NFPA 472

Standard for Professional Competence of Responders to Hazardous Materials Incidents

2002 Edition

NFPA, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

IMPORTANT NOTICE ABOUT THIS DOCUMENT

NFPA codes, standards, recommended practices, and guides, of which the document contained herein is one, are developed through a consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on fire and other safety issues. While the NFPA administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in its codes and standards.

The NFPA disclaims liability for any personal injury, property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this document. The NFPA also makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making this document available, the NFPA is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is the NFPA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

The NFPA has no power, nor does it undertake, to police or enforce compliance with the contents of this document. Nor does the NFPA list, certify, test or inspect products, designs, or installations for compliance with this document. Any certification or other statement of compliance with the requirements of this document shall not be attributable to the NFPA and is solely the responsibility of the certifier or maker of the statement.

NOTICES

All questions or other communications relating to this document and all requests for information on NFPA procedures governing its codes and standards development process, including information on the procedures for requesting Formal Interpretations, for proposing Tentative Interim Amendments, and for proposing revisions to NFPA documents during regular revision cycles, should be sent to NFPA headquarters, addressed to the attention of the Secretary, Standards Council, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

Users of this document should be aware that this document may be amended from time to time through the issuance of Tentative Interim Amendments, and that an official NFPA document at any point in time consists of the current edition of the document together with any Tentative Interim Amendments then in effect. In order to determine whether this document is the current edition and whether it has been amended through the issuance of Tentative Interim Amendments, consult appropriate NFPA publications such as the *National Fire Codes*® Subscription Service, visit the NFPA website at www.nfpa.org, or contact the NFPA at the address listed above.

A statement, written or oral, that is not processed in accordance with Section 5 of the Regulations Governing Committee Projects shall not be considered the official position of NFPA or any of its Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation.

The NFPA does not take any position with respect to the validity of any patent rights asserted in connection with any items which are mentioned in or are the subject of this document, and the NFPA disclaims liability for the infringement of any patent resulting from the use of or reliance on this document. Users of this document are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Users of this document should consult applicable federal, state, and local laws and regulations. NFPA does not, by the publication of this document, intend to urge action that is not in compliance with applicable laws, and this document may not be construed as doing so.

NFPA 472

Standard for

Professional Competence of Responders to Hazardous Materials Incidents

2002 Edition

This edition of NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents*, was prepared by the Technical Committee on Hazardous Materials Response Personnel and acted on by NFPA at its November Association Technical Meeting held November 10–14, 2001, in Dallas, TX. It was issued by the Standards Council on January 11, 2002, with an effective date of January 31, 2002, and supersedes all previous editions.

This edition of NFPA 472 was approved as an American National Standard on January 31, 2002.

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 the interest is due to an increased awareness of the wide proliferation of hazardous materials, while much of the interest 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. During the same time period the Committee developed a related document, NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents*, which was also released as a 1992 edition.

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

In 1998 the committee processed a Tentative Interim Amendment (TIA) to address concerns related to the unique challenges of responding to hazardous materials incidents caused by criminal or terrorist activity. These concerns were motivated by incidents such as the bombing of the Murrah Building in Oklahoma City and other national and international incidents.

The TIA added paragraphs on recognizing criminal and terrorist activities, actions to take when criminal or terrorist activity is suspected, differentiating between chemical and biological agents, identification of body substance isolation and decontamination procedures when faced with an incident involving biological warfare, and other similar competencies.

In this 2002 edition, the TIA material was updated and moved into the body of the text with modifications and additions, along with updates to coordinate with a similar TIA and other new material in NFPA 473. The events of September 11, 2001, which occurred after the Committee had completed its development work on this new edition, demonstrated the necessity of increasing awareness and preparation for terrorist incidents involving hazardous materials of all kinds.

In addition to new coverage of weapons of mass destruction, this 2002 edition contains material on responding to transportation or other incidents involving radioactive materials. This content began as a suggestion from the U.S. Department of Energy (DOE). A task group with DOE representation worked on a draft for Committee consideration. One addition includes Annex D, "Competencies for the Technician with a Radioactive Material Specialty."

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.

The Committee would like to dedicate this standard to the fallen heroes of the terrorist attack on September 11, 2001. Many lives were saved because of their efforts. These individuals gave the ultimate sacrifice in the line of duty and stand alone in their bravery and dedication to their job and their country. Our thoughts and prayers are with their families, friends and co-workers. Let us never forget these brave individuals and the other emergency responders who have died in the line of duty. The Committee especially wishes to honor Committee member John J. Fanning, FDNY, who died in the line of duty on September 11.

