critique.

7-6.3.3 Describe why an effective critique is necessary after a hazardous materials incident.

7-6.3.4 Describe what written documents should be prepared as a result of the critique.

7-6.3.5 Identify the procedure for conducting a critique of the incident.

7-6.3.6 Identify the requirements for conducting a post-incident analysis as defined in the local emergency response plan, the organization's standard operating procedures, or federal, state, and local regulations.

7-6.4 Reporting and Documenting the Hazardous Materials Incident. Given a simulated hazardous materials incident, the hazardous materials branch officer shall demonstrate the ability to report and document the incident consistent with the local, state, and federal requirements. The hazardous materials branch officer shall be able to:

7-6.4.1 Identify the reporting requirements of federal, state, and local agencies.

7-6.4.2 Identify the importance of documentation for a hazardous materials incident, including training records, exposure records, incident reports, and critique reports.

7-6.4.3 Identify the steps in keeping an activity log and exposure records for hazardous materials incidents.

7-6.4.4 Identify the requirements found in the local emergency response plan and the organization's standard operating procedures for compiling hazardous materials incident reports.

7-6.4.5 Identify the requirements for filing documents and maintaining records as defined in the local emergency response plan and the organization's standard operating procedures.

Chapter 8 Competencies for the Hazardous Materials Branch Safety Officer

8-1 General.

8-1.1* Introduction. The hazardous materials branch safety officer shall be trained to meet all the competencies for the first responder at the awareness, operational, and technician levels and the competencies of this chapter. The hazardous materials branch safety officer also shall receive any additional training to meet applicable United States Department of Transportation (DOT), United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and other appropriate state, local, or provincial occupational health and safety regulatory requirements.

8-1.2* Definition. The hazardous materials branch safety officer is that person who works within an incident management system (IMS) to ensure that recognized safe practices are followed within the hazardous materials branch. The hazardous materials branch safety officer will be called upon to provide technical advice or assistance regarding safety issues to the hazardous materials branch officer and incident safety officer at a hazardous materials incident.

8-1.3 Goal. The goal of this chapter shall be to provide the hazardous materials branch safety officer with the knowledge and skills to evaluate a hazardous materials incident for safety and ensure that recognized safe operational practices are followed. Therefore, in addition to being knowledgeable at the level of operations being performed, the hazardous materials branch safety officer shall be able to:

(a) Analyze a hazardous materials incident to determine the magnitude of the problem in terms of safety by observing a scene and reviewing and evaluating hazard and response information as it pertains to the safety of all persons within the hazardous materials branch

(b) Assist in planning a safe response within the capabilities of available response personnel, personal protective equipment, and control equipment by completing the following tasks:

1. Identify the safety precautions for potential action options

2. Provide recommendations regarding safety considerations

3. Assist in the development of a plan of action

4. Review the plan of action and provide recommendations regarding safety

5. Review the selection of personal protective equipment required for a given action option

6. Review the decontamination operations

7. Ensure that the proper emergency medical services are provided

(c) Ensure the implementation of a safe planned response consistent with the local emergency response plan, the organization's standard operating procedures, and safety considerations by completing the following tasks:

1. Perform the duties of the hazardous materials branch safety officer within the local incident management system (IMS)

2. Identify safety considerations for personnel performing the control functions identified in the plan of action

3. Conduct safety briefings for personnel performing the control functions identified in the plan of action

4. Assist in the implementation and enforcement of safety considerations

5. Maintain communications within the incident command structure during the incident

6. Monitor status reports of activities in the hot and warm zones

7. Ensure the implementation of exposure monitoring (personnel and environment)

(d) Evaluate the progress of the planned response to ensure that the response objectives are being met safely by completing the following tasks:

1. Identify deviations from safety considerations and any dangerous situations

2. Alter, suspend, or terminate any activity that can be judged to be unsafe

(e) Assist in terminating the incident by completing the following tasks:

1. Perform the reporting, documentation and follow-up required of the hazardous materials branch safety officer

2. Assist in the debriefing of hazardous materials branch personnel

3. Assist in the incident critique

8-2 Competencies — Analyzing the Incident.

8-2.1 Determining the Magnitude of the Problem in Terms of Safety. Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, the hazardous materials branch safety officer shall observe a scene and review and evaluate hazard and response information as it pertains to the safety of all persons within the hazardous materials branch. The hazardous materials branch safety officer shall be able to:

8-2.1.1* Describe the following radioactive materials terms and explain their significance in predicting the extent of health hazards and environmental impact in a hazardous materials incident:

(a) Types

(b) Measurement

(c) Protection

8-2.1.2 Describe the following toxicological terms and exposure values and explain their significance in the risk assessment process:

(a) Parts per million (ppm)

(b) Parts per billion (ppb)

(c) Lethal dose (LD_{50})

(d) Lethal concentrations (LC_{50})

(e) Permissible exposure limit (PEL)

(f) Threshold limit value time-weighted average (TLV-TWA)

(g) Threshold limit value short-term exposure limit (TLV-STEL)

(h) Threshold limit value ceiling (TLV-C)

(i) Immediately dangerous to life and health value (IDLH)

8-2.1.3 Explain the basic toxicological principles relative to assessment and treatment of personnel exposed to hazardous materials, including the following:

(a) Acute and delayed toxicity
(b) Dose-response
(c) Local and systemic effects
(d) Routes of exposure to toxic materials
(e) Synergistic effects

8-2.1.4* Identify five conditions where the hazards from flammability would require chemical-protective clothing with thermal protection.

8-2.1.5* Identify five conditions where personnel would not be allowed to enter the hot zone.

8-2.1.6 Given the names of five hazardous materials and at least three reference sources, identify the physical and chemical properties and their potential impact on the safety of personnel at an incident involving each of the materials.

8-2.1.7 Given the names of five hazardous materials and at least three reference sources, identify the health concerns and their potential impact on the safety and health of personnel at an incident involving each of the materials.

8-2.1.8* Given the names of five hazardous materials and a description of their containers, identify five hazards or physical conditions that would impact the safety of personnel at an incident involving each of the materials.

8-2.1.9 Given at least three unknown materials, one of which is a solid, one a liquid, and one a gas, identify or classify by hazard each unknown material.

8-2.1.9.1 Identify steps in an analysis process for identifying unknown solid and liquid materials.

8-2.1.9.2 Identify steps in an analysis process for identifying an unknown atmosphere.

8-2.1.9.3 Identify the type(s) of monitoring equipment, test strips, and reagents used to determine the following hazards:

(a) Corrosivity (pH)
(b) Flammability
(c) Oxidation potential
(d) Oxygen deficiency
(e) Radioactivity
(f) Toxic levels

8-2.1.9.4* Identify the capabilities and limiting factors associated with the selection and use of the following monitoring equipment, test strips, and reagents:

(a) Carbon monoxide meter
(b) Colorimetric tubes
(c) Combustible gas indicator
(d) Oxygen meter
(e) Passive dosimeter
(f) Photoionization detectors
(g) pH indicators and/or pH meters
(h) Radiation detection instruments
(i) Reagents
(j) Test strips

8-2.1.9.5 Given three hazardous materials, one of which is a solid, one a liquid, and one a gas, and the following monitoring equipment, select and demonstrate the appropriate equipment to identify and quantify the materials:

(a) Carbon monoxide meter
(b) Colorimetric tubes
(c) Combustible gas indicator
(d) Oxygen meter
(e) pH papers and/or pH meters
(f) Radiation detection instruments
(g) Reagents
(h) Test strips

8-2.1.9.6 Demonstrate the field maintenance and testing procedures for the monitoring equipment, test strips and reagents provided by the authority having jurisdiction.

8-3 Competencies — Planning the Response.

8-3.1* Identifying the Safety Precautions for Potential Action Options. Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, the hazardous materials branch safety officer shall assist in planning a safe response within the capabilities of available response personnel, personal protective equipment, and control equipment. The hazardous materials branch safety officer shall be able to:

8-3.1.1* Identify five specific safety precautions to observe while mitigating each of the hazards or conditions identified in 8-2.1.8.

8-3.1.2* Identify five safety precautions associated with search and rescue missions at hazardous materials incidents.

8-3.2 Providing Recommendations Regarding Safety Considerations. Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, the hazardous materials branch safety officer shall provide the incident safety officer, hazardous materials branch officer, and incident commander with observation-based recommendations regarding considerations for the safety of on-site personnel. The hazardous materials branch safety officer shall be able to identify five recommendations to the incident commander regarding safety considerations on the hazards or conditions for each of the hazardous materials and containers identified in 8-2.1.8.

8-3.3 Assisting in the Development of a Plan of Action. Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, the hazardous materials branch safety officer shall assist the incident safety officer and hazardous materials branch officer in the development of a safe plan of action. The hazardous materials branch safety officer shall be able to:

8-3.3.1* Identify the importance and list five benefits of pre-emergency planning relating to specific sites.

8-3.3.2* Identify and name five hazards and precautions to be observed when approaching a hazardous materials incident.

8-3.3.3* List the elements of safety considerations.

8-3.3.4 Given an organizations pre-incident plan and a simulated hazardous materials incident involving one of the hazardous materials and containers described in 8-2.1.8, develop safety considerations for the incident.

8-3.4 Providing Recommendations Regarding Safety and Reviewing the Plan of Action. Given a proposed plan of action for an incident involving one of the hazardous materials and containers described in 8-2.1.8, the hazardous materials branch safety officer shall identify to the incident safety officer, hazardous materials branch officer, and incident commander the safety precautions for the plan of action. The hazardous materials branch safety officer shall be able to:

8-3.4.1 Ensure that the safety considerations in the proposed plan of action are consistent with the local emergency response plan and the organization's standard operating procedures.

8-3.4.2 Make recommendations to the incident commander on the safety considerations in the proposed plan of action.

8-3.5 Reviewing Selection of Personal Protective Equipment. Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, the hazardous materials branch safety officer shall demonstrate the ability to review the selection of personal protective equipment required for a given action option. The hazardous materials branch safety officer shall be able to:

8-3.5.1 Identify the four levels of chemical protection (EPA/NIOSH) and describe the equipment required for each level and the conditions under which each level is used.

8-3.5.2 Identify five safety considerations for personnel wearing vapor-protective, liquid splash-protective, and high temperature-protective clothing.

8-3.5.3 Given the names of five different hazardous materials and a chemical compatibility chart for chemical-protective clothing, identify the chemical-protective clothing that would provide the appropriate protection to the wearer for each of the five substances.

8-3.5.4* Given the names of five different hazardous materials, identify appropriate chemical-protective clothing levels for typical action options.

8-3.5.5 Demonstrate proper methods for donning, doffing, and using all personal protective equipment provided by the authority having jurisdiction for use in hazardous materials response activities.

8-3.6 Reviewing the Proposed Decontamination Plan. Given a site-specific decontamination plan by the hazardous materials branch officer or incident commander for a simulated hazardous materials incident, the hazardous materials branch safety officer shall review the plan to identify safety considerations prior to plan implementation. The hazardous materials branch safety officer shall be able to:

8-3.6.1 Identify the advantages and limitations and describe an example where each of the following decontamination methods would be used:

(a) Absorption
(b) Adsorption
(c) Chemical degradation
(d) Dilution
(e) Disposal
(f) Evaporation
(g) Neutralization
(h) Solidification
(i) Vacuuming
(j) Washing

8-3.6.2 Identify how personnel, personal protective equipment, apparatus, tools, and equipment become contaminated, as well as the importance and limitations of decontamination procedures.

8-3.6.3 Explain the need for decontamination procedures at hazardous materials incidents.

8-3.6.4 Identify three sources of technical information for selecting appropriate decontamination procedures and identify how to contact those sources in an emergency.

8-3.6.5 Identify the considerations associated with the placement, location, and setup of the decontamination corridor.

8-3.6.6 Identify the decontamination procedures as defined by the authority having jurisdiction for personnel and personal protective equipment at hazardous materials incidents.

8-3.6.7 Given three reference sources and a simulated hazardous materials incident involving two or more different chemicals, develop a site-specific personnel decontamination plan that is consistent with the local emergency response plan and the organization's standard operating guidelines.

8-3.7 Ensuring Provision of Proper Emergency Medical Services. Given a simulated hazardous materials incident, the hazardous materials branch safety officer shall review the emergency medical services plan to ensure that response personnel are provided medical care. The hazardous materials branch safety officer shall be able to:

8-3.7.1* Identify the elements required in an emergency medical services plan.

8-3.7.2 Identify the importance of an on-site medical monitoring program.

8-3.7.3 Identify three resources for the transportation and care of the injured persons exposed to hazardous materials.

8-4 Competencies — Implementing the Planned Response.

8-4.1 Performing the Duties of the Hazardous Materials Branch Safety Officer. Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, the hazardous materials branch safety officer shall perform the duties of their position in a manner consistent with the local emergency response plan, the organization's standard operating procedures, and safety considerations. The hazardous materials branch safety officer shall be able to:

8-4.1.1 Identify the duties of the hazardous materials branch safety officer as defined in the organization's standard operating procedures.

8-4.1.2 Demonstrate proper performance of the duties of the hazardous materials branch safety officer as defined in the organization's standard operating procedures.

8-4.2 Monitoring Safety of Response Personnel. Given a simulated hazardous materials incident and safety considerations, the hazardous materials branch safety officer shall ensure that personnel perform their tasks in a safe manner by identifying

the safety considerations for the control functions identified in the plan of action. The hazardous materials branch safety officer shall be able to:

8-4.2.1 Identify the safe operating practices that are required to be followed at a hazardous materials incident as stated in the local emergency response plan and the organization's standard operating procedures.

8-4.2.2 Identify how the following factors influence heat and cold stress for hazardous materials response personnel:

(a) Activity levels
(b) Duration of entry
(c) Environmental factors
(d) Hydration
(e) Level of PPE
(f) Physical fitness

8-4.2.3 Identify the methods that will minimize the potential harm from heat and cold stress.

8-4.2.4 Identify the safety considerations that will minimize the psychological and physical stresses on personnel wearing vapor-protective, liquid splash-protective, and high temperature-protective clothing.

8-4.2.5 Describe five conditions where it would be prudent to withdraw from a hazardous materials incident.

8-4.3 Conducting Safety Briefings. Given a simulated hazardous materials incident and safety considerations, the hazardous materials branch safety officer shall conduct safety briefings for personnel performing the control functions identified in the plan of action. The hazardous materials branch safety officer shall be able to demonstrate the proper procedure for conducting a safety briefing to personnel for an incident involving one of the hazardous materials and its container identified in 8-2.1.8, as specified by the organization's standard operating procedures.

8-4.4 Implementing and Enforcing Safety Considerations. Given a simulated hazardous materials incident and safety considerations, the hazardous materials branch safety officer shall assist the incident commander, the incident safety officer, and the hazardous materials branch officer in implementing and enforcing the safety considerations. The hazardous materials branch safety officer shall be able to:

8-4.4.1 Identify whether the boundaries of the established control zones are clearly marked, consistent with the safety considerations, and are being maintained.

8-4.4.2 Identify whether the on-site medical monitoring that are required by the authority having jurisdiction is being performed.

8-4.4.3 Given an entry team, a backup team, and a decontamination team wearing personal protective clothing and equipment, identify that each team is properly protected and prepared to safely perform its assigned tasks.

8-4.4.3.1 Identify whether the selection of clothing and equipment is consistent with safety considerations.

8-4.4.3.2 Identify whether each team has examined the clothing for barrier integrity and the equipment to ensure proper working order.

8-4.4.3.3 Identify whether protective clothing and equipment have been donned in accordance with the organization's standard operating procedures and the manufacturer's recommendations.

8-4.4.4 Identify whether each person entering the hot zone has a specific task assignment, understands the assignment, is properly trained to perform the assigned task(s), and is working with a designated partner at all times during the assignment.

8-4.4.5 Identify whether a backup team with the appropriate level of personal protective equipment is prepared at all times for immediate entry into the hot zone during entry team operations.

8-4.4.6 Identify whether the decontamination process specified in the safety considerations is in place before any entry into the hot zone.

8-4.4.7 Identify that each person exiting the hot zone and each tool or piece of equipment is decontaminated in accordance with the safety considerations and the degree of hazardous materials exposure.

8-4.4.8 Demonstrate the proper procedure for recording the names of the individuals exiting the hot zone, as specified in the local emergency response plan and the organization's standard operating procedures.