Technical Committee on Hazardous Materials Response Personnel

John M. Eversole, *Chair*
Chicago Fire Department, IL [E]
Rep. International Association of Fire Chiefs

Gerald L. Grey, *Vice Chair*
San Francisco Fire Department, CA [U]
Rep. International Society of Fire Service Instructors

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

Donald Beckering, Minnesota State Colleges and Universities, MN [U]
Glenn P. Benarick, Fairfax County Fire and Rescue Department, VA [E]
Bud Berry, 3M, MN [M]
Rep. American Society of Safety Engineers
Gregory F. Britt, Virginia Department of Emergency Services, VA [U]
Gene P. Carlson, VFIS-Glatfeller Insurance Group, PA [I]
Rep. VFIS
Don L. Crowson, Arlington Fire Department, TX [U]
Manuel H. Ehrlich, Jr., Wayne, NJ [M]
Rep. American Chemistry Council
Richard B. Emery, Emery & Associates, Inc., IL [SE]
Paul L. Errico, Paul L. Errico Associates, CT [U]
Rep. Mid-Fairfield County Hazardous Materials Unit
Remmit P. R. Gaade, Gaade & Associates, ON [SE]
Warren D. Graef, Jr., Graef E&S Consultants, TX [SE]
H. Dieter Heinz, Heinz Laboratories International, CA [E]
Rep. California State Firefighters' Association
Sandra Holka, Dow Corning Corporation, MI [U]
Rep. NFPA Industrial Fire Protection Section
Robert J. Ingram, New York City Fire Department/Haz Mat Operations, NY [U]
Jan D. Kuczma, U.S. Fire Administration, MD [SE]
M. Jo McMullen, Summit County Hazardous Materials Response Team, OH [SE]
Gregory G. Noll, Hildebrand & Noll Associates, Inc., PA [SE]
Irving Owens, Rhode Island State Fire Marshal, RI [E]
Rep. International Fire Marshals Association
Bruce Potoka, U.S. Environmental Protection Agency, OH [E]
Danny G. Simpson, Association of American Railroads, CO [RT]
Daniel Gary Snell, Houston Fire Department, TX [U]
William H. Stringfield, William H. Stringfield & Associates, Inc., AL [SE]

Alternates

William Lee Bullock, Fairfax County Fire and Rescue Department, VA [E]
(Alt. to G. P. Benarick)
Michael E. Burns, Michael E. Burns & Associates, MD [M]
(Alt. to B. Berry)
H. K. "Skip" Carr, H. K. Carr and Associates Inc., NJ [U]
(Alt. to G. L. Grey)
Jeffery C. Davis, Association of American Railroads, CO [RT]
(Alt. to D. G. Simpson)
Leslie D. English, Wackenhut Services, Inc., AL [U]
(Alt. to S. Holka)
John J. Fanning, New York City Fire Department, NY [U]
(Alt. to R. J. Ingram)
Michael S. Hildebrand, Hildebrand & Noll Associates, Inc., MD [SE]
(Alt. to G. G. Noll)
Louis J. Klein, VFIS, FL [I]
(Alt. to G. P. Carlson)
John P. O'Gorman, Ponderosa Volunteer Fire Department, TX [E]
(Alt. to J. M. Eversole)
Robert C. Weiderhold, National Fire Academy, VA [SE]
(Alt. to J. D. Kuczma)

Nonvoting

Samuel Alecio, Sao Paulo Fire Department, SP, Brazil

Jerry W. Laughlin, NFPA Staff Liaison

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.

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

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.

Contents

NFPA 472

Standard for

Professional Competence of Responders to Hazardous Materials Incidents

2002 Edition

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

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, Annex H lists the complete title and edition of the source documents for both mandatory and nonmandatory extracts. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text shall be sent to the appropriate technical committee.

Information on referenced publications can be found in Chapter 2 and Annex H.

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard shall identify the levels of competence required of responders to hazardous materials incidents.

1.1.2 This standard shall cover 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.

1.2 Purpose.

1.2.1 The purpose of this standard shall be to specify minimum competencies for those who will respond to hazardous materials incidents.