8-4.4.9* Identify three safety considerations that can minimize secondary contamination.

8-4.5 Maintaining Communications. Given a simulated hazardous materials incident and the safety considerations, the hazardous materials branch safety officer shall maintain routine and emergency communications within the incident command structure at all times during the incident. The hazardous materials branch safety officer shall be able to:

8-4.5.1* Identify three types of communications systems used at hazardous materials incident sites.

8-4.5.2 Identify whether each person assigned to work in the hot zone understands the emergency alerting and response procedures specified in the safety considerations prior to entry into the hot zone.

8-4.6 Monitoring Status Reports. Given a simulated hazardous materials incident and the safety considerations, the hazardous materials branch safety officer shall monitor routine and emergency communications within the incident command structure at all times during the incident. The hazardous materials branch safety officer shall be able to identify whether entry team members regularly communicate the status of their work assignment to the hazardous materials branch officer.

8-4.7 Implementing Exposure Monitoring. Given a simulated hazardous materials incident and the safety considerations, the hazardous materials branch safety officer shall assist the incident commander, the incident safety officer, and the hazardous materials branch officer in implementing exposure monitoring.

8-4.8 The hazardous materials branch safety officer shall identify that exposure monitoring (personnel and environment) as specified in the organization's standard operating procedures and safety considerations is performed.

8-5 Competencies — Evaluating Progress.

8-5.1 Identifying Deviations from Safety Considerations and Any Dangerous Situations. Given simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, and given simulated deviations from the safety considerations for activities in both the hot and warm zones and simulated dangerous conditions, the hazardous materials branch safety officer shall evaluate the progress of the planned response to ensure that the response objectives are being met safely. The hazardous materials branch safety officer shall be able to:

8-5.1.1 Identify those actions that deviate from the safety considerations or otherwise violate generally accepted safe operating practices, organizational policies, or applicable occupational safety and health laws, regulations, codes, standards, or guidelines.

8-5.1.2 Identify dangerous conditions that develop or are identified during work in the hot or warm zones that threaten the safety or health of persons in those zones.

8-5.1.3 Identify the signs and symptoms of psychological and physical stresses on personnel wearing vapor-protective, liquid splash-protective, and high temperature-protective clothing.

8-5.2 Taking Corrective Actions. Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, and given simulated deviations from the safety considerations for activities in both the hot and warm zones and simulated dangerous conditions, the hazardous materials branch safety officer shall take such corrective actions as are necessary to ensure the safety and health of persons in the hot and warm zones. The hazardous materials branch safety officer shall be able to:

8-5.2.1 Send emergency communications to, and receive emergency communications from, the incident safety officer, entry team personnel, the hazardous materials branch officer, and others as appropriate regarding safe working practices and conditions.

8-5.2.1.1* Given a hazardous situation or condition that has developed or been identified following initial hot zone entry, demonstrate the application of the emergency alerting procedures specified in the safety considerations to communicate the hazard and emergency response information to the affected personnel.

8-5.2.1.2 Given a demonstrated emergency alert via hand signal by a member of the entry team operating within the hot zone, identify the meaning of that signal as specified in the safety considerations.

8-5.2.2 Identify the procedures to alter, suspend, or terminate any activity that can be judged to be unsafe, as specified in the local emergency response plan and the organization's standard operating procedures.

8-5.2.3 Demonstrate the procedure for notifying the appropriate individual of the unsafe action and for directing alternative safe actions, in accordance with the safety considerations and the organization's standard operating procedures.

8-5.2.4 Demonstrate the procedure for suspending or terminating an action that could result in an imminent hazard condition, in accordance with the safety considerations and the organization's standard operating procedures.

8-6 Competencies — Terminating the Incident.

8-6.1 Providing Reports and Documentation. Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, the hazardous materials branch safety officer shall complete and submit the reports, documentation, and follow-up required of the hazardous materials branch safety officer. The hazardous materials branch safety officer shall be able to:

8-6.1.1 Identify the safety reports and supporting documentation required by the local emergency response plan and the organization's standard operating procedures.

8-6.1.2 Demonstrate the proper completion of the safety reports required by the local emergency response plan and the organization's standard operating procedures.

8-6.1.3 Describe the importance of personnel exposure records.

8-6.2 Debriefing of Hazardous Materials Branch Personnel. Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, the hazardous materials branch safety officer shall debrief hazardous materials branch personnel regarding site-specific occupational safety and health issues. The hazardous materials branch safety officer shall be able to:

8-6.2.1* Identify five health and safety topics to be addressed in an incident debriefing.

8-6.2.2 Demonstrate the proper procedure for debriefing hazardous materials branch personnel regarding site-specific occupational safety and health areas of concern, as specified in the safety considerations, local emergency response plan, and the organization's standard operating procedures.

8-6.3 Assisting in the Incident Critique. Given various simulated facility and transportation hazardous materials incidents involving nonbulk and bulk packaging, the hazardous materials branch safety officer shall provide safety and health-related critical observations of the activities that were performed in the hot and warm zones during the incident.

8-6.4 Given the safety considerations and hazardous materials branch safety officer's report for a simulated incident, the hazardous materials branch safety officer shall demonstrate the proper procedure for verbally presenting the following in accordance with the local emergency response plan and the organization's standard operating procedures:

(a) Safety and health-related critical observations of the activities that were performed in the hot and warm zones during the incident

(b) Recorded violations of the safety considerations or generally accepted safe operating practices, organizational policies, or applicable occupational safety and health laws, regulations, codes, standards, or guidelines

(c) Injuries or deaths that occurred as a result of reasonably unforeseen dangerous conditions that developed during the incident

(d) Injuries or deaths that occurred as a result of violations of the safety considerations or generally accepted safe operating practices, organizational policies, or applicable occupational safety and health laws, regulations, codes, standards, or guidelines

(e) The proper course of action(s) that would likely have prevented the injuries or deaths that occurred as a result of the safety violations identified in (d)

(f) Deficiencies or weaknesses in the safety considerations, local emergency response plan, and organizational standard operating procedures that were noted during or following the incident

Chapter 9 Competencies for the Technician with a Tank Car Specialty

9-1 General.

9-1.1 Introduction. Technicians with a tank car specialty shall meet all competencies of the first responder awareness, operational, and hazardous materials technician levels and the competencies of this chapter. The technician with a tank car specialty also shall receive any additional training to meet applicable United States Department of Transportation (DOT), United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and other appropriate state, local, or provincial occupational health and safety regulatory requirements.

9-1.2 Definition. Technicians with a tank car specialty are those persons who provide support to the hazardous materials technician, provide oversight for product removal and movement of damaged tank cars, and act as a liaison between technicians and other outside resources. These technicians are expected to use specialized chemical-protective clothing and specialized control equipment.

9-1.3 Goals. The goal of this chapter shall be to provide the technician with a tank car specialty with the knowledge and skills to perform the following tasks safely. In addition to being competent at the hazardous materials technician level, the technician with a tank car specialty shall be able to:

(a) Analyze a hazardous materials incident involving tank cars to determine the magnitude of the problem in terms of outcomes by completing the following tasks:

1. Determine the type and extent of damage to tank cars

2. Predict the likely behavior of tank cars and their contents in an emergency

(b) Plan a response for an emergency involving tank cars within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by completing the following tasks:

1. Determine the response options (offensive, defensive, and nonintervention) for a hazardous materials emergency involving tank cars

2. Ensure that the options are within the capabilities and competencies of available personnel, personal protective equipment, and control equipment

(c) Implement the planned response to a hazardous materials incident involving tank cars

9-1.4 Mandating of Competencies. This standard does not mandate that hazardous materials response teams performing offensive operations on tank cars have technicians with a tank car specialty. Technicians operating within the bounds of their training as listed in Chapter 4 of this standard are able to intervene in railroad incidents. However, if a hazardous materials response team desires to train some or all its technicians to have in-depth knowledge of tank cars, this chapter sets out the required competencies.

9-2 Competencies — Analyzing the Incident.

9-2.1 Determining the Type and Extent of Damage to Tank Cars. Given examples of damaged tank cars, technicians with a tank car specialty shall describe the type and extent of damage to each tank car and its fittings. Technicians with a tank car specialty shall be able to:

9-2.1.1 Given the specification mark for a tank car and the appropriate reference materials, describe the car's basic construction and features.

9-2.1.2 Point out the "B" end of the car.

9-2.1.3 Given examples of various tank cars, point out and explain the design and purpose of each of the following tank car components, when present.

(a) Tank, including shell, and head

(b) Head shield

(c) Jacket

(d) Lining/cladding

(e) Heater coils – interior vs. exterior

(f) Underframe – continuous vs. stub sill

(g) Shelf couplers

(h) Body bolster

(i) Trucks (pin and bowl)

9-2.1.4 Given examples of tank cars (some jacketed; some not jacketed), point out the jacketed tank cars.

9-2.1.5 Describe the difference between "insulation" and "thermal protection" on tank cars.

9-2.1.6 Describe the difference between "jacketed" and "sprayed-on" thermal protection on tank cars.

9-2.1.7 Describe the difference between "interior" and "exterior" heater coils on tank cars.

9-2.1.8 Given examples of various fittings arrangements for pressure, nonpressure, cryogenic, and CO_2 tank cars (including examples of each of the following fittings), point out and explain the design, construction, and operation of each of the following fittings, when present:

(a) Fittings for loading and unloading tank cars, including the following:

1. Bottom outlet valves (top operated with stuffing box, bottom operated — internal or external ball, wafersphere)

2. Liquid valve/vapor valve (ball vs. plug type)

3. Excess flow valve

4. Air valve

5. Bottom outlet nozzle

6. Quick fill hole cover

7. Flange for manway, valves, etc.

8. CO_2 tank car fittings

9. Cryogenic liquid tank car fittings

(b) Fittings for pressure relief, including the following:

1. Safety relief devices (safety valve, safety vent, combination safety valve)

2. Pressure regulators on CO_2 cars and liquefied atmospheric gases in cryogenic liquid tank cars

3. Staged safety relief system for a CO_2 car

4. Vacuum relief valve (negative pressure or vacuum)

(c) Fittings for gauging, including the following:

1. Open gauging devices, e.g., slip tube

2. Closed gauging devices, e.g., magnetic

3. Other gauging devices (T-bar, long/short pole)

(d) Miscellaneous fittings, including the following:

1. Thermometer well

2. Sample line

3. Manway, manway cover plate, hinged and bolted manway cover, protective housing

4. Washout

5. Sump

9-2.1.9 Given examples of various fitting arrangements on tank cars (including CO_2 and cryogenic liquid tank cars) with the following fittings included, point out the location(s) where each fitting is likely to leak and a reason for the leak:

(a) Bottom outlet valve/top-operated bottom outlet valve (with stuffing box)

(b) Liquid valve/vapor valve (ball vs. plug type)

(c) Air valve

(d) Bottom outlet nozzle

(e) Quick fill hole cover

(f) Flange for manway, valves, etc.

(g) Safety relief valve

(h) Safety vent (with rupture/frangible) disk

(i) Combination safety valve

(j) Pressure regulators on CO_2 cars and liquefied atmospheric gases in cryogenic liquid tank cars

(k) Vacuum relief valve (negative pressure or vacuum)

(l) Open gauging devices, e.g., slip tube

(m) Closed gauging devices, e.g., magnetic

(n) Thermometer well

(o) Sample line

(p) Manway, manway cover plate, hinged and bolted manway cover, protective housing

(q) Washout

9-2.1.10 Given examples of each of the following types of tank car damage, identify the type of damage:

(a) Crack

(b) Score, gouge, wheel burn, rail burn

(c) Puncture

(d) Flame impingement

(e) Dent

(f) Corrosion

9-2.1.11* Given examples (actual or simulated) of scores, gouges, wheel burns, and rail burns, perform each of the following tasks:

(a) Use a depth gauge to measure the depth of each score, gouge, wheel burn, and rail burn

(b) Point out where each score, gouge, wheel burn, and rail burn crosses a weld, if that condition exists

(c) Measure the depth of the weld metal removed for any point where the score, gouge, wheel burn, and rail burn crosses a weld

(d) Given examples (actual or simulated) of where a score, gouge, wheel burn, and rail burn crosses a weld, determine if the "heat-affected zone" has been damaged

9-2.1.12 Given examples (actual or simulated) of dents and rail burns, perform each of the following tasks:

(a) Use a dent gauge to measure the radius of curvature for each dent or rail burn

(b) Identify those examples that include cracks at the point of minimum curvature

9-2.1.13 Given examples of damaged tank car fittings, describe the extent of damage to those fittings.

9-2.1.14 Given examples of tank car tank damage, describe the extent of damage to the tank car tank.

9-2.1.15 Given a tank car and the appropriate equipment and reference material, determine the pressure in the tank car, using either of the following methods:

(a) A pressure gauge

(b) The temperature of the contents

9-2.1.16* Given a tank car, use the car's gauging device to determine the amount of lading in it.

9-2.2 Predicting the Likely Behavior of the Tank Car and its Contents. Technicians with a tank car specialty shall predict the likely behavior of the tank car and its contents. The technician with a tank car specialty shall be able to:

9-2.2.1 Given the following types of tank cars, describe the likely breach/release mechanisms associated with each type.

(a) Nonpressure tank cars

(b) Pressure tank cars

(c) Cryogenic liquid tank cars

(d) High-pressure tube cars

(e) Pneumatically unloaded covered hopper cars

9-2.2.2 Describe the difference in the following types of construction materials used in tank cars and their significance in assessing tank damage:

(a) ln steel

(b) Alloy steel

(c) Aluminum

9-2.2.3 Discuss the significance of selection of lading for compatibility with tank car construction material.

9-2.2.4 Describe the significance of "lining" and "cladding" on tank cars in assessing tank damage.

9-2.2.5 Describe the significance of the jacket on tank cars in assessing tank damage.

9-2.2.6 Describe the significance of "insulation" and "thermal protection" on tank cars in assessing tank damage.

9-2.2.7 Describe the significance of "jacketed" and "sprayed-on" thermal protection on tank cars in assessing tank damage.

9-2.2.8 Describe the significance of "interior" and "exterior" heater coils on tank cars in assessing tank damage.

9-2.2.9 Describe the significance of each of the following types of tank car damage on different types of tank cars in assessing tank damage:

(a) Crack

(b) Score, gouge, wheel burn, rail burn

(c) Puncture

(d) Flame impingement

(e) Dent

(f) Corrosion

9-2.2.10 Describe the significance of the depth of scores, gouges, wheel burns, and rail burns on tank cars in assessing tank damage.

9-2.2.11 Describe the significance of scores, gouges, wheel burns, and rail burns crossing a weld on a pressure tank car in assessing tank damage.

9-2.2.12 Describe the significance of damage to the "heat affected" zone of a weld on a tank car in assessing tank damage.

9-2.2.13 Describe the significance of a condemning dent of a tank car in assessing tank damage.

9-2.2.14 Given various types of tank cars, describe the significance of pressure increases in assessing tank damage.

9-2.2.15 Given various types of tank cars, describe the significance of the amount of lading in the tank in assessing tank damage.

9-2.2.16 Describe the significance of flame impingement on a tank car.

9-3 Competencies — Planning the Response.

9-3.1 Determining the Response Options. Given the analysis of an emergency involving tank cars, technicians with a tank car specialty shall determine the response options for each tank car involved. The technician with a tank car specialty shall be able to:

9-3.1.1 Describe the purpose of, potential risks associated with, procedures for, equipment required to implement, and safety precautions for the following product removal techniques for tank cars:

(a) Transferring liquids and vapors

(b) Flaring liquids and vapors

(c) Venting

(d) Hot and cold tapping

(e) Vent and burn

9-3.1.2 Describe the inherent risks associated with, procedures for, equipment required to implement, and safety precautions for leak control techniques on various tank car fittings.

9-3.1.3 Describe the effect flaring or venting gas or liquid has on the pressure in the tank (flammable gas or flammable liquid product).

9-3.1.4 Describe the inherent risks associated with, procedures for, equipment required to implement, and safety precautions for lifting of tank cars.

9-3.1.5 Describe the inherent risks associated with, procedures for, and safety precautions for the following operations:

(a) Shutting off locomotives using the fuel shutoff and the battery disconnect

(b) Setting and releasing brakes on rail cars

(c) Uncoupling rail cars

9-3.1.6 Describe the hazards associated with working on railroad property during emergencies.

9-4 Competencies — Implementing the Planned Response.

9-4.1 Implementing the Planned Response. Given an analysis of an emergency involving tank cars and the planned response, technicians with a tank car specialty shall implement or oversee the implementation of the selected response options safely and effectively. The technician with a tank car specialty shall be able to:

9-4.1.1 Given a leaking manway cover plate (loose bolts), control the leak.

9-4.1.2 Given leaking packing on the following tank car fittings, control the leak:

(a) Gauging device packing nut

(b) Liquid or vapor valve packing nut

(c) Top-operated bottom outlet valve packing gland

9-4.1.3 Given an open bottom outlet valve with a defective gasket in the cap, control the leak.

9-4.1.4 Given a leaking top-operated bottom outlet valve, close valve completely to control leak.

9-4.1.5 Given leaking fittings on a chlorine tank car, use the Chlorine C kit, as appropriate, to control the leak.

9-4.1.6 Given the following types of leaks on various types of tank cars, plug or patch those leaks:

(a) Puncture

(b) Irregular-shaped hole

(c) Cracks, splits, or tears

9-4.1.7 Given the appropriate equipment and resources, demonstrate the following:

(a) Transferring of liquids and vapors

(b) Flaring of liquids and vapors

(c) Venting

9-4.1.8 Given the appropriate resources, perform the following tasks:

(a) Shut off locomotives using the fuel shutoff and the battery disconnect

(b) Set and release brakes on rail cars

(c) Uncouple rail cars

9-4.1.9* Demonstrate bonding and grounding procedures for the transfer of flammable and combustible products from tank cars, or other products that can give off flammable gases or vapors when heated or contaminated, including the following:

(a) Selection of proper equipment

(b) Sequence of bonding and grounding connections

(c) Proper testing of bonding and grounding connections

9-4.1.10 Given a simulated flammable liquid spill from a tank car, describe the procedures for site safety and fire control during cleanup and removal operations.

Chapter 10 Competencies for the Technician with a Cargo Tank Specialty

10-1 General.

10-1.1 Introduction. Technicians with a cargo tank specialty shall be trained to meet all competencies of the first responder awareness, operational, and hazardous materials technician levels and the competencies of this chapter. The technician with a cargo tank specialty also shall receive any additional training to meet applicable United States Department of Transportation (DOT), United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and other appropriate state, local, or provincial occupational health and safety regulatory requirements.

10-1.2 Definition. Technicians with a cargo tank specialty are those persons who provide support to the hazardous materials technician, provide oversight for product removal and movement of damaged cargo tanks, and act as a liaison between technicians and other outside resources. These technicians are expected to use specialized chemical-protective clothing and specialized control equipment.

10-1.3 Goals. The goal of this chapter shall be to provide the technician with a cargo tank specialty with the knowledge and skills to perform the following tasks safely. In addition to being competent at the technician level, the technician with a cargo tank specialty shall be able to:

(a) Analyze a hazardous materials incident involving cargo tanks to determine the magnitude of the problem in terms of outcomes by completing the following tasks:

1. Determine the type and extent of damage to cargo tanks

2. Predict the likely behavior of cargo tanks and their contents in an emergency

(b) Plan a response for an emergency involving cargo tanks within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by determining the response options (offensive, defensive, and nonintervention) for a hazardous materials emergency involving cargo tanks

(c) Implement the planned response to a hazardous materials incident involving cargo tanks

10-1.4 Mandating of Competencies. This standard does not mandate that hazardous materials response teams performing offensive operations on cargo tanks have technicians with a cargo tank specialty. Technicians operating within the bounds of their training as listed in Chapter 4 of this standard are able to intervene in cargo tank incidents. However, if a hazardous materials response team desires to train some or all its technicians to have in-depth knowledge of cargo tanks, this chapter sets out the required competencies.

10-2 Competencies — Analyzing the Incident.

10-2.1 Determining the Type and Extent of Damage to Cargo Tanks. Given examples of damaged cargo tanks, technicians with a cargo tank specialty shall describe the type and extent of damage to each cargo tank and its fittings. The technician with a cargo tank specialty shall be able to:

10-2.1.1 Given the specification mark for a cargo tank and the appropriate reference materials, describe the tank's basic construction and features.

10-2.1.2 Given examples of cargo tanks (some jacketed; some not jacketed), point out the jacketed cargo tanks.

10-2.1.3 Given examples of the following types of cargo tank damage, identify the type of damage in each example:

(a) Crack

(b) Scrape, score, gouge, or loss of metal

(c) Puncture

(d) Dent

(e) Flame impingement

(f) Corrosion (internal/external)

10-2.1.4 Given simulated damage to an MC-331 cargo tank, determine the extent of damage to the heat-affected zone.

10-2.1.5* Given an MC-331 cargo tank containing a liquefied gas, determine the amount of liquid in the tank.

10-2.1.6 Given an MC-306/DOT-406, MC-307/DOT-407, and MC-312/DOT-412 cargo tank, point out and explain the design, construction, and operation of each of the following safety devices:

(a) Internal safety valve or external valve with accident protection, including method of activation (air, cable, hydraulic)

(b) Shear-type breakaway piping

(c) Emergency remote shutoff device

(d) Pressure and vacuum relief protection devices

(e) Dome cover design

10-2.1.7 Given an MC-331 and MC-338 cargo tank, point out and explain the design, construction, and operation of each of the following safety devices:

(a) Internal safety valve or external valve with accident protection, including method of activation (air, cable, hydraulic)

(b) Excess flow valve

(c) Fusible link and nut assemblies

(d) Emergency remote shutoff device

(e) Pressure relief protection devices

10-2.1.8 Given an MC-306/DOT-406 cargo tank, identify and describe the following normal methods of loading and unloading:

(a) Top loading

(b) Bottom loading

(c) Vapor recovery system

10-2.1.9 Given the following types of cargo tank trucks and tube trailer, identify and describe the normal methods of loading and unloading:

(a) MC-307/DOT-407

(b) MC-312/DOT-412

(c) MC-331

(d) MC-338

(e) Compressed gas tube trailer

10-2.1.10 Describe the normal and emergency methods of activation for the following types of cargo tank truck valve systems:

(a) Air

(b) Cable

(c) Hydraulic

10-2.1.11 Given a cargo tank involved in an emergency, identify the factors to be evaluated as part of the cargo tank damage assessment process, including the following:

(a) Type of cargo tank (MC or DOT specification)

(b) Pressurized or nonpressurized

(c) Number of compartments

(d) Type of tank metal (e.g., aluminum vs. stainless steel)

(e) Nature of the emergency (e.g., rollover, vehicle accident, struck by object, etc.)

(f) Container stress applied to the cargo tank

(g) Type and nature of tank damage (e.g., puncture, dome cover leak, valve failure, etc.)

(h) Amount of product both released and remaining in the cargo tank

10-2.2 Predicting the Likely Behavior of the Cargo Tank and its Contents. Technicians with a cargo tank specialty shall predict the likely behavior of the cargo tank and its contents. The technician with a cargo tank specialty shall be able to:

10-2.2.1 Given the following types of cargo tanks (including a tube trailer), describe the likely breach/release mechanisms:

(a) MC-306/DOT-406 cargo tanks

(b) MC-307/DOT-407 cargo tanks

(c) MC-312/DOT-412 cargo tanks

(d) MC-331 cargo tanks

(e) MC-338 cargo tanks

(f) Compressed gas tube trailer

10-2.2.2 Describe the difference in types of construction materials used in cargo tanks and their significance in assessing tank damage.

10-2.2.3 Describe the significance of the jacket on cargo tanks in assessing tank damage.

10-2.2.4 Describe the significance of each of the following types of damage on different types of cargo tanks in assessing tank damage:

(a) Crack

(b) Scrape, score, gouge, or loss of metal

(c) Puncture

(d) Dent

(e) Flame impingement

(f) Corrosion (internal/external)

10-2.2.5 Given simulated damage to the heat-affected zone on a MC-331 cargo tank, describe the significance of the damage in assessing tank damage.

10-3 Competencies — Planning the Response.

10-3.1 Determining the Response Options. Given the analysis of an emergency involving cargo tanks, technicians with a cargo tank specialty shall determine the response options for each cargo tank involved. The technician with a cargo tank specialty shall be able to:

10-3.1.1 Given an incident involving a cargo tank, describe the methods, procedures, risks, safety precautions, and equipment that are required to implement spill and leak control procedures.

10-3.1.2 Given an overturned cargo tank, describe the factors to be evaluated for uprighting, including the following:

(a) Type of cargo tank and material of construction

(b) Condition and weight of the cargo tank

(c) Type and nature of stress applied to the cargo tank

(d) Preferred lifting points

(e) Selection of lifting straps and/or air bags

(f) Lifting capabilities of wreckers and cranes

(g) Site safety precautions

10-4 Competencies — Implementing the Planned Response.

10-4.1 Implementing the Planned Response. Given an analysis of an emergency involving a cargo tank and the planned response, technicians with a cargo tank specialty shall implement or oversee the implementation of the selected response options safely and effectively. The technician with a cargo tank specialty shall be able to:

10-4.1.1 Demonstrate the methods for containing the following leaks on liquid cargo tanks (e.g., MC-306/DOT-406, MC-307/DOT-407, and MC-312/DOT-412):

(a) Puncture

(b) Irregular-shaped hole

(c) Split or tear

(d) Dome cover leak

(e) Valves and piping

(f) Pressure relief devices (e.g., vents, burst disc, etc.)

10-4.1.2 Describe the methods for containing the following leaks in MC-331 and MC-338 cargo tanks:

(a) Crack

(b) Failure of safety relief device (e.g., relief valve, burst disc, etc.)

(c) Piping failure

10-4.1.3* Demonstrate bonding and grounding procedures for the transfer of flammable and combustible products from cargo tanks, or other products that can give off flammable gases or vapors when heated or contaminated, including the following:

(a) Selection of proper equipment

(b) Sequence of bonding and grounding connections

(c) Proper testing of bonding and grounding connections

10-4.1.4 Given the following product transfer and recovery equipment, demonstrate the safe and correct application and use of each of the following:

(a) Portable pumps (air, electrical, gasoline/diesel)

(b) Vehicles with power-take-off (PTO) driven pumps

(c) Pressure transfer

(d) Vacuum trucks

10-4.1.5 Given a simulated overturned MC-306/DOT-406 cargo tank, demonstrate the safe and proper procedures for the following methods of product removal and transfer:

(a) Drilling

(b) Unloading lines

(c) Vapor recovery lines

(d) Internal safety valve

10-4.1.6 Given a simulated overturned MC-307/DOT-407 cargo tank, demonstrate the safe and proper procedures for product removal and transfer.

10-4.1.7 Given a simulated overturned MC-331 cargo tank, demonstrate the safe and proper procedures for product removal and transfer.

10-4.1.8 Given the necessary resources, demonstrate the flaring of a MC-331 flammable gas cargo tank.

10-4.1.9 Given a simulated flammable liquid spill from a cargo tank, describe the procedures for site safety and fire control during cleanup and removal operations.

Chapter 11 Competencies for the Technician with an Intermodal Tank Specialty

11-1 General.

11-1.1 Introduction. Technicians with an intermodal tank specialty shall be trained to meet all competencies of the first responder awareness, operational, and hazardous materials technician levels and the competencies of this chapter. The technician with an intermodal tank specialty also shall receive any additional training to meet applicable United States Department of Transportation (DOT), United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and other appropriate state, local, or provincial occupational health and safety regulatory requirements.

11-1.2 Definition. Technicians with an intermodal tank specialty are those persons who provide support to the hazardous materials technician, provide oversight for product removal and movement of damaged intermodal tanks, and act as a liaison between technicians and other outside resources. These technicians are expected to use specialized chemical-protective clothing and specialized control equipment.

11-1.3 Goals. The goal of this chapter shall be to provide the technician with an intermodal tank specialty with the knowledge and skills to perform the following tasks safely. In addition to being competent at the technician level, the technician with an intermodal tank specialty shall be able to:

(a) Analyze a hazardous materials incident involving an intermodal tank to determine the magnitude of the problem in terms of outcomes by completing the following tasks:

1. Determine the type and extent of damage to an intermodal tank

2. Predict the likely behavior of an intermodal tank and its contents in an emergency

(b) Plan a response for an emergency involving an intermodal tank within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by determining the response options (offensive, defensive, and nonintervention) for a hazardous materials emergency involving intermodal tanks

(c) Implement the planned response to a hazardous materials incident involving intermodal tanks

11-1.4 Mandating of Competencies. This standard does not mandate that hazardous materials response teams performing offensive operations on intermodal tanks have technicians with an intermodal tank specialty. Technicians operating within the bounds of their training as listed in Chapter 4 of this standard are able to intervene in intermodal tank incidents. However, if a hazardous materials response team desires to train some or all its technicians to have in-depth knowledge of intermodal tanks, this chapter sets out the required competencies.

11-2 Competencies — Analyzing the Incident.

11-2.1 Determining the Type and Extent of Damage to Intermodal Tanks. Given examples of damaged intermodal tanks, technicians with an intermodal tank specialty shall describe the type and extent of damage to each intermodal tank and its fittings. The technician with an intermodal tank specialty shall be able to:

11-2.1.1 Given the specification mark for an intermodal tank and the appropriate reference materials, describe the tank's basic construction and features.

11-2.1.2 Given examples of intermodal tanks (some jacketed; some not jacketed), point out the jacketed intermodal tanks.

11-2.1.3 Given examples of various intermodal tanks, point out and explain the design and purpose of each of the following intermodal tank components, when present:

(a) Supporting frame

(b) Corner casting

(c) Insulation

(d) Jacket

(e) Heater coils (steam/electric)

(f) Refrigeration unit

(g) Data plate

11-2.1.4 Given examples of various fittings arrangements for pressure, nonpressure, and cryogenic intermodal tanks, point out and explain the design, construction, and operation of each of the following fittings, when present:

(a) Spill box

(b) Manhole cover

(c) Air line connection

(d) Top outlet

(e) Bottom outlet valve

(f) Thermometer

(g) Pressure gauge

(h) Gauging device

(i) Liquid or vapor valve

(j) Sample valve

(k) Thermometer well

11-2.1.5 Given examples of various safety devices for pressure, nonpressure, and cryogenic intermodal tanks, point out and explain the design, construction, and operation of each of the following safety devices, when present:

(a) Safety relief valve

(b) Regulator valve

(c) Rupture disc

(d) Fusible link/nut assemblies

(e) Emergency remote shutoff device

(f) Excess flow valve

11-2.1.6 Given the following types of intermodal tank damage, identify the type of damage in each example and explain its significance.

(a) Crack

(b) Puncture

(c) Dent

(d) Flame impingement

(e) Corrosion (internal/external)

(f) Metal loss (gouge/score)

11-2.1.7 Given three examples of damage to the framework of intermodal tanks, describe the damage in each example and explain its significance in the risk analysis process.

11-2.1.8 Given an intermodal tank involved in an emergency, identify the factors to be evaluated as part of the intermodal tank damage assessment process, including the following:

(a) Type of intermodal tank

(b) Pressurized or nonpressurized

(c) Number of compartments

(d) Type of tank metal

(e) Nature of the emergency

(f) Container stress applied to the intermodal tank

(g) Type and nature of tank damage

(h) Amount of product both released and remaining in the intermodal tank

11-2.1.9* Given a pressure intermodal tank containing a liquefied gas, determine the amount of liquid in the tank.

11-2.1.10* Given simulated damage to a pressure intermodal tank, determine the extent of damage to the heat-affected zone.

11-2.2 Predicting the Likely Behavior of the Intermodal Tank and its Contents. Technicians with an intermodal tank specialty shall predict the likely behavior of the intermodal tank and its contents. The technician with an intermodal tank specialty shall be able to:

11-2.2.1 Given the following types of intermodal tanks, describe the likely breach/release mechanisms:

(a) IMO Type 1/IM-101

(b) IMO Type 2/IM-102

(c) IMO Type 5/DOT-51

(d) DOT-56

(e) DOT-57

(f) DOT-60

(g) Cryogenic (IMO Type 7)

11-2.2.2 Describe the difference in types of construction materials used in intermodal tanks relative to assessing tank damage.

11-3 Competencies — Planning the Response.