1.2.2 One purpose of the competencies contained herein shall be 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.

1.3 Application. It shall not be the intent of this standard to restrict any jurisdiction from exceeding these minimum requirements.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 471, *Recommended Practice for Responding to Hazardous Materials Incidents,* 2002 edition.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response,* 2001 edition.

2.3 Other Publications.

2.3.1 U.S. Government Publication. U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402.

Emergency Response Guidebook, U.S. Department of Transportation, 2000 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not included, common usage of the terms shall apply.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

3.2.3* 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 appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.4 Shall. Indicates a mandatory requirement.

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

3.3 General Definitions.

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

3.3.2 Chemical. Regulated and nonregulated hazardous materials (solids, liquids, and gases, whether natural or manmade, including petroleum products) with the potential for creating harm to people, the environment, and property when released. [**306:**1.5]

3.3.3 CHEMTREC. The Chemical Transportation Emergency Center is a public service of the American Chemistry Council, which provides emergency response information and assistance on a 24-hour basis for responders to hazardous materials incidents.

3.3.4 Cold Zone. See 3.3.13, Control Zones.

3.3.5 Competence. Possessing knowledge, skills, and judgment needed to perform indicated objectives satisfactorily. [**473:**3.3]

3.3.6* Confined Space. An area large enough and so configured that a member can bodily enter and perform assigned

work but which has limited or restricted means for entry and exit and is not designed for continuous human occupancy. [**1500:**3.3]

3.3.7 Confinement. Those procedures taken to keep a material, once released, in a defined or local area. [**471:**3.3]

3.3.8* Container. Any vessel or receptacle that holds material, including storage vessels, pipelines, and packaging (*see definition of Packaging*). [**30:**1.6]

3.3.9 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). [**471:**3.3]

3.3.10 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. [**1500:**3.3]

3.3.11 Contamination. The process of transferring a hazardous material from its source to people, animals, the environment, or equipment, which may act as a carrier. [**471:**3.3]

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

3.3.13* Control Zones. The areas at a hazardous materials incident that are designated based upon safety and the degree of hazard. [**471:**3.3]

3.3.13.1 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.

3.3.13.2 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.

3.3.13.3* Warm Zone. The control zone at a hazardous materials incident site where personnel and equipment decontamination and hot zone support takes place.

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

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

3.3.16 Decontamination Corridor. The area usually located within the warm zone where decontamination procedures take place.

3.3.17 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. [**471:**3.3]

3.3.18* Demonstrate. To show by actual performance.

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

3.3.20 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.

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

3.3.22 Emergency Response Plan. A plan developed by an agency, with the cooperation of all participating agencies, that details specific actions to be performed by all personnel who are expected to respond during an emergency.

3.3.23 Endangered Area. The actual or potential area of exposure from a hazardous material.

3.3.24* Exposure. The process by which people, animals, the environment, and equipment are subjected to or come in contact with a hazardous material.

3.3.25 First Responder at the Awareness Level. Those persons who, in the course of their normal duties, could be the first on the scene of an emergency involving hazardous materials and who are expected to recognize the presence of hazardous materials, protect themselves, call for trained personnel, and secure the area. *(See Annex E.)*

3.3.26 First Responder at the Operational Level. 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 and who are expected to respond in a defensive fashion to control the release from a safe distance and keep it from spreading. *(See Annex E.)*

3.3.27* Gross Decontamination. The initial phase of the decontamination process during which the amount of surface contaminant is significantly reduced. [**471:**3.3]

3.3.28 Hazard/Hazardous. Capable of posing an unreasonable risk to health, safety, or the environment; capable of causing harm. [**471:**3.3]

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

3.3.30* Hazardous Materials Branch. The function within an overall incident management system that deals with the mitigation of the hazardous materials portion of a hazardous materials incident.

3.3.31 Hazardous Materials Branch Officer. The person who is responsible for directing and coordinating all operations assigned to the hazardous materials branch by the incident commander.

3.3.32* Hazardous Materials Branch Safety Officer. The person who works within an incident management system (IMS) to ensure that recognized safe practices are followed within the hazardous materials branch.

3.3.33* 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.

3.3.34 Hazardous Materials Technician. Person who responds to releases or potential releases of hazardous materials for the purpose of controlling the release using specialized protective clothing and control equipment. *(See Annex E.)*

3.3.34.1 Hazardous Materials Technician with a Cargo Tank Specialty. Person who provides support to the hazardous materials technician, provides oversight for product removal and movement of damaged cargo tanks, and acts as a liaison between technicians and other outside resources.