11-3.1 Determining the Response Options. Given the analysis of an emergency involving intermodal tanks, technicians with an intermodal tank specialty shall determine the response options for each intermodal tank involved. The technician with an intermodal tank specialty shall be able to:

11-3.1.1 Describe the purpose of, potential risks associated with, procedures for, equipment required to implement, and safety precautions for the following product removal techniques for intermodal tanks:

(a) Transferring liquids and vapors (pressure/pump)

(b) Hot tapping

(c) Flaring liquids and vapors

11-3.1.2 Describe the purpose of, procedures for, and risks associated with controlling leaks from various fittings on intermodal tanks, including equipment needed and safety precautions.

11-4 Competencies — Implementing the Planned Response.

11-4.1 Implementing the Planned Response. Given an analysis of an emergency involving intermodal tanks and the planned response, technicians with an intermodal tank specialty shall implement or oversee the implementation of the selected response options safely and effectively. The technician with an intermodal tank specialty shall be able to:

11-4.1.1 Given leaks from the following fittings on intermodal tanks, control the leaks using proper methods and procedures.

(a) Manway cover

(b) Bottom outlet

(c) Liquid/vapor valve

(d) Safety relief device

(e) Tank

11-4.1.2 Demonstrate proper procedures for the following types of emergency product removal:

(a) Gas/liquid transfer (pressure/pump)

(b) Flaring

(c) Venting

11-4.1.3* Demonstrate bonding and grounding procedures for the transfer of flammable and combustible products from an intermodal tank, or other products that can give off flammable gases or vapors when heated or contaminated, including the following:

(a) Selection of proper equipment

(b) Sequence of bonding and grounding connections

(c) Proper testing of bonding and grounding connections

11-4.1.4 Demonstrate the methods for containing the following leaks on liquid intermodal tanks (e.g., IM-101 and IM-102):

(a) Puncture

(b) Irregular-shaped hole

(c) Split or tear

(d) Dome cover leak

(e) Valves and piping

(f) Pressure relief devices (e.g., vents, burst disc, etc.)

11-4.1.5 Describe the methods for containing the following leaks in pressure intermodal tanks:

(a) Crack

(b) Failure of safety relief device (e.g., relief valve, burst disc, etc.)

(c) Piping failure

11-4.1.6 Given the following product transfer and recovery equipment, demonstrate the safe and correct application and use of the following:

(a) Portable pumps (air, electrical, gasoline/diesel)

(b) Vehicles with power-take-off (PTO) driven pumps

(c) Pressure transfer

(d) Vacuum trucks

11-4.1.7* Given a simulated overturned liquid intermodal tank, demonstrate the safe and proper procedures for product removal and transfer.

11-4.1.8* Given a simulated overturned pressure intermodal tank, demonstrate the safe and proper procedures for product removal and transfer.

11-4.1.9* Given the necessary resources, demonstrate the flaring of a pressure flammable gas intermodal tank.

11-4.1.10 Given a simulated flammable liquid spill from an intermodal tank, describe the procedures for site safety and fire control during cleanup and removal operations.

Chapter 12 Referenced Publications

12-1 The following documents or portions thereof are referenced within this standard as mandatory requirements and shall be considered part of the requirements of this standard. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this standard. Some of these mandatory documents might also be referenced in this standard for specific informational purposes and, therefore, are also listed in Appendix D.

12-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, 1996 edition.

NFPA 1561, *Standard on Fire Department Incident Management System*, 1995 edition.

NFPA 1991, *Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies*, 1994 edition.

NFPA 1992, *Standard on Liquid Splash-Protective Suits for Hazardous Chemical Emergencies*, 1994 edition.

12-1.2 Other Publications.

12-1.2.1 U.S. Government Publications. U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402.

Title 29, *Code of Federal Regulations*, Part 1910.120

North American Emergency Response Guidebook, U.S. Department of Transportation, 1996 edition.

Appendix A Explanatory Material

This appendix is not a part of the recommendations of this NFPA document but is included for informational purposes only.

A-1-1.2 Definitions of Responder Levels.

Awareness Level. First responders at the awareness level are those persons who, in the course of their normal duties, can be the first on the scene of an emergency involving hazardous materials. First responders at the awareness level are expected to recognize the presence of hazardous materials, protect themselves, call for trained personnel, and secure the area.

Operational Level. First responders at the operational level are those persons who respond to releases or potential releases of hazardous materials as part of the initial response to the incident for the purpose of protecting nearby persons, the environment, or property from the effects of the release. They should be trained to respond in a defensive fashion to control the release from a safe distance and keep it from spreading.

Technician Level. Hazardous materials technicians are those persons who respond to releases or potential releases of hazardous materials for the purpose of controlling the release. Hazardous materials technicians are expected to use specialized chemical protective clothing and specialized control equipment.

Command Level. The incident commander is that person who is responsible for all decisions relating to the management of the incident. The incident commander is in charge of the incident site.

List of Tasks by Responder Level

Analysis Tasks

(a) *Awareness Level.* The first responder at the awareness level should analyze an incident to determine both the hazardous materials present and the basic hazard and response information for each hazardous material by completing the following tasks:

1. Detect the presence of the hazardous materials

2. Survey a hazardous materials incident from a safe location to identify the name, UN/NA identification number, or type placard applied for any hazardous materials involved

3. Collect hazard and response information from the current edition of the *North American Emergency Response Guidebook*

(b) *Operational Level.* The first responder at the operational level should be competent at the awareness level and be able to analyze a hazardous materials incident to determine the magnitude of the problem in terms of outcomes by completing the following tasks:

1. Survey the hazardous materials incident to identify the containers and materials involved, determine whether hazardous materials have been released, and evaluate the surrounding conditions

2. Collect hazard and response information from material safety data sheets (MSDS), CHEMTREC/CANUTEC/SETIQ, and shipper/manufacturer contacts

3. Predict the likely behavior of a material and its container

4. Estimate the potential harm at a hazardous materials incident

(c) *Technician Level.* The hazardous materials technician should be competent at the awareness and operational level and be able to analyze a hazardous materials incident to determine the magnitude of the problem in terms of outcomes by completing the following tasks:

1. Survey the hazardous materials incident to identify special containers involved, to identify or classify unknown materials, and to verify the presence and concentrations of hazardous materials through the use of monitoring equipment

2. Collect and interpret hazard and response information from printed resources, technical resources, computer data bases, and monitoring equipment

3. Determine the extent of damage to containers

4. Predict the likely behavior of released materials and their containers when multiple materials are involved

5. Estimate the size of an endangered area using computer modeling, monitoring equipment, or specialists in this area

(d) *Command Level.* The incident commander should be competent to analyze a hazardous materials incident to determine the magnitude of the problem in terms of outcomes by completing the following tasks:

1. Collect and interpret hazard and response information from printed resources, technical resources, computer data bases, and monitoring equipment

2. Estimate the potential outcomes within the endangered area at a hazardous materials incident

Planning Tasks

(a) *Awareness Level.* No requirements.

(b) *Operational Level.* The first responder at the operational level should be competent at the first responder awareness level and be able to plan an initial response within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by completing the following tasks:

1. Describe the response objectives for hazardous materials incidents

2. Describe the defensive options available by response objective

3. Determine if the personal protective equipment provided is appropriate for implementing each action option

4. Identify the emergency decontamination procedures

(c) *Technician Level.* The hazardous materials technician should be competent at both the first responder awareness and operational levels and be able to plan a response within the capabilities of available personnel, personal protective equipment, and control equipment by completing the following tasks:

1. Identify the response objectives for hazardous materials incidents

2. Identify the potential action options available by response objective

3. Select the personal protective equipment required for a given action option

4. Select the appropriate decontamination procedures

5. Develop a plan of action, including safety considerations, consistent with the local emergency response plan and the organization's standard operating procedures and within the capability of the available personnel, personal protective equipment, and control equipment

(d) *Command Level.* The incident commander should be competent to plan response operations within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by completing the following tasks:

1. Identify the response objectives for hazardous materials incidents

2. Identify the potential action options (defensive, offensive, and nonintervention) available by response objective

3. Approve the level of personal protective equipment required for a given action option

4. Develop a plan of action, including safety considerations, consistent with the local emergency response plan and the organization's standard operating procedures and within the capability of available personnel, personal protective equipment, and control equipment

Implementation Tasks

(a) *Awareness Level.* The first responder at the awareness level should be able to implement actions consistent with the local emergency response plan, the organization's standard operating procedures, and the current edition of the *North American Emergency Response Guidebook* by completing the following tasks:

1. Initiate protective actions

2. Initiate the notification process

(b) *Operational Level.* The first responder at the operational level should be competent at the awareness level and be able to 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:

1. Establish and enforce scene control procedures, including control zones, decontamination, and communications

2. Initiate an incident management system (IMS)

3. Don, work in, and doff personal protective equipment provided by the authority having jurisdiction

4. Perform the defensive control actions identified in the plan of action

(c) *Technician Level.* The hazardous materials technician should be competent at both the first responder awareness and operational levels and be able to implement the planned response to favorably change the outcomes consistent with the organization's standard operating procedures or safety considerations by completing the following tasks:

1. Perform the duties of an assigned position within the local incident management system (IMS)

2. Don, work in, and doff appropriate personal protective clothing, including, but not limited to, both liquid splash- and vapor-protective clothing with appropriate respiratory protection

3. Perform the control functions identified in the plan of action

(d) *Command Level.* The incident commander should be competent at the operational level and be able to implement a 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:

1. Implement the incident management system, including the specified procedures for notification and utilization of nonlocal resources (including private, state, and federal government personnel)

2. Direct resources (private, governmental, and others) with expected task assignments and on-scene activities, provide management overview, technical review, and logistical support to private and governmental sector personnel

3. Provide a focal point for information transfer to media and local elected officials through the IMS structures

Evaluation Tasks

(a) *Awareness Level.* No requirements.

(b) *Operational Level.* The first responder at the operational level should be competent at the awareness level and be able to 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:

1. Evaluate the status of the defensive actions taken in accomplishing the response objectives

2. Communicate the status of the planned response

(c) *Technician Level.* The hazardous materials technician should be competent in evaluating the progress of the planned response by evaluating the effectiveness of the control functions.

(d) *Command Level.* The incident commander should be competent at the operational level and be able to evaluate the progress of the planned response to ensure the response objectives are being met safely, effectively, and efficiently and adjust the plan of action accordingly by evaluating the effectiveness of the control functions.

Termination Tasks

(a) *Awareness Level.* No requirements.

(b) *Operational Level.* No requirements.

(c) *Technician Level:* The hazardous materials technician should be competent to terminate an incident by completing the following tasks:

1. Assist in the incident debriefing

2. Assist in the incident critique

3. Provide reports and documentation of the incident

(d) *Command Level:* The incident commander should be competent to terminate an incident by completing the following tasks:

1. Transfer of command (control) when appropriate

2. Conduct an incident debriefing

3. Conduct a multi-agency critique

4. Report and document the hazardous materials incident and submit the reports to the proper entity

A-1-2 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A-1-2 Authority Having Jurisdiction. The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A-1-2 Hazardous Material. There are many definitions and descriptive names being used for the term hazardous material, each of which depends on the nature of the problem being addressed.

Unfortunately, there is no one list or definition that covers everything. The U.S. agencies involved, as well as state and local governments, have different purposes for regulating hazardous materials that, under certain circumstances, pose a risk to the public or the environment.

Hazardous Materials. The U.S. Department of Transportation (DOT) uses the term *hazardous materials* to cover 11 hazard classes, some of which have subcategories called divisions. DOT includes in its regulations hazardous substances and hazardous wastes as Class 9 (Miscellaneous Hazardous Materials), both of which are regulated by the U.S. Environmental Protection Agency (EPA), if their inherent properties would not otherwise be covered.

Hazardous Substances. EPA uses the term *hazardous substances* for chemicals that, if released into the environment above a certain amount, must be reported, and, depending on the threat to the environment, federal involvement in handling the incident can be authorized. A list of the hazardous substances is published in Title 40, *Code of Federal Regulations,* Part

302, Table 302.4. The U.S. Occupational Safety and Health Administration (OSHA) uses the term *hazardous substance* in Title 29, *Code of Federal Regulations*, Part 1910.120, which resulted from Title I of Superfund Amendments and Reauthorization Act (SARA) and covers emergency response. OSHA uses the term differently than EPA. Hazardous substances, as used by OSHA, cover every chemical regulated by both DOT and EPA.

Extremely Hazardous Substances. EPA uses the term *extremely hazardous substances* for chemicals that must be reported to the appropriate authorities if released above the threshold reporting quantity. Each substance has a threshold reporting quantity. The list of extremely hazardous substances is identified in Title III of SARA of 1986 (Title 40, *Code of Federal Regulations*, Part 355).

Toxic Chemicals. EPA uses the term *toxic chemicals* for chemicals whose total emissions or releases must be reported annually by owners and operators of certain facilities that manufacture, process, or otherwise use a listed toxic chemical. The list of toxic chemicals is identified in Title III of SARA.

Hazardous Wastes. EPA uses the term *hazardous wastes* for chemicals that are regulated under the Resource, Conservation, and Recovery Act (Title 40, *Code of Federal Regulations*, Part 261.33). Hazardous wastes in transportation are regulated by DOT (Title 49, *Code of Federal Regulations*, Parts 170–179).

Hazardous Chemicals. OSHA uses the term *hazardous chemicals* to denote any chemical that would be a risk to employees if exposed in the workplace. Hazardous chemicals cover a broader group of chemicals than the other chemical lists.

Dangerous Goods. In Canadian transportation, hazardous materials are called *dangerous goods.*

Highly Hazardous Chemicals. OSHA uses the term *highly hazardous chemicals* for those chemicals that fall under the requirements of Title 29, *Code of Federal Regulations*, Part 1910.119, "Process Safety Management of Highly Hazardous Chemicals." *Highly hazardous chemicals* are those chemicals that possess toxic, reactive, flammable, or explosive properties. A list of covered substances is published in Appendix A of the OSHA rule.

A-1-2 Incident Management System. For more information, see NFPA 1561, *Standard on Fire Department Incident Management System.*

A-1-2 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A-1-2 Planned Response. The following site safety plan considerations are referenced from the Standard Operating Safety Guides, EPA, June 1992:

(a) Site description

(b) Entry objectives

(c) On-site organization

(d) On-site control

(e) Hazard evaluations

(f) Personal protective equipment

(g) On-site work plans

(h) Communication procedures

(i) Decontamination procedures

(j) Site safety and health plan

A-2-2.1.1 See A-1-2 Hazardous Material.

A-2-2.1.2, A-2-2.1.3 Definitions of Department of Transportation Hazard Classes and Divisions. Title 49, *Code of Federal Regulations*, Parts 170–180.

Class 1 (Explosives)

An explosive is any substance or article, including a device, that is designed to function by explosion (i.e., an extremely rapid release of gas and heat) or that, by chemical reaction within itself, is able to function in a similar manner even if not designed to function by explosion. Explosives in Class 1 are divided into six divisions. Each division will have a letter designation.

Division 1.1 consists of explosives that have a mass explosion hazard. A mass explosion is one that affects almost the entire load instantaneously.

Examples of Division 1.1 explosives include black powder, dynamite, and TNT.

Division 1.2 consists of explosives that have a projection hazard but not a mass explosion hazard.

Examples of Division 1.2 explosives include aerial flares, detonating cord, and power device cartridges.

Division 1.3 consists of explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard, or both, but not a mass explosion hazard.

Examples of Division 1.3 explosives include liquid-fueled rocket motors and propellant explosives.

Division 1.4 consists of explosive devices that present a minor explosion hazard. No device in the division may contain more than 25 g (0.9 oz) of a detonating material. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.

Examples of Division 1.4 explosives include line-throwing rockets, practice ammunition, and signal cartridges.

Division 1.5 consists of very insensitive explosives. This division is comprised of substances that have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.

Examples of Division 1.5 explosives include pilled ammonium nitrate fertilizer-fuel oil mixtures (blasting agents).

Division 1.6 consists of extremely insensitive articles that do not have a mass explosive hazard. This division is comprised of articles that contain only extremely insensitive detonating substances and that demonstrate a negligible probability of accidental initiation or propagation.

Class 2 (Gases)

Division 2.1 (flammable gas) consists of any material that is a gas at 20°C (68°F) or less and 101.3 kPa (14.7 psi) of pressure, a material that has a boiling point of 20°C (68°F) or less at 101.3 kPa (14.7 psi), and that:

(a) Is ignitable at 101.3 kPa (14.7 psi) when in a mixture of 13 percent or less by volume with air

(b) Has a flammable range at 101.3 kPa (14.7 psi) with air of at least 12 percent regardless of the lower limit

Examples of Division 2.1 gases include inhibited butadienes, methyl chloride, and propane.

Division 2.2 (nonflammable, nonpoisonous compressed gas, including compressed gas, liquefied gas, pressurized cryogenic gas, and compressed gas in solution) consists of any material (or mixture) that exerts in the packaging an absolute pressure of 280 kPa (41 psia) at 20°C (68°F).

A cryogenic liquid is a refrigerated liquefied gas having a boiling point colder than –90°C (–130°F) at 101.3 kPa (14.7 psi) absolute.

Examples of Division 2.2 gases include anhydrous ammonia, cryogenic argon, carbon dioxide, and compressed nitrogen.

Division 2.3 (poisonous gas) consists of a material that is a gas at 20°C (68°F) or less and a pressure of 101.3 kPa (14.7 psi or 1 atm), a material that has a boiling point of 20°C (68°F) or less at 101.3 kPa (14.7 psi), and that:

(a) Is known to be so toxic to humans as to pose a hazard to health during transportation

(b) In the absence of adequate data on human toxicity, is presumed to be toxic to humans because, when tested on laboratory animals, it has an LC_{50} value of not more than 5,000 ppm

Examples of Division 2.3 gases include anhydrous hydrogen fluoride, arsine, chlorine, and methyl bromide.

Hazard zones associated with Division 2.3 materials are the following:

(a) Hazard zone A – LC_{50} less than or equal to 200 ppm

(b) Hazard zone B – LC_{50} greater than 200 ppm and less than or equal to 1,000 ppm

(c) Hazard zone C – LC_{50} greater than 1,000 ppm and less than or equal to 3,000 ppm

(d) Hazard zone D – LC_{50} greater than 3,000 ppm and less than or equal to 5,000 ppm

Class 3 (Flammable Liquid)

Flammable liquid is any liquid having a flash point of not more than 60.5°C (141°F).

Examples of Class 3 liquids include acetone, amyl acetate, gasoline, methyl alcohol, and toluene.

Combustible Liquid

Combustible liquid is any liquid that does not meet the definition of any other hazard class and has a flash point above 60°C (140°F) and below 93°C (200°F). Flammable liquids with a flash point above 38°C (100°F) can be reclassified as a combustible liquid.

Examples of combustible liquids include mineral oil, peanut oil, and No. 6 fuel oil.

Class 4 (Flammable Solids)

Division 4.1 (flammable solid) consists of any of the following three types of materials:

(a) Wetted explosives – explosives wetted with sufficient water, alcohol, or plasticizers to suppress explosive properties

(b) Self-reactive materials – materials that are liable to undergo, at normal or elevated temperatures, a strongly exothermic decomposition caused by excessively high transport temperatures or by contamination

(c) Readily combustible solids – solids that can cause a fire through friction and any metal powders that can be ignited

Examples of Division 4.1 materials include magnesium (pellets, turnings, or ribbons) and nitrocellulose.

Division 4.2 (spontaneously combustible material) consists of any of the following materials:

(a) Pyrophoric material – a liquid or solid that, even in small quantities and without an external ignition source, can ignite within five minutes after coming in contact with air

(b) Self-heating material – a material that, when in contact with air and without an energy supply, is liable to self-heat

Examples of Division 4.2 materials include aluminum alkyls, charcoal briquettes, magnesium alkyls, and phosphorus.

Division 4.3 (dangerous when wet material) consists of materials that, by contact with water, are liable to become spontaneously flammable or to give off flammable or toxic gas at a rate greater than 1 L/kg of the material per hour.

Examples of Division 4.3 materials include calcium carbide, magnesium powder, potassium metal alloys, and sodium hydride.

Class 5 (Oxidizers and Organic Peroxides)

Division 5.1 (oxidizer) consists of materials that can, generally by yielding oxygen, cause or enhance the combustion of other materials.

Examples of Division 5.1 materials include ammonium nitrate, bromine trifluoride, and calcium hypochlorite.

Division 5.2 (organic peroxide) consists of any organic compound containing oxygen (O) in the bivalent -O-O- structure that can be considered a derivative of hydrogen peroxide, where one or more of the hydrogen atoms have been replaced by organic radicals.

Division 5.2 (organic peroxide) materials are assigned to one of seven types:

Type A–organic peroxide that can detonate or deflagrate rapidly as packaged for transport. Transportation of Type A organic peroxides is forbidden.

Type B–organic peroxide that neither detonates nor deflagrates rapidly, but that can undergo a thermal explosion.

Type C–organic peroxide that neither detonates nor deflagrates rapidly and cannot undergo a thermal explosion.

Type D–organic peroxide that detonates only partially or deflagrates slowly, with medium to no effect when heated under confinement.

Type E–organic peroxide that neither detonates nor deflagrates and shows low, or no, effect when heated under confinement.

Type F–organic peroxide that will not detonate, does not deflagrate, shows only a low, or no, effect if heated when confined, and has low, or no, explosive power.

Type G–organic peroxide that will not detonate, does not deflagrate, shows no effect if heated when confined, and has no explosive power, is thermally stable, and is desensitized.

Examples of Division 5.2 materials include dibenzoyl peroxide, methyl ethyl ketone peroxide, and peroxyacetic acid.

Class 6 (Poisonous Materials)

Division 6.1 (poisonous material) consists of materials, other than gases, that either are known to be so toxic to humans as to afford a hazard to health during transportation, or in the absence of adequate data on human toxicity, are presumed to be toxic to humans, including materials that cause irritation.

Examples of Division 6.1 materials include aniline, arsenic compounds, carbon tetrachloride, hydrocyanic acid, and tear gas.

Division 6.2 (infectious substance) consists of viable microorganisms, or their toxin, that cause or can cause disease in humans or animals. Infectious substance and etiologic agent are synonymous.

Examples of Division 6.2 materials include anthrax, botulism, rabies, and tetanus.

Hazard zones associated with Class 6 materials are the following:

(a) Hazard zone A– LC_{50} less than or equal to 200 ppm

(b) Hazard zone B– LC_{50} greater than 200 ppm and less than or equal to 1,000 ppm

Class 7 (Radioactive Materials)

Radioactive material is any material having a specific activity greater than 0.002 microcuries per gram (mCi/g).

Examples of Class 7 materials include cobalt, uranium hexafluoride, and "yellow cake."

Class 8 (Corrosive Materials)

Corrosive material is a liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact or a liquid that has a severe corrosion rate on steel or aluminum.

Examples of Class 8 materials include nitric acid, phosphorus trichloride, sodium hydroxide, and sulfuric acid.

Class 9 (Miscellaneous Hazardous Materials)

Miscellaneous hazardous material is a material that presents a hazard during transport, but that is not included in another hazard class, including the following:

(a) Any material that has an anesthetic, noxious, or other similar property that could cause extreme annoyance or discomfort to a flight crew member so as to prevent the correct performance of assigned duties

(b) Any material that is not included in any other hazard class, but is subject to the DOT requirements (a hazardous substance or a hazardous waste)

Examples of Class 9 materials include adipic acid, hazardous substances (e.g., PCBs), and molten sulfur.

ORM-D Material

An ORM-D material is a material that presents a limited hazard during transportation due to its form, quantity, and packaging.

Examples of ORM-D materials include consumer commodities and small arms ammunition.

Forbidden

Forbidden means prohibited from being offered or accepted for transportation. Prohibition does not apply if these materials are diluted, stabilized, or incorporated in devices.

Marine Pollutant

A marine pollutant is a material that has an adverse effect on aquatic life.

Elevated Temperature Material

An elevated temperature material is a material that, when offered for transportation in a bulk packaging, meets one of the following conditions:

(a) Liquid at or above 100°C (212°F)

(b) Liquid with a flash point at or above 37.8°C (100°F) that is intentionally heated and is transported at or above its flash point

(c) Solid at a temperature at or above 240°C (464°F)

A-2-2.1.11 These clues would include odors, gas leaks, fire or vapor cloud, visible corrosive actions or chemical reactions, pooled liquids, hissing of pressure releases, condensation lines on pressure tanks, injured victims, or casualties.

A-2-2.3 It is the intent of this standard that the first responder at the awareness level be taught the noted competency to a specific task level. This task level would be to have knowledge of the contents of the current edition of the *North American Emergency Response Guidebook* or other reference material provided. Awareness level responders should be familiar with the information provided in those documents so that they can use it to assist with accurate notification of an incident and take protective actions.

If other sources of response information [including the material safety data sheet (MSDS)] are provided to the hazardous materials responder at the awareness level in lieu of the current edition of the *North American Emergency Response Guidebook*, the responder should identify hazard information similar to that found in the current edition of the *North American Emergency Response Guidebook*.

A-2-2.3.1 Three methods for determining the appropriate guide page include the following:

(a) Using the numerical index for UN/NA identification numbers

(b) Using the alphabetical index for chemical names

(c) Using the "Table of Placards and Initial Response Guides"

A-2-4.1 Those jurisdictions that have not developed an emergency response plan can refer to the document NRT-1, *Hazardous Materials Emergency Planning Guide*, developed by the National Response Team.

The National Response Team, composed of 14 federal agencies having major responsibilities in environmental, transportation, emergency management, worker safety, and public health areas, is the national body responsible for coordinating federal planning, preparedness, and response actions related to oil discharges and hazardous substance releases. Under the Superfund Amendments and Reauthorization Act of 1986, the NRT is responsible for publishing guidance documents for the preparation and implementation of hazardous substance emergency plans.

A-2-4.1.3.3 This would include thermal, mechanical, poisonous, corrosive, asphyxiation, radiation, and etiologic. This can also include psychological harm.

A-2-4.1.3.4 General routes of human exposure are contact, absorption, inhalation, and ingestion. Absorption includes entry through the eyes and through punctures.

A-2-4.1.4 If other sources of response information [including the material safety data sheet (MSDS)] are provided to the hazardous materials responder at the awareness level in lieu of the current edition of the *North American Emergency Response Guidebook*, the responder should identify response information similar to that found in the current edition of the *North American Emergency Response Guidebook*.

A-2-4.1.4.2(c) "In-place protection," "sheltering in-place," and "protection in-place" all mean the same thing.

A-3-2.1 The survey of the incident should include an inventory of the type of containers involved, identification markings on containers, quantity in or capacity of containers, materials involved, release information, and surrounding conditions. The accuracy of the data should be verified.

A-3-2.1.1 Examples should include all containers, including nonbulk packaging, bulk packaging, vessels, and facility containers such as piping, open piles, reactors, and storage bins. Refer to the Chemical Manufacturers Association/Association of American Railroads Hazardous Materials Technical Bulletin *Packaging for Transporting Hazardous and Non-hazardous Materials*, issued June 1989.

A-3-2.1.4 The list of surrounding conditions should include: topography; land use; accessibility; weather conditions; bodies of water; public exposure potential; overhead and underground wires and pipelines; storm and sewer drains; possible ignition sources; adjacent land use such as rail lines, highways, and airports; and nature and extent of injuries. Building information such as floor drains, ventilation ducts, air returns, etc., also should be included when appropriate.

A-3-2.3 Predicting the likely behavior of a hazardous material and its container requires the ability to identify the types of stress involved and the ability to predict the type of breach, release, dispersion pattern, length of contact, and the health and physical hazards associated with the material and its container. Reference can be made to *A Textbook for Use in the Study of Hazardous Materials Emergencies,* the National Fire Academy's training program, *Hazardous Materials Incident Analysis, Hazardous Materials; Managing the Incident*, or "Managing the Hazardous Materials Incident," *Fire Protection Handbook*.

A-3-2.3.2 The three types of stress that could cause a container to release its contents are thermal stress, mechanical stress, and chemical stress.

A-3-2.3.3 The five ways in which containers can breach are disintegration, runaway cracking, closures opening up, punctures, and splits or tears.

The performance objectives contained in 3-2.3.3 through 3-2.3.5 should be taught in a manner and language understandable to the audience. The intent is to convey the simple concepts that containers of hazardous materials under stress can open up and allow the contents to escape. This refers to both pressurized and nonpressurized containers. This content release will vary in type and speed. A pattern will be formed by the escaping product that will possibly expose people, the environment, or property, creating physical and/or health hazards. This overall concept is often referred to as a general behavior model and is used to estimate the behavior of the container and its contents under emergency conditions.

A-3-2.3.4 The four ways in which containment systems can release their contents are detonation, violent rupture, rapid relief, and spill or leak.

A-3-2.3.5 The seven dispersion patterns that can be created upon release of hazardous materials are hemisphere, cloud, plume, cone, stream, pool, and irregular.

A-3-2.3.6 The three general time frames for predicting the length of time that an exposure can be in contact with hazardous materials in an endangered area are short-term (minutes and hours), medium-term (days, weeks, and months), and long-term (years and generations).

A-3-2.3.7 The health and physical hazards that could cause harm in a hazardous materials incident are thermal, mechanical, poisonous, corrosive, asphyxiation, radiation, and etiologic.

A-3-2.3.8 Health Hazard Definitions.

(a) *Carcinogen:* A chemical that falls within any of the following categories:

1. It has been evaluated by the International Agency for Research on Cancer (IARC) and found to be a carcinogen or potential carcinogen

2. It is listed as a carcinogen or potential carcinogen in the *Annual Report on Carcinogens* published by the National Toxicology Program (NTP) (latest edition)

3. It is regulated by federal OSHA as a carcinogen (can be regulated additionally by states)

(b) *Corrosive:* A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact

(c) *Highly toxic:* A chemical that falls within any of the following categories:

1. A chemical that has a median lethal dose (LD_{50}) of 50 mg or less per kg of body weight when administered orally to albino rats weighing between 200 g and 300 g each

2. A chemical that has a median lethal dose (LD_{50}) of 200 mg or less per kg of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 kg and 3 kg each

3. A chemical that has a median lethal concentration (LD_{50}) in air of 200 parts per million by volume or less of gas or vapor, or 2 mg per L or less of mist, fume, or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 g and 300 g each

(d) *Irritant:* A chemical that is not corrosive but that causes a reversible inflammatory effect on living tissue by chemical action at the site of contact

(e) *Sensitizer:* A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemicals

(f) *Toxic:* A chemical that falls within any of the following categories:

1. A chemical that has a median lethal dose (LD_{50}) or more than 50 mg per kg but not more than 500 mg per kg of body weight when administered orally to albino rats weighing between 200 g and 300 g each

2. A chemical that has a median lethal dose (LD_{50}) of more than 200 mg per kg but not more than 1,000 mg per kg of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 kg and 3 kg each

3. A chemical that has a median lethal concentration (LD_{50}) in air of more than 200 parts per million but not more than 3,000 parts per million by volume of gas or vapor, or more than 2 mg per L but not more than 200 mg per L of mist, fume, or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 g and 300 g each

(g) *Target organ effects:* A target organ categorization of effects that can occur, including examples of signs and symptoms and chemicals that have been found to cause such effects. These examples are presented to illustrate the range and diversity of effects and hazards that can be encountered and is not intended to be all-inclusive.

1. *Hepatotoxins.* Chemicals that produce liver damage (signs and symptoms: jaundice, liver enlargement; chemicals: carbontetrachloride, nitrosamines)

2. *Nephrotoxins.* Chemicals that produce kidney damage (signs and symptoms: edema, protein urea; chemicals: halogenated hydrocarbons, uranium)

3. *Neurotoxins.* Chemicals that produce their primary toxic effects on the nervous system

a. *Central Nervous System Hazards:* Chemicals that cause depression or stimulation of consciousness or otherwise injure the brain

b. *Peripheral Nervous System Hazards:* Chemicals that damage the nerves that transmit messages to and from the brain and the rest of the body (signs and symptoms: numbness, tingling, decreased sensation, change in reflexes, decreased motor strength; examples: arsenic, lead, toluene, styrene)

4. Agents that decrease hemoglobin in the blood of function; deprive the hematopolatic body tissues of oxygen system (signs and symptoms: cyanosis, loss of consciousness; chemicals: carbon monoxide, benzene)

5. Agents that irritate the lung or damage the pulmonary tissue (signs and symptoms: cough, tightness in chest, shortness of breath; chemicals: silica, asbestos, HCL)

6. *Reproductive toxins.* Chemicals that affect the reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogenesis) (signs and symptoms: birth defects, sterility; chemicals: lead, DBCP)

7. *Cutaneous hazards.* Chemicals that affect the dermal layer of the body (signs and symptoms: defatting of the skin, rashes, irritation; chemicals: ketones, chlorinated compounds)

8. *Eye hazards.* Chemicals that affect the eye or visual capacity (signs and symptoms: conjunctivitis, corneal damage; chemicals: organic solvents, acids)

A-3-2.3.8(e) Chronic health hazards include carcinogen, mutagen, and teratogen.