3.3.34.2 Hazardous Materials Technician with a Tank Car Specialty. Person who provides support to the hazardous materials technician, provides oversight for product removal and movement of damaged tank cars, and acts as a liaison between technicians and other outside resources.

3.3.34.3* Hazardous Materials Technician with an Intermodal Tank Specialty. Person who provides support to the hazardous materials technician, provides oversight for product removal and movement of damaged intermodal tanks, and acts as a liaison between technicians and other outside resources.

3.3.35 Hot Zone. See 3.3.13, Control Zones.

3.3.36 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.

3.3.37 Incident. An emergency involving the release or potential release of a hazardous material, with or without fire. [**295:**1.3]

3.3.38* Incident Commander. The person who is responsible for all decisions relating to the management of the incident and is in charge of the incident site. *(See Annex E.)*

3.3.39* Incident Management System. A system that defines the roles and responsibilities to be assumed by personnel and the operating procedures to be used in the management and direction of emergency operations.

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

3.3.41 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.

3.3.42 Match. To provide with a counterpart.

3.3.43 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.

3.3.44 Monitoring Equipment. Instruments and devices used to identify and quantify contaminants. [**471:**3.3]

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

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

3.3.47* Packaging. Any container that holds a material (hazardous and nonhazardous).

3.3.47.1* Bulk Packaging. Any packaging, including transport vehicles, having a liquid capacity of more than 450 L (119 gal), a solids capacity of more than 400 kg (882 lb), or a compressed gas water capacity of more than 454 kg (1001 lb).

3.3.47.2 Nonbulk Packaging. Any packaging having a liquid capacity of 450 L (119 gal) or less, a solids capacity of 400 kg (882 lb) or less, or a compressed gas water capacity of 454 kg (1001 lb) or less.

3.3.47.3 Radioactive Materials Packaging. Any packaging for radioactive materials having a use or capacity meeting one of the criteria in 3.3.47.3.1 through 3.3.47.3.5.

3.3.47.3.1 Excepted Packaging. Range from product's fiberboard box to a sturdy wooden or steel crate, and may include limited quantities of materials, instruments, and articles such as smoke detectors.

3.3.47.3.2 Industrial Packaging. Packaging grouped into three categories based on the strength of the packaging.

3.3.47.3.3 Strong-tight Packaging. Used for domestic shipment of materials with low levels of radioactivity with a low hazard and historical safety record such as depleted or natural uranium and rubble.

3.3.47.3.4 Type A. Packaging for radioactive materials such as radiopharmaceuticals and low level materials typically having an inner containment vessel of glass, plastic, or metal, and packaging materials made of polyethylene, rubber or vermiculite.

3.3.47.3.5 Type B. Packaging for radioactive materials such as spent fuel, high-level radioactive waste, and high concentrations of radioisotopes ranging from small drums (208 liter), Tru-Packs, to heavily shielded steel casks that can weigh more than 100 metric tons.

3.3.48 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. [**471:**3.3]

3.3.49 Permeation. A chemical action involving the movement of a chemical, on a molecular level, through intact material. [**471:**3.3]

3.3.50* 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. [**1581:**1.3]

3.3.51* 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.

3.3.52* Private Sector Specialist Employee A. That person who is specifically trained to handle incidents involving chemicals or containers for chemicals used in the organization's area of specialization. Consistent with the organization's emergency response plan and standard operating procedures, the private sector specialist employee A is 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.

3.3.53* Private Sector Specialist Employee B. 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 the individual's area of specialization. Because of the employee's 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 the organization's emergency response plan and standard operating procedures and the local emergency response plan.

3.3.54* Private Sector Specialist Employee C. That person who responds to emergencies involving chemicals and/or containers within the organization's area of specialization. Consistent with the organization's emergency response plan and standard operating procedures, the private sector specialist employee 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.

3.3.55* Protective Clothing. Equipment designed to protect the wearer from heat and/or hazardous materials contacting the skin or eyes.

3.3.55.1* Structural Fire–Fighting Protective Clothing. The protective clothing normally worn by fire fighters during structural fire-fighting operations, which 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.

3.3.55.2* High Temperature–Protective Clothing. Protective clothing designed to protect the wearer for short-term high temperature exposures.

3.3.55.3* 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.

3.3.55.3.1* 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.

3.3.55.3.2* 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.

3.3.56 Qualified. Having knowledge of the installation, construction, or operation of apparatus and the hazards involved. [**25:**3.3]

3.3.57 Radioactive Material. Any material that spontaneously emits ionizing radiation.

3.3.58* Respiratory Protection. Equipment designed to protect the wearer from the inhalation of contaminants.

3.3.59* Response. That portion of incident management in which personnel are involved in controlling a hazardous materials incident.

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

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

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

3.3.63 Stabilization. The point in an incident at which the adverse behavior of the hazardous material is controlled. [**424:**1.3]

3.3.64* State. Any outlying U.S. areas where this standard is in effect.

3.3.65* 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.

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

3.3.67 Warm Zone. See 3.3.13, Control Zones.

Chapter 4 Competencies for the First Responder at the Awareness Level

4.1 General.

4.1.1 Introduction.

4.1.1.1 First responders at the awareness level shall be trained to meet all competencies of this chapter.

4.1.1.2 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 state, local, or provincial occupational health and safety regulatory requirements.

4.1.2 Goal.

4.1.2.1 The goal of the competencies at the awareness level shall be to provide first responders with the knowledge and skills to perform the tasks in 4.1.2.2 safely.

4.1.2.2 When first on the scene of an emergency involving hazardous materials, the first responder at the awareness level shall be able to perform the following tasks:

(1) 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:
   (a) Detect the presence of hazardous materials
   (b) 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
   (c) Collect hazard information from the current edition of the *Emergency Response Guidebook*

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

4.2 Competencies — Analyzing the Incident.

4.2.1 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 and also shall meet the following requirements:

(1)*Identify the definition of hazardous materials (or dangerous goods, in Canada).
(2) Identify the UN/DOT hazard classes and divisions of hazardous materials and identify common examples of materials in each hazard class or division.
(3)*Identify the primary hazards associated with each of the UN/DOT hazard classes and divisions of hazardous materials by hazard class or division.
(4) Identify the difference between hazardous materials incidents and other emergencies.
(5) Identify typical occupancies and locations in the community where hazardous materials are manufactured, transported, stored, used, or disposed of.
(6) Identify typical container shapes that can indicate the presence of hazardous materials.
(7) Identify facility and transportation markings and colors that indicate hazardous materials, including the following:
  (a) Transportation markings, including UN/NA identification number marks, marine pollutant mark, elevated temperature (HOT) mark, commodity marking, and inhalation hazard mark
  (b) NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, markings
  (c) Military hazardous materials markings
  (d) Special hazard communication markings for each hazard class
  (e) Pipeline markings
  (f) Container markings
(8) Given an NFPA 704 marking, describe the significance of the colors, numbers, and special symbols.
(9) Identify U.S. and Canadian placards and labels that indicate hazardous materials.
(10) Identify the following basic information on material safety data sheets (MSDS) and shipping papers that indicates hazardous materials:
  (a) Identify where to find MSDS.
  (b) Identify entries on an MSDS that indicate the presence of hazardous materials.
  (c) Identify the entries on shipping papers that indicate the presence of hazardous materials.
  (d) Match the name of the shipping papers found in transportation (air, highway, rail, and water) with the mode of transportation.
  (e) Identify the person responsible for having the shipping papers in each mode of transportation.
  (f) Identify where the shipping papers are found in each mode of transportation.
  (g) Identify where the papers can be found in an emergency in each mode of transportation.
(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.
(12) Describe the limitations of using the senses in determining the presence or absence of hazardous materials.
(13)*Identify at least four types of locations that could become targets for criminal or terrorist activity using hazardous materials.
(14)*Describe the difference between a chemical and a biological incident.
(15)*Identify at least four indicators of possible criminal or terrorist activity involving chemical agents.
(16)*Identify at least four indicators of possible criminal or terrorist activity involving biological agents.

4.2.2 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, and also shall meet the following requirements:

(1) Identify difficulties encountered in determining the specific names of hazardous materials in both facilities and transportation.
(2) Identify sources for obtaining the names of, UN/NA identification numbers for, or types of placard associated with hazardous materials in transportation.
(3) Identify sources for obtaining the names of hazardous materials in a facility.

4.2.3* 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 *Emergency Response Guidebook* and also shall meet the following requirements:

(1)*Identify the three methods for determining the guide page for a hazardous material.
(2) Identify the two general types of hazards found on each guide page.