A-3-2.4 The process for estimating the potential outcomes within an endangered area at a hazardous materials incident includes determining the dimensions of the endangered area, estimating the number of exposures within the endangered area, measuring or predicting concentrations of materials within the endangered area, estimating the physical, health, and safety hazards within the endangered area, identifying the areas of potential harm within the endangered area, and estimating the potential outcomes within the endangered area.

A-3-2.4.1 Resources for determining the size of an endangered area of a hazardous materials incident is the current edition of the *North American Emergency Response Guidebook* and plume dispersion modeling results from facility pre-incident plans.

A-3-2.4.4 The factors for determining the extent of physical, health, and safety hazards within an endangered area at a hazardous materials incident are surrounding conditions, an indication of the behavior of the hazardous material and its container, and the degree of hazard.

A-3-3.3.1 The minimum requirement for respiratory protection at hazardous materials incidents (emergency operations until concentrations have been determined) is positive pressure self-contained breathing apparatus. Therefore, the minimum for the first responder at the operational level is positive pressure self-contained breathing apparatus.

A-3-3.4, A-3-4.1.5 Refer to *Hazardous Materials Response Handbook*, National Fire Protection Association, Quincy, MA.

A-3-4.1.6 Refer to NIOSH/OSHA/USCG/EPA *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.*

A-3-4.2 See A-2-4.1.

A-3-4.2.6 The hazardous materials safety officer should meet all the competencies for the responder at the level of operations being performed.

A hazardous materials branch safety officer is an individual who directs the safety of operations within the hot and warm zones. A hazardous materials branch safety officer should be designated specifically at all hazardous material incidents (CFR 1910.120). The hazardous materials safety officer has the following responsibilities:

(a) Obtains a briefing from the incident commander or incident safety officer and the hazardous materials branch safety officer

(b) Participates in the preparation of and monitors the implementation of the incident safety considerations (including medical monitoring of entry team personnel before and after entry)

(c) Advises the incident commander/sector officer of deviations from the incident safety considerations and of any dangerous situations

(d) Alters, suspends, or terminates any activity that is judged to be unsafe

A-4-1.3 The following site safety plan considerations are referenced from the *Standard Operating Safety Guides*, EPA, June 1992:

(a) Site description

(b) Entry objectives

(c) On-site organization
(d) On-site control
(e) Hazard evaluation
(f) Personal protective equipment
(g) On-site work plans
(h) Communication procedures
(i) Decontamination procedures
(j) Site safety and health plan.

A-4-2.1.3 Suggested materials to identify can include the most commonly released materials that are identified on several lists annually (EPA, State of California).

A-4-2.1.3.4 These factors include, but are not limited to, operation, calibration, response time, detection range, relative response, sensitivity, selectivity, inherent safety, environmental conditions, and nature of hazard. Also refer to NIOSH/OSHA/USCG/EPA *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities,* October 1985.

A-4-2.1.3.5 For example, the techniques for the use of the monitoring equipment should include monitoring for lighter than air gases in a confined area, heavier than air gases and vapors in a confined area, and heavier than air gases and vapors in an unconfined area.

A-4-2.2.1 For example, the significance of high concentrations of three airborne hazardous materials readings at scenarios relative to the hazards and harmful effects of the hazardous materials on the responders and the general public should be known.

A-4-2.2.4 The selection of scenarios to test the knowledge and ability to identify exposure symptoms should consider the following:

(a) Select materials common to the jurisdiction. This selection can be based on historical local records or any of the lists of materials that are commonly spilled throughout the country (i.e., chlorine, anhydrous ammonia, mineral acids, bases, aliphatic and aromatic solvents).

(b) Select concentrations and formulation of the materials common to the jurisdiction. It is especially important with pesticides to select realistic scenarios since the state of matter, behavior, and exposure routes can vary considerably from technical-grade materials to common-use formulations.

(c) Select weather conditions and release conditions appropriate to the jurisdiction since the behavior and the exposure hazards can vary considerably from summer conditions in the deep south to winter conditions in the north.

A-4-2.3 The condition of the container should be described using one of the following terms:

(a) Undamaged, no product release
(b) Damaged, no product release
(c) Damaged, product release
(d) Undamaged, product release

A-4-2.3.1 See Appendix D for the appropriate reference guides.

A-4-2.3.4 Some of the types of damage that containers can incur include the following:

(a) *Cracks.* A crack is a narrow split or break in the container metal that can penetrate through the metal of the container.

(b) *Scores.* A score is a reduction in the thickness of the container shell. It is an indentation in the container made by a relatively blunt object. A score is characterized by the relocation of the container or weld metal in such a way that the metal is pushed aside along the track of contact with the blunt object.

(c) *Gouges.* A gouge is a reduction in the thickness of the container. It is an indentation in the shell made by a sharp, chisel-like object. A gouge is characterized by the cutting and complete removal of the container or weld metal along the track of contact.

(d) *Dents.* A dent is a deformation of the container metal. It is caused by impact with a relatively blunt object. With a sharp radius, there is the possibility of cracking.

A-4-2.5.2.2

(a) Types:
1. Alpha
2. Beta
3. Gamma

(b) Units of measurement:
1. Activity
2. Quantity gamma
3. Absorbed dose

(c) Protection factors:
1. Half-life
2. Inverse square law
3. Time, distance, and shielding

The radiation absorbed dose (rad) and the roentgen equivalent man (rem) were used for many years to measure the amount and effect of ionizing radiation absorbed by humans. While officially replaced by the gray and the sievert, both rad and rem are still used. The rad equals the energy absorption of 100 ergs per gram of irradiated material (an erg is a unit of work or energy). The rem is the absorbed dose of ionizing radiation that produces the same biological effect as 1 rad of X rays or gamma rays (which are equal). The rem of X rays and gamma rays is therefore equal to the rad; for each type of radiation the number of rads is multiplied by a specific factor to find the number of rems. The millirem, 0.001 rems, is also frequently used; the average radiation dose received by a person in the United States is about 180 millirems per year.

In the SI system (Systeme International d' Unite's, or International System of Units), the gray and the sievert are used to measure radiation absorbed; these units have largely superseded the older rad and rem. The gray (Gy), equal to 100 rads, is now the base unit. It is also expressed as the energy absorption of 1 joule per kilogram of irradiated material. The sievert (Sv) is the absorbed dose of radiation that produces the same biological effect as 1 gray of X rays or gamma rays. The sievert is equal to 100 rems, and has superseded the rem. The becquerel (Bq) measures the radioactive strength of a source, but does not consider effects on tissue. One becquerel is defined as one disintegration (or other nuclear transformation) per second.

Curie

A curie is the standard unit of radioactivity, being the quantity of a radioactive isotope that decays at a rate of 3.7×10^{10} disintegrations per second.

Roentgen

A roentgen is the international unit of the intensity of X rays or gamma rays. It is the quantity of radiation that would produce, in air, ions carrying a positive or negative charge equal to one electrostatic unit in 0.001293 grams of air.

A-4-2.5.3 See A-3-2.4.

A-4-3.3.3.3 Refer to the Chemical Manufacturers Association and Association of American Railroads Hazardous Materials Technical Bulletin *Recommended Terms for Personal Protective Equipment,* issued October 1985. Also refer to NFPA 1991, *Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies;* NFPA 1992, *Standard on Liquid Splash-Protective Suits for Hazardous Chemical Emergencies;* and NFPA 1993, *Standard on Support Function Protective Clothing for Hazardous Chemical Operations.*

A-4-3.5.4 Safety hazards associated with confined spaces could include the following:

(a) Atmospheric hazards, such as the following:
1. Oxygen-deficient atmosphere
2. Oxygen-enriched atmosphere
3. Flammable/explosive atmosphere
4. Toxic atmosphere

(b) Physical hazards, such as the following:
1. Engulfment hazards
2. Falls/slips
3. Electrical hazards
4. Structural hazards
5. Mechanical hazards

A-4-4.2.2 Emergency procedures for personnel wearing vapor-protective clothing should include procedures for the following:

(a) Loss of air supply
(b) Loss of suit integrity
(c) Loss of verbal communications
(d) Buddy down in hot zone

A-4-4.2.3 Competency for wearing positive pressure self-contained breathing apparatus should have been met as part of Chapter 3.

A-4-4.3.1, A-4-4-3.2 Contact the Chlorine Institute for assistance in obtaining training on the use of the various chlorine kits.

A-4-4.3.7 The safety considerations for product transfer operations should include the following:

(a) Bonding
(b) Grounding
(c) Elimination of ignition sources and shock hazards

A-4-4.3.11 Product removal and transfer considerations should include the following:

(a) Inherent risks associated with such operations
(b) Procedures and safety precautions
(c) Equipment required

A-5-1.3 The following site safety plan considerations are referenced from the *Standard Operating Safety Guides*, EPA, June 1992:

(a) Site description
(b) Entry objectives
(c) On-site organization
(d) On-site control
(e) Hazard evaluation
(f) Personal protective equipment
(g) On-site work plans
(h) Communication procedures
(i) Decontamination procedures
(j) Site safety and health plan

A-5-2.2.3

(a) Types:
1. Alpha
2. Beta
3. Gamma

(b) Units of measurement:
1. Activity
2. Quantity gamma
3. Absorbed dose

(c) Protection factors:
1. Half-life
2. Inverse square law
3. Time, distance, and shielding

A-5-3.4.5.3 Safety precautions should include the following:

(a) Buddy systems
(b) Backup team
(c) Personal protective equipment

A-5-3.4.5.5 See A-4-3.5.4.

A-5-4.2 Criteria/factors should include the following:

(a) Task assignment (based upon strategical and tactical options)
(b) Operational safety
(c) Operational effectiveness
(d) Planning support
(e) Logistical support
(f) Administrative support

A-5-6.1.1 The appropriate steps to transfer command/control of the incident include the following:

(a) Fully brief the incoming command/control person on the details of the incident

(b) Communicate the transfer of command/control to all other interests involved in the incident

A-6-3.1.2 An example of a private sector specialist employee B is a person who regularly loads and unloads tank trucks of the specific chemical involved in the incident as part of their regular job. At a hazardous materials incident, this person would be assigned the task of transferring the contents of the damaged tank truck into another container. The private sector specialist employee B would not be involved with chemicals for which the responder has not been trained. This person would leave the hot or warm zone when this work is completed.

A-6-3.1.3 The following site safety plan considerations are referenced from the *Standard Operating Safety Guides*, EPA, June 1992:

(a) Site description
(b) Entry objectives

(c) On-site organization

(d) On-site control

(e) Hazard evaluation

(f) Personal protective equipment

(g) On-site work plans

(h) Communication procedures

(i) Decontamination procedures

(j) Site safety and health plan

A-6-3.4.1.2 Such factors include heat, cold, working in confined space, working in personal protective equipment, working in a flammable or toxic atmosphere, and pre-existing health conditions.

A-7-4.2 These abilities should include the following:

(a) Task assignment (based upon strategical and tactical options)

(b) Operational safety

(c) Operational effectiveness

(d) Planning support

(e) Information/research

(f) Logistical support

(g) Administrative support

A-8-1.1 These competencies are intended to address even situations when no "hazardous materials branch" is established, such as when only defensive (operational level) activities are being conducted.

If only defensive activities (i.e., at the operational level) are being conducted, the hazardous materials branch safety officer shall be trained to at least the operational level and in addition shall meet the competencies of this chapter.

If the functions and responsibilities of the hazardous materials branch safety officer are performed by the overall incident safety official or on-scene incident commander, that individual shall meet the competencies of this chapter.

A-8-1.2 Under this section, the hazardous materials branch safety officer is given specific responsibilities. It should be understood that even though these duties are to be carried out by the hazardous materials branch safety officer, the incident commander still has overall responsibility for the implementation of these tasks.

A-8-2.1.1 See A-4-2.5.2.2.

A-8-2.1.4 Conditions where protective clothing with thermal protection might be required if entry was made into an area where flammability was a concern can include the following:

(a) Unknown materials involved

(b) Oxygen-enriched atmosphere

(c) Detectable percent of LEL on monitoring instruments

(d) Materials with a wide flammable range present

(e) Reactive materials present

A-8-2.1.5 Conditions under which personnel would not be allowed in the hot zone include the following:

(a) Decontamination procedures not established or in place

(b) Advanced first aid and transportation not available

(c) Flammable atmosphere present

(d) Oxygen-enriched atmosphere of 23.5 percent or greater present

(e) Runaway reaction occurring

(f) Appropriate personal protective clothing not available

(g) No effective action can be taken

(h) Risk outweighs benefit

(i) Personnel not properly trained

(j) Insufficient personnel to perform tasks

A-8-2.1.8 Examples of scenarios that would help prepare emergency responders for situations they might encounter in the field include the following:

(a) Ammonia leaking from a fitting or valve of a railroad tank car

(b) Chlorine leaking from the valve stem of a 150-lb (68-kg) cylinder

(c) Lacquer thinner leaking from a hole in a 55-gal (208-L) drum

(d) Gasoline leaking from a hole in the side of an aluminum tank truck

(e) Carbaryl, a powdered insecticide, found stored in a broken cardboard drum

A-8-2.1.9.4 Such limiting factors include, but are not limited to, operation, calibration, response time, detection range, relative response, sensitivity, selectivity, inherent safety, environmental conditions, and nature of hazard. Also refer to *Standard Operating Safety Guides*, EPA, June 1992.

A-8-3.1 Potential action options are either defensive or offensive in nature. See NFPA 471, *Recommended Practice for Responding to Hazardous Materials Incidents*.

A-8-3.1.1 Safety precautions to observe while mitigating hazards or conditions can include the following:

(a) Elimination of ignition sources

(b) Using monitoring instruments

(c) Stabilizing the container

(d) Establishing emergency evacuation procedures

(e) Ensuring availability of hose lines and foam, when appropriate

(f) Evacuating exposures

(g) Isolating the area

(h) Protecting in place

(i) Wearing proper protective equipment

A-8-3.1.2 Safety precautions to be observed during search and rescue missions at hazardous materials incidents can include the following:

(a) Ensuring availability of appropriate personal protective clothing for all personnel

(b) Using monitoring instruments

(c) Maintaining an escape path

(d) Knowledge of approved hand signals by all personnel

(e) Ensuring availability of communications equipment for each team

(f) Preplanning the search sequence prior to entry

A-8-3.3.1 Benefits of pre-emergency planning include the following:

(a) Identifies and mitigates hazards during the planning process

(b) Familiarizes personnel with facility

(c) Identifies 24-hour responsible parties

(d) Identifies built-in containment systems

(e) Identifies the location of utility and other shutoff/shutdown valves and switches

(f) Identifies location of facility map

(g) Identifies location and quantities of hazardous materials

(h) Identifies vulnerable populations

(i) Identifies facility response capabilities

A-8-3.3.2 Hazards to observe when approaching a hazardous materials incident include the following:

(a) Inhalation hazard

(b) Dermal hazard

(c) Flammable hazard

(d) Reactive hazard

(e) Electrical hazard

(f) Mechanical hazard

A-8-3.3.3 The following are the elements of a site safety plan referenced from the *Standard Operating Safety Guides*, EPA, June 1992:

(a) Site description

(b) Entry objectives

(c) On-site organization

(d) On-site control

(e) Hazard evaluation

(f) Personal protective equipment

(g) On-site work plans

(h) Communication procedures

(i) Decontamination procedures

(j) Site safety and health plan

A-8-3.5.4 Typical action options can include surveying the scene, sampling, monitoring, plugging, and patching.