4.3* Competencies — Planning the Response. (Reserved)

4.4 Competencies — Implementing the Planned Response.

4.4.1* 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 *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 and shall also meet the following requirements:

(1) Identify the location of both the local emergency response plan and the organization's standard operating procedures.
(2) Identify the role of the first responder at the awareness level during a hazardous materials incident.
(3) Identify the following basic precautions to be taken to protect themselves and others in a hazardous materials incident:
  (a) Identify the precautions necessary when providing emergency medical care to victims of hazardous materials incidents.
  (b) Identify typical ignition sources found at the scenes of hazardous materials incidents.
  (c)*Identify the ways hazardous materials are harmful to people, the environment, and property at hazardous materials incidents.
  (d)*Identify the general routes of entry for human exposure to hazardous materials for each hazard class.
(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

(5) 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

(6) First responders at the awareness level shall 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

(7) First responders at the awareness level shall identify the shapes of recommended initial isolation and protective action zones.

(8) First responders at the awareness level shall describe the difference between small and large spills as found in the table of initial isolation and protective action distances in the *Emergency Response Guidebook*.

(9) First responders at the awareness level shall identify 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

(10) First responders at the awareness level shall 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.

(11) First responders at the awareness level shall identify the techniques used to isolate the hazard area and deny entry to unauthorized persons at hazardous materials incidents.

(12)*Identify at least four specific actions necessary when an incident is suspected to involve criminal or terrorist activity.

4.4.2 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 initial notifications to be made and how to make them, consistent with the local emergency response plan or the organization's standard operating procedures.

4.5* Competencies — Evaluating Progress. (Reserved)

4.6* Competencies — Terminating the Incident. (Reserved)

Chapter 5 Competencies for the First Responder at the Operational Level

5.1 General.

5.1.1 Introduction.

5.1.1.1 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.

5.1.1.2 First responders at the operational level also shall receive any additional training to meet applicable DOT, EPA, OSHA, and other state, local, or provincial occupational health and safety regulatory requirements.

5.1.2 Goal. The goal of the competencies at the operational level shall be to provide first responders with the knowledge and skills to perform the tasks in 5.1.2.1 safely.

5.1.2.1 The first responder at the operational level shall be able to perform the following tasks:

(1) Analyze a hazardous materials incident to determine the magnitude of the problem in terms of outcomes by completing the following tasks:
(a) Survey the hazardous materials incident to identify the containers and materials involved, determine whether hazardous materials have been released, and evaluate the surrounding conditions
(b) Collect hazard and response information from MSDS; CHEMTREC/CANUTEC/SETIQ; local, state, and federal authorities; and shipper/manufacturer contacts
(c) Predict the likely behavior of a material as well as its container
(d) Estimate the potential harm at a hazardous materials incident

(2) Plan an initial response within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by completing the following tasks:
(a) Describe the response objectives for hazardous materials incidents
(b) Describe the defensive options available for a given response objective
(c) Determine whether the personal protective equipment provided is appropriate for implementing each defensive option
(d) Identify the emergency decontamination procedures

(3) Implement the planned response to favorably change the outcomes consistent with the local emergency response plan and the organization's standard operating procedures by completing the following tasks:
(a) Establish and enforce scene control procedures including control zones, emergency decontamination, and communications
(b) Initiate an incident management system (IMS) for hazardous materials incidents
(c) Don, work in, and doff personal protective equipment provided by the authority having jurisdiction
(d) Perform defensive control functions identified in the plan of action

(4) Evaluate the progress of the actions taken to ensure that the response objectives are being met safely, effectively, and efficiently by completing the following tasks:
(a) Evaluate the status of the defensive actions taken in accomplishing the response objectives
(b) Communicate the status of the planned response

5.2 Competencies — Analyzing the Incident.

5.2.1* 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 and also shall meet the requirements in 5.2.1.1 through 5.2.1.6.

5.2.1.1* Given three examples each of liquid, gas, and solid hazardous materials, including various hazard classes, the first responder at the operational level shall identify the general shapes of containers in which the hazardous materials are typically found.