A-8-3.7.1 The elements of an emergency medical services plan according to NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents,* include the following:

(a) EMS control activities

(b) EMS component of an incident management system

(c) Medical monitoring of personnel utilizing chemical-protective and high temperature-protective clothing

(d) Triage of hazardous materials victims

(e) Medical treatment for chemically contaminated individuals

(f) Product and exposure information gathering and documentation

A-8-4.4.9 Safety considerations that can minimize secondary contamination include the following:

(a) Control zones are established and enforced

(b) All people and equipment exiting the hot zone are decontaminated

(c) Personnel performing decontamination are properly trained

(d) Personnel performing decontamination are properly protected

See NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents*.

A-8-4.5.1 Communications systems include in-suit radio communications, hand-held portable radios, air horns, and hand signals.

A-8-5.2.1.1 Examples of such situations or conditions can include, but are not limited to, the following:

(a) Fire or explosion

(b) Container failure

(c) Sudden change in weather conditions

(d) Failure of entry team personal protective clothing and/or equipment

(e) Updated information on identification of hazardous materials(s) involved warranting reassessment of level of protective clothing and equipment being used

A-8-6.2.1 Topics can include, but are not limited to, the following:

(a) The identity of the hazardous materials to which personnel have been or may have been exposed

(b) The signs and symptoms of exposure to the hazardous material(s) involved in the incident

(c) The signs and symptoms of critical incident stress

(d) The duration of a recommended observation period for such signs and symptoms

(e) Procedures to follow in the event of delayed presentation of such signs or symptoms

(f) The name of the individual responsible for post-incident medical contact

(g) Safety and health hazards remaining at the site

A-9-2.1.11 The heat-affected zone is an area in the metal next to the actual weld. This zone is less ductile than either the weld or the metal due to the effect of the welding process. The heat-affected zone is vulnerable to cracks.

A-9-2.1.16 Other methods for determining the amount of liquid include shipping papers, the presence of frost line, the use of touch to feel for the colder liquid level, and the use of heat sensors.

A-9-4.1.9 When bonding and grounding, a ground resistance tester and an ohm meter should be used. The ground resistance tester measures the earth's resistance to a ground rod, and the ohm meter measures the resistance of the connections to ensure electrical continuity. One ground rod might not be enough; more may have to be driven and connected to the first to ensure a good ground. Resistance varies with types of soils.

A-10-2.1.5 See A-9-2.1.16.

A-10-4.1.3 See A-9-4.1.9.

A-11-2.1.9 Methods for determining the amount of liquid include the use of gauges, shipping papers, the presence of frost line, the use of touch or feel for the colder liquid level, and the use of heat sensors.

A-11-2.1.10 See A-9-2.1.11.

A-11-4.1.3 , A-11-4.1.7, A-11-4.1.8, A-11-4.1.9 See A-9-4.1.9.

Appendix B Competencies for the Technician with a Flammable Liquids Bulk Storage Specialty

This appendix is not a part of the requirements of this NFPA document but is included for informational purposes only.

B-1 General.

B-1.1 Introduction. Technicians with a flammable liquids bulk storage specialty should meet all requirements of the first responder awareness, operational, and hazardous materials technician levels and the competencies of this Appendix. The technician with a flammable liquids bulk storage specialty also should receive additional training to meet applicable United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and other appropriate state, local, or provincial occupational health and safety regulatory requirements.

B-1.2 Definition. Technicians with a flammable liquids bulk storage specialty are those persons who, in incidents involving bulk flammable liquid storage tanks, provide support to the hazardous materials technician and other personnel, provide strategical and tactical recommendations to the on-scene incident commander, provide oversight for fire control and product removal operations, and act as a liaison between technicians, fire fighting personnel, and other outside resources. These technicians are expected to use appropriate personal protective clothing and specialized fire, leak, and spill control equipment.

B-1.3 Goal. The goal of this Appendix is to provide the technicians with a flammable liquids bulk storage specialty with the knowledge and skills to perform the following tasks safely. In addition to being competent at the technician levels, the technician with a flammable liquids bulk storage specialty should be able to:

(a) Analyze an incident involving a bulk flammable liquid storage tank to determine the magnitude of the problem by completing the following tasks:

1. Determine the type and extent of damage to the bulk liquid storage tank

2. Predict the likely behavior of the bulk liquid storage tank and its contents in an incident

(b) Plan a response for an incident involving a flammable liquid bulk storage tank within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by completing the following tasks:

1. Determine the response options (offensive, defensive, and nonintervention) for a hazardous materials incident involving flammable liquid bulk storage tanks

2. Ensure that the options are within the capabilities and competencies of available personnel, personal protective equipment, and control equipment

(c) Implement the planned response to a hazardous materials incident involving a flammable liquid bulk storage tank

B-1.4 Mandating of Competencies. This standard does not mandate that hazardous materials response teams performing offensive operations on flammable liquids bulk storage tanks have technicians with a flammable liquids bulk storage specialty. Technicians operating within the bounds of their training as listed in Chapter 4 of this standard are able to intervene in flammable liquids bulk storage incidents. However, if a hazardous materials response team desires to train some or all its technicians to have in-depth knowledge of flammable liquids bulk storage facilities, this Appendix sets out the recommended competencies.

B-2 Competencies — Analyzing the Incident.

B-2.1 Determining the Type and Extent of Damage to the Bulk Storage Tank. Given examples of storage tank incidents, technicians with a flammable liquids bulk storage specialty should describe the type of storage tank, and the type and extent of damage to the tank and its associated piping and fittings. The technician with a flammable liquids bulk storage specialty should be able to:

B-2.1.1 Given examples of various flammable liquid bulk storage operations, identify and describe the procedures for the normal movement and transfer of product(s) into and out of the facility and storage tanks.

Examples should be based upon local or regional facilities and could include marketing terminals, pipeline operations and terminals, refineries, and bulk storage facilities.

B-2.1.2 Given examples of the following atmospheric pressure bulk liquid storage tanks, describe the tank's design and construction features, and types of products commonly found.

(a) Cone roof tank

(b) Open (external) floating roof tank

(c) Open floating roof tank with a geodesic dome external roof

(d) Covered (internal) floating roof tank

According to NFPA 30, *Flammable and Combustible Liquids Code,* atmospheric tanks are defined as storage tanks operating at pressures from atmospheric to 0.5 psig. The floating roof on an open floating roof tank can be a pan roof or a pontoon floating roof, while the floating roof on a covered floating roof tank can be constructed of aluminum, steel or fiberglass, or a pontoon floating roof.

B-2.1.3 Given examples of the following types of low pressure horizontal and vertical bulk liquid storage tanks, describe the tank's uses and design and construction features.

(a) Horizontal tank

(b) Dome roof tank

According to NFPA 30, *Flammable and Combustible Liquids Code,* low pressure tanks are defined as storage tanks operating at pressures from 0.5 psig but not more than 15 psig.

B-2.1.4 Given examples of various atmospheric and low pressure bulk liquid storage tanks, describe the design and purpose of each of the following storage tank components, when present:

(a) Tank shell material of construction

(b) Type of roof and material of construction

(c) Primary and secondary roof seals (as applicable)

(d) Incident venting/pressure relief devices

(e) Tank valves

(f) Tank gauging devices

(g) Tank overfill device

(h) Secondary containment methods (as applicable)

(i) Tank piping and piping supports

(j) Fixed or semi-fixed fire protection system

B-2.1.5 Given three examples of primary and secondary spill confinement measures, describe the design, construction, and incident response considerations associated with each method provided.

B-2.2 Predicting the Likely Behavior of the Bulk Storage Tank and Contents. Technicians with a flammable liquids bulk storage specialty should predict the likely behavior of the tank and its contents. The technician with a flammable liquids bulk storage specialty should be able to:

B-2.2.1 Given examples of different types of bulk flammable liquid storage tank facilities, identify the impact of the following fire and safety features on the behavior of the products during an incident, when present:

(a) Tank spacing

(b) Product spillage and control (impoundment and diking)

(c) Tank venting and flaring systems

(d) Transfer and product movement capabilities

(e) Monitoring and detection systems

(f) Fire protection systems

B-2.2.2 Given a flammable liquid bulk storage tank involved in a fire, identify the factors to be evaluated as part of the risk assessment process, including the following:

(a) Type of storage tank

(b) Product involved

(c) Amount of product within the storage tank

(d) Nature of the incident (e.g., seal fire, tank overfill, full-surface fire, etc.)

(e) Tank spacing and exposures

(f) Fixed or semi-fixed fire protection systems present

B-2.2.3 Given three types of incidents involving flammable liquid bulk storage tanks, describe the likely fire and spill behavior for each incident.

Examples of fire and spill incidents could include tank overfills, seal fires on floating roof tanks, floating roof with a sunk internal roof, tank or piping failures, full surface fire, etc.

B-2.2.4 Describe the causes, hazards, and methods of handling the following conditions as they relate to fires involving flammable liquid bulk storage tanks:

(a) Frothover

(b) Slopover

(c) Boilover

For additional information, see NFPA 30, *Flammable and Combustible Liquids Code* and API 2021, *Guide for Fighting Fires In and Around Flammable and Combustible Atmospheric Petroleum Storage Tanks.*

B-3 Competencies — Planning the Response.

B-3.1 Determining the Response Options. Given an analysis of an incident involving flammable liquid storage tanks, technicians with a flammable liquids bulk storage specialty should determine response options for the storage tank involved. The technician with a flammable liquids bulk storage specialty should be able to:

B-3.1.1 Describe the factors to be evaluated in evaluating and selecting Class B fire fighting foam concentrates for use on flammable liquids.

B-3.1.2 Describe the factors to be considered for the portable application of Class B fire fighting foam concentrates for the following types of incidents:

(a) Flammable liquid spill (no fire)

(b) Flammable liquid spill (with fire)

(c) Flammable liquid storage tank fire

B-3.1.3 Given examples of different types of flammable liquid bulk storage tanks, identify and describe the application, use, and limitations of the types of fixed and semi-fixed fire protection systems that can be used, including the following:

(a) Foam chambers

(b) Catenary systems

(c) Subsurface injection system

(d) Fixed foam monitors

(e) Foam/water sprinkler systems

B-3.1.4 Describe the hazards, safety procedures, and tactical guidelines for handling an accumulated (in-depth) flammable liquid-spill fire.

B-3.1.5 Describe the hazards, safety procedures, and tactical guidelines for handling product/water drainage and runoff problems that can be created at a flammable liquid bulk storage tank fire.

B-3.1.6 Describe the hazards, safety procedures, and tactical guidelines for handling a flammable liquid bulk storage tank with a sunken floating roof.

B-3.1.7 Given a flammable liquid storage tank fire, describe the methods and associated safety considerations for extinguishing the following types of fires by using portable application devices:

(a) Pressure vent fire

(b) Seal fire on an open floating roof tank

(c) Seal fire on an internal floating roof tank

(d) Full-surface fire on an internal floating roof tank

(e) Full-surface fire on an external floating roof tank

(f) Dike fire

(g) Pipeline manifold fire

B-3.1.8 Given the size, dimensions, and products involved for a flammable liquid-spill fire, determine the following:

(a) Appropriate extinguishing agent

(b) Appropriate application method (both portable and fixed system application)

(c) Appropriate application rate and duration

(d) Required amount of Class B foam concentrate and required amount of water

(e) Volume and rate of application of water for cooling exposed tanks

For additional information, see NFPA 11, *Standard for Low-Expansion Foam*.

B-3.1.9 Given the size, dimensions, and product involved for a flammable liquid storage tank fire, determine the following:

(a) Appropriate extinguishing agent

(b) Appropriate application method (both portable and fixed system application)

(c) Appropriate application rate and duration

(d) Required amount of Class B foam concentrate and required amount of water

(e) Volume and rate of application of water for cooling involved and exposed tanks

For additional information, see NFPA 11, *Standard for Low-Expansion Foam*.

B-3.1.10 Given the size, dimensions, and product involved for a fire involving a single flammable liquid bulk storage tank and its dike area, determine the following:

(a) Appropriate extinguishing agent

(b) Appropriate application method (both portable and fixed system application)

(c) Appropriate application rate and duration

(d) Required amount of Class B foam concentrate and required amount of water

(e) Volume and rate of application of water for cooling involved and exposed tanks

For additional information, see NFPA 11, *Standard for Low-Expansion Foam*.

B-3.1.11 Given the size, dimensions, and product involved for multiple flammable liquid storage tanks burning within a common dike area, determine the following:

(a) Appropriate extinguishing agent

(b) Appropriate application method (both portable and fixed system application)

(c) Appropriate application rate and duration

(d) Amount of Class B foam concentrate and water required

(e) Volume and rate of application of water for cooling involved and exposed tanks

For additional information, see NFPA 11, *Standard for Low-Expansion Foam*.

B-4 Competencies — Implementing the Planned Response.

B-4.1 Implementing the Planned Response. Given an analysis of an incident involving flammable liquid storage tanks, technicians with a flammable liquids bulk storage specialty should implement or oversee the implementation of the selected response options safely and effectively. The technician with a flammable liquids bulk storage specialty should be able to:

B-4.1.1 Given a simulated flammable liquid fire, demonstrate the safe and effective methods for extinguishing the following types of fires by using portable application devices:

(a) Valve and/or flange fire

(b) Pump fire (horizontal or vertical)

(c) Pressure vent fire

(d) Large spill fire

(e) Storage tank fire

B-4.1.2 Given a simulated incident involving a three-dimensional flammable liquid fire, demonstrate the safe and effective method for controlling the fire by using portable application devices.

B-4.1.3 Demonstrate bonding and grounding procedures for the transfer of flammable liquids, including the following:

(a) Selection of proper equipment

(b) Sequence of bonding and grounding connections

(c) Proper testing of bonding and grounding connections

B-4.1.4 Given a simulated flammable liquid spill from a bulk storage tank or pipeline, describe the procedures for site safety and fire control during cleanup and removal operations.

Appendix C Competencies for the Technician with a Flammable Gases Bulk Storage Specialty

This appendix is not a part of the requirements of this NFPA document but is included for informational purposes only.

C-1 General.

C-1.1 Introduction. Technicians with a flammable gases bulk storage specialty should meet all requirements of the first responder awareness, operational, and hazardous materials technician levels and the competencies of this Appendix. The technician with a flammable gases bulk storage specialty also should receive additional training to meet applicable United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and other appropriate state, local, or provincial occupational health and safety regulatory requirements.

C-1.2 Definition. Technicians with a flammable gases bulk storage specialty are those persons who, in incidents involving bulk flammable gas storage tanks, provide support to the hazardous materials technician and other personnel, provide strategical and tactical recommendations to the on-scene incident commander, provide oversight for fire control and product removal operations, and act as a liaison between technicians, fire fighting personnel, and other outside resources. These technicians are expected to use appropriate personal protective clothing and specialized fire, leak, and spill control equipment.

C-1.3 Goal. The goal of this Appendix is to provide the technicians with a flammable gases bulk storage specialty with the knowledge and skills to perform the following tasks safely. In addition to being competent at the technician levels, the technician with a flammable gases bulk storage specialty should be able to:

(a) Analyze an incident involving a bulk flammable gas storage tank to determine the magnitude of the problem by completing the following tasks:

1. Determine the type and extent of damage to the bulk storage tank

2. Predict the likely behavior of the bulk storage tank and its contents in an incident

(b) Plan a response for an incident involving a flammable gas bulk storage tank within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by completing the following tasks:

1. Determine the response options (offensive, defensive, and nonintervention) for a hazardous materials incident involving flammable gas bulk storage tanks

2. Ensure that the options are within the capabilities and competencies of available personnel, personal protective equipment, and control equipment

(c) Implement the planned response to a hazardous materials incident involving a flammable gas bulk storage tank

C-1.4 Mandating of Competencies. This standard does not mandate that hazardous materials response teams performing offensive operations on flammable gas bulk storage tanks have technicians with a flammable gases bulk storage specialty. Technicians operating within the bounds of their training as listed in Chapter 4 of this standard are able to intervene in flammable gas bulk storage incidents. However, if a hazardous materials response team desires to train some or all its technicians to have in-depth knowledge of flammable gas bulk storage facilities, this Appendix sets out the recommended competencies.

C-2 Competencies — Analyzing the Incident.

C-2.1 Determining the Type and Extent of Damage to the Bulk Storage Tank. Given examples of storage tank incidents, technicians with a flammable gases bulk storage specialty should describe the type of storage tank and extent of damage to the tank and its associated piping and fittings. The technician with a flammable gases bulk storage specialty should be able to:

C-2.1.1* Given examples of various flammable gas bulk storage operations, identify and describe the procedures for the normal movement and transfer of product(s) into and out of the facility storage tanks.

Examples should be based upon local or regional facilities and could include marketing terminals, pipeline operations and terminals, refineries, bulk storage facilities, and underground storage caverns.

C-2.1.2* Given examples of the following types of high pressure bulk gas storage tanks, describe the tank's uses and design and construction features.

(a) Horizontal (bullet) tank

(b) Spherical tank

Additional information on the design and construction of high pressure bulk gas storage tanks can be referenced from NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases,* and API 2510-A, *Fire Protection Considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities.*

C-2.1.3 Given examples of various high pressure bulk gas storage tanks, point out and explain the design and purpose of each of the following storage tank components and fittings, when present:

(a) Liquid valve and vapor valve

(b) Safety relief valve

(c) Gauging device

(d) Tank piping and piping supports

(e) Fixed or semi-fixed fire protection system

C-2.2 Predicting the Likely Behavior of the Bulk Storage Tank and Contents. Technicians with a flammable gases bulk storage specialty should predict the likely behavior of the tank and its contents. The technician with a flammable gases bulk storage specialty should be able to:

C-2.2.1* Given examples of different types of bulk flammable gas storage tank facilities, identify the impact of the following fire and safety features on the behavior of the products during an incident, when present.

(a) Tank spacing

(b) Product spillage and control (impoundment and diking)

(c) Tank venting and flaring systems

(d) Transfer and product movement capabilities

(e) Monitoring and detection systems

(f) Fire protection systems

C-2.2.2 Given examples of different types of flammable gas bulk storage tanks, identify and describe the application, use, and limitations of the types of fixed and semi-fixed fire protection systems that can be used, including the following:

(a) Water spray systems

(b) Fixed foam monitors

(c) Fixed hydrocarbon monitoring systems

C-2.2.3 Given a flammable gas bulk storage tank and its associated piping, describe the likely breach/release mechanisms and fire scenarios.

C-3 Competencies — Planning the Response.

C-3.1 Determining the Response Options. Given an analysis of an emergency involving flammable gas storage tanks, technicians with a flammable gases bulk storage specialty should determine response options for the storage tank involved. The technician with a flammable gases bulk storage specialty should be able to:

C-3.1.1 Describe the hazards, safety, and tactical considerations required for the following types of flammable gas incidents:

(a) Flammable vapor release (no fire)

(b) Flammable vapor release (with fire)

(c) Liquefied flammable gas release (no fire)

(d) Liquefied flammable gas release (with fire)

C-3.1.2 Given a flammable gas storage tank with a liquid leak from the safety relief valve, describe the hazards, safety, and tactical considerations for controlling this type of leak.

C-3.1.3 Given a flammable gas fire from an elevated structure (e.g., tower or column), describe the hazards, safety, and tactical considerations for controlling this type of leak.

C-3.1.4 Describe the purpose of, potential risks associated with, procedures for, equipment required to implement, and safety precautions for the following product removal techniques:

(a) Transfer of liquids and vapors

(b) Flaring of liquids and vapors

(c) Venting

(d) Hot and cold tapping

C-3.1.5 Describe the effect flaring or venting of gas or liquid has on the pressure in the tank (flammable gas or flammable liquid product).

C-3.1.6 Describe the hazards, safety procedures, and tactical guidelines for handling product/water drainage and runoff problems that can be created at a flammable gas bulk storage facility incident.

C-4 Competencies — Implementing the Planned Response.

C-4.1 Implementing the Planned Response. Given an analysis of an emergency involving flammable gas bulk storage tanks, technicians with a flammable gases bulk storage specialty should implement or oversee the implementation of the selected response options safely and effectively. The technician with a flammable gases bulk storage specialty should be able to:

C-4.1.1 Given a simulated flammable gas incident, demonstrate the safe and effective method for controlling the following types of emergencies by using portable application devices:

(a) Unignited vapor release

(b) Valve and/or flange vapor release (no fire)

(c) Valve and/or flange fire

(d) Pump fire (horizontal or vertical)

C-4.1.2 Given a simulated incident involving the simultaneous release of both flammable liquids and flammable gases, demonstrate the safe and effective method for controlling the following types of emergencies by using portable application devices:

(a) Unignited vapor release

(b) Flange fire

(c) Pump seal fire

C-4.1.3 Demonstrate bonding and grounding procedures for the transfer of flammable gases, including the following:

(a) Selection of proper equipment

(b) Sequence of bonding and grounding connections

(c) Proper testing of bonding and grounding connections

C-4.1.4 Given a simulated flammable gas incident from a bulk storage tank or pipeline, describe the procedures for site safety and fire control during cleanup and removal operations.

Appendix D Referenced Publications

D-1 The following documents or portions thereof are referenced within this standard for informational purposes only and are thus not considered part of the requirements of this standard unless also listed in Chapter 12. The edition indicated here for each reference is the current edition as of the date of the NFPA issuance of this standard.

D-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 11, *Standard for Low-Expansion Foam*, 1994 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 1996 edition.

NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases*, 1995 edition.

NFPA 471, *Recommended Practice for Responding to Hazardous Materials Incidents*, 1997 edition.

NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents*, 1997 edition.

NFPA 1561, *Standard on Fire Department Incident Management System*, 1995 edition.

NFPA 1991, *Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies*, 1994 edition.

NFPA 1992, *Standard on Liquid Splash-Protective Suits for Hazardous Chemical Emergencies*, 1994 edition.

NFPA 1993, *Standard on Support Function Protective Clothing for Hazardous Chemical Operations*, 1994 edition.

Hazardous Materials Response Handbook.

D-1.2 Other Publications.

D-1.2.1 API Publications. American Petroleum Institute, 2101 L Street, NW, Washington, DC 20037.

API 2021, *Guide for Fighting Fires In and Around Flammable and Combustible Liquid Atmospheric Petroleum Storage Tanks*, 1991.

API 2510-A, *Fire Protection Considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities*, 1989.

D-1.2.2 Chemical Manufacturers Association Publications.

Chemical Manufacturers Association, 1300 Wilson Blvd., Arlington, VA 22209.

Packaging for Transporting Hazardous and Non-Hazardous Materials, June 1989 edition.

Recommended Terms for Personal Protective Equipment, 1985.

D-1.2.3 National Fire Academy Publication. National Fire Academy, Federal Emergency Management Agency, Emmitsburg, MD 21727.

Hazardous Materials Incident Analysis, 1984.

D-1.2.4 National Response Team Publication. National Response Team, National Oil and Hazardous Substances Contingency Plan, Washington, DC 20593.

NRT-1, *Hazardous Materials Emergency Planning Guide*, 1987.

D-1.2.5 U.S. Government Publications. U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402.

Title 29, *Code of Federal Regulations*, Parts 1910.119 – 1910.120

Title 40, *Code of Federal Regulations*, Part 261.33

Title 40, *Code of Federal Regulations*, Part 302

Title 40, *Code of Federal Regulations*, Part 355

Title 49, *Code of Federal Regulations*, Parts 170–179.

D-1.2.6 Miscellaneous Publications.

Benner, Ludwig, Jr., *A Textbook for Use in the Study of Hazardous Materials Emergencies*, 2nd edition, Lufred Industries, Inc., Oakton, VA, 1978.

Noll, Gregory G., et al., *Hazardous Materials, Managing the Incident*, 2nd edition, Fire Protection Publications, Stillwater, OK, 1995.

NIOSH/OSHA/USCG/EPA *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, October 1985.

Wright, Charles J., "Managing the Hazardous Materials Incident," *Fire Protection Handbook*, 18th edition, National Fire Protection Association, Quincy, MA, 1997.

EPA, *Standard Operating Safety Guides*, June 1992.

Maslansky, Carol J. and Stephen P., "Air Monitoring Instrumentation", New York, NY, Van Nostrand Reinhold, 1993.

Grey, Gerald L., et al., *Hazardous Materials/Waste Handling for the Emergency Responder*, Fire Engineering Publications, New York, NY, 1989.

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Tentative Interim Amendment

NFPA 472

Professional Competence of Responders to Hazardous Materials Incidents

1997 Edition

Reference: Chapters 2, 3, 4 and 5
TIA 97-1 (NFPA 472)

Pursuant to Section 4 of the NFPA Regulations Governing Committee Projects, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents,* 1997 edition. The TIA was processed by the Hazardous Materials Response Personnel Committee, and was issued by the Standards Council on April 3, 1997, with an effective date of April 23, 1997.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. Add the following new paragraphs to read:

2-2.1.13* Identify types of locations that could become targets for criminal or terrorist activity using hazardous materials.

A-2-2.1.13 The following are some examples of potential criminal or terrorist targets:

(a) Public assembly
(b) Public buildings
(c) Mass transit systems
(d) Places with high economic impact
(e) Telecommunications facilities
(f) Places with historical or symbolic significance

2-2.1.14* Identify at least 4 indicators of possible criminal or terrorist activity involving hazardous materials.

A-2-2.1.14 The following are some examples of indicators of possible criminal or terrorist activity:

(a) The presence of hazardous materials or laboratory equipment that is not relevant to the occupancy
(b) Intentional release of hazardous materials
(c) Unexplained patterns of sudden onset illnesses or deaths
(d) Unusual odors or tastes
(e) Unexplained signs of skin, eye, or airway irritation
(f) Unusual security, locks, bars on windows, covered windows, and barbed wire
(g) Unexplained vapor clouds, mists, and plumes
(h) Victims twitching, tightness in chest, sweating, pin-point pupils (miosos), runny nose (rhinorrhea), and nausea and vomiting

2-4.1.6* Identify the specific actions necessary when an incident is suspected to involve criminal or terrorist activity.

A-2-4.1.6 The following are some examples of actions required to be taken:

(a) Communicate the suspicion during the notification process
(b) Isolate potentially exposed people
(c) Document the initial observation

3-2.1.6* Identify at least 3 additional hazards that could be associated with an incident involving criminal or terrorist activity.

A-3-2.1.6 The following are some example of hazards:

(a) Secondary events intended to incapacitate emergency responders
(b) Armed resistance
(c) Use of weapons
(d) Booby traps
(e) Secondary contamination from handling patients

3-2.2.6 Identify the type of assistance provided by the federal defense authorities, such as Defense Logistics Agency and U.S. Army Operations Center, with respect to criminal or terrorist activities involving hazardous materials.

3-2.2.6.1 Identify the procedure for contacting federal defense authorities as specified in the local emergency response plan (ERP) or the organization's standard operating procedures (SOP).

3-2.3.9* Given the following types of warfare agents, identify the corresponding 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

A-3-2.3.9 Some examples of hazard class are as follows:

	DOT Hazard Class
(a) Nerve agents	
Tabun (GA)	6.1
Sarin (GB)	6.1
Soman (GD)	6.1
V agent (VX)	6.1
(b) Vesicants (blister agents)	
Mustard (H)	6.1
Distilled mustard (HD)	6.1
Nitrogen mustard (HN)	6.1
Lewisite (L)	6.1
(c) Blood agents	
Hydrogen cyanide (AC)	6.1
Cyanogen chloride (CK)	2.3
(d) Choking agents	
Chlorine (CL)	2.3
Phosgene (CG)	2.3

(e) Irritants

CS	6.1
CR	6.1
CN	6.1
OC	2.2 (subsequent risk 6.1)

(f) Biological agents and toxins

Anthrax	6.2
Mycotoxin	6.1 or 6.2
Plague	6.2
Tularemia	6.2

3-3.4.5 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.

3-4.4.6 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.

4-2.1.1.7 For each of the following, describe a method that can be used to detect them:

(a) Nerve agents
(b) Vesicants (blister agents)
(c) Biological agents and toxins
(d) Irritants (riot control agents)

4-2.3.1.4 Demonstrate a method for collecting samples of the following:

(a) Liquid
(b) Solid
(c) Gas

4-3.5.6 Identify the procedures, equipment, and safety precautions for collecting legal evidence at hazardous materials incidents.

5-2.2.7* Describe the health risks associated with the following:

(a) Nerve agents
(b) Vesicants (blister agents)
(c) Blood agents
(d) Choking agents
(e) Biological agents and toxins
(f) Irritants (riot control agents)

A-5-2.2.7 Some examples are as follows:

Common Name	**NFPA 704**	**Military Abbreviation**	**PEL/TWA mg/m³**	**LD_{50} (mg min/m³)**
(a) Nerve agents				
Sarin	411	GB	0.0001	70
Soman	411	GD	0.00003	70
Tabun	421	GA	0.0001	133
V agent	411	VX	0.00001	10 (percutaneous) 30 (vapor)
(b) Vesicants (blister agents)				
Mustard	411	H, HD	0.003	1500
Lewisite	411	L	0.003	1000-1500
(e) Biological agents and toxins		**Days/Latency**	**Fatal**	
Anthrax		1-5	Yes	
Botulism		2-3	Yes	
Cholera		2-5	Yes	
Encephalitis		2-5	Yes	
Plague		1-3	Yes	
Tularemia		1-10	Yes	

5-3.3.5 Identify the limitations of military chemical/biological protective clothing.

5-6.4.6 Identify the procedures required for legal documentation and chain of custody/continuity described in the organization's standard operating procedures or the local emergency response plan.

2. Revise the following paragraphs to read as follows:

2-4.2 Initiating the Notification Process. Given either a facility or transportation scenario involving hazardous materials, regardless of the presence of criminal or terrorist activities, the first responder at the awareness level shall identify the appropriate initial notifications to be made and how to make them, consistent with the local emergency response plan or the organization's standard operating procedures.

3-4.1.6 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.

A-3-4.1.6(b) See A-3.2.1.6.

4-2.2.2 Describe the following terms and explain their significance in the risk assessment process:

(a) Acid, caustic
(b) Air reactivity
(c) Biological agents and toxins
(d) Boiling point
(e) Catalyst
(f) Chemical interactions
(g) Chemical reactivity
(h) Compound, mixture
(i) Concentration
(j) Corrosivity (pH)
(k) Critical temperatures and pressure
(l) Expansion ratio
(m) Flammable (explosive) range (LEL & UEL)
(n) Fire point
(o) Flash point
(p) Halogenated hydrocarbon
(q) Ignition (autoignition) temperature
(r) Inhibitor
(s) Instability
(t) Ionic and covalent compounds
(u) Irritants (riot control agents)
(v) Maximum safe storage temperature (MSST)
(w) Melting point/freezing point
(x) Miscibility
(y) Nerve agents
(z) Organic and inorganic
(aa) Oxidation potential
(bb) pH
(cc) Physical state (solid, liquid, gas)
(dd) Polymerization
(ee) Radioactivity
(ff) Saturated, unsaturated, and aromatic hydrocarbons
(gg) Self-accelerating decomposition temperature (SADT)
(hh) Solution, slurry
(ii) Specific gravity
(jj) Strength

(kk) Sublimation
(ll) Temperature of product
(mm) Toxic products of combustion
(nn) Vapor density
(oo) Vapor pressure
(pp) Vesicants (blister agents)
(qq) Viscosity
(rr) Volatility
(ss) Water reactivity
(tt) Water solubility

5-3.4.3 Given the local emergency response plan and/or the organization's standard operating procedures, identify which agency will perform the following:

(a) Receive the initial notification
(b) Provide secondary notification and activation of response agencies
(c) Make ongoing assessments of the situation
(d) Command on-scene personnel (incident management system)
(e) Coordinate support and mutual aid
(f) Provide law enforcement and on-scene security (crowd control)
(g) Provide traffic control and rerouting
(h) Provide resources for public safety protective action (evacuation or shelter in-place)
(i) Provide fire suppression services when appropriate
(j) Provide on-scene medical assistance (ambulance) and medical treatment (hospital)
(k) Provide public notification (warning)
(l) Provide public information (news media statements)
(m) Provide on-scene communications support
(n) Provide emergency on-scene decontamination when appropriate
(o) Provide operational-level hazard control services
(p) Provide technician-level hazard mitigation services
(q) Provide environmental remedial action ("cleanup") services
(r) Provide environmental monitoring
(s) Implement on-site accountability
(t) Provide on-site responder identification
(u) Provide command post security
(v) Provide crime scene investigation
(w) Provide evidence collection and sampling