(A) Given examples of the following tank cars, the first responder at the operational level shall identify each tank car by type as follows:

(1) Cryogenic liquid tank cars
(2) High-pressure tube cars
(3) Nonpressure tank cars
(4) Pneumatically unloaded hopper cars
(5) Pressure tank cars

(B) Given examples of the following intermodal tanks, the first responder at the operational level shall identify each intermodal tank by type and identify at least one material and its hazard class that is typically found in each tank as follows:

(1) Nonpressure intermodal tanks, such as the following:
    (a) IM-101 (IMO Type 1 internationally) portable tank
    (b) IM-102 (IMO Type 2 internationally) portable tank
(2) Pressure intermodal tanks
(3) Specialized intermodal tanks, such as the following:
    (a) Cryogenic intermodal tanks
    (b) Tube modules

(C) Given examples of the following cargo tanks, the first responder at the operational level shall identify each cargo tank by type as follows:

(1) Nonpressure liquid tanks
(2) Low pressure chemical tanks
(3) Corrosive liquid tanks
(4) High pressure tanks
(5) Cryogenic liquid tanks
(6) Dry bulk cargo tanks
(7) Compressed gas tube trailers

(D) Given examples of the following tanks, the first responder at the operational level shall identify at least one material, and its hazard, that is typically found in each tank as follows:

(1) Nonpressure tank
(2) Pressure tank
(3) Cryogenic liquid tank

(E) Given examples of the following nonbulk packages, the first responder at the operational level shall identify each package by type as follows:

(1) Bags
(2) Carboys
(3) Cylinders
(4) Drums

(F) Given examples of the following radioactive material containers, the first responder at the operational level shall identify each container/package by type as follows:

(1) Type A
(2) Type B
(3) Industrial
(4) Excepted
(5) Strong, tight containers

5.2.1.2 Given examples of facility and transportation containers, the first responder at the operational level shall identify the markings that differentiate one container from another.

(A) Given examples of the following marked transport vehicles and their corresponding shipping papers, the first responder at the operational level shall identify the vehicle or tank identification marking as follows:

(1) Rail transport vehicles, including tank cars
(2) Intermodal equipment including tank containers
(3) Highway transport vehicles, including cargo tanks

(B) Given examples of facility containers, the first responder at the operational level shall identify the markings indicating container size, product contained, and/or site identification numbers.

5.2.1.3 Given examples of facility and transportation situations involving hazardous materials, the first responder at the operational level shall identify the name(s) of the hazardous material(s) in each situation.

(A) The first responder at the operational level shall identify the following information on a pipeline marker:

(1) Product
(2) Owner
(3) Emergency telephone number

(B) Given a pesticide label, the first responder at the operational level shall identify each of the following pieces of information, then match the piece of information to its significance in surveying the hazardous materials incident:

(1) Name of pesticide
(2) Signal word
(3) Pest control product (PCP) number (in Canada)
(4) Precautionary statement
(5) Hazard statement
(6) Active ingredient

(C) Given a label for a radioactive material, the first responder at the operational level shall identify vertical bars, contents, activity, and transport index.

5.2.1.4* The first responder at the operational level shall identify and list the surrounding conditions that should be noted by the first responders when surveying hazardous materials incidents.

5.2.1.5 The first responder at the operational level shall give examples of ways to verify information obtained from the survey of a hazardous materials incident.

5.2.1.6* The first responder at the operational level shall identify at least three additional hazards that could be associated with an incident involving criminal or terrorist activity.

5.2.2 Collecting Hazard and Response Information. Given known hazardous materials, the first responder at the operational level shall collect hazard and response information using MSDS; CHEMTREC/CANUTEC/SETIQ; local, state, and federal authorities; and contacts with the shipper/manufacturer and also shall meet the following requirements:

(1) Match the definitions associated with the UN/DOT hazard classes and divisions of hazardous materials, including refrigerated liquefied gases and cryogenic liquids, with the class or division.
(2) Identify two ways to obtain an MSDS in an emergency.
(3) Using an MSDS for a specified material, identify the following hazard and response information:
    (a) Physical and chemical characteristics
    (b) Physical hazards of the material

(c) Health hazards of the material
(d) Signs and symptoms of exposure
(e) Routes of entry
(f) Permissible exposure limits
(g) Responsible party contact
(h) Precautions for safe handling (including hygiene practices, protective measures, procedures for cleanup of spills or leaks)
(i) Applicable control measures including personal protective equipment
(j) Emergency and first-aid procedures

(4) Identify the following:
(a) Type of assistance provided by CHEMTREC/CANUTEC/SETIQ and local, state, and federal authorities
(b) Procedure for contacting CHEMTREC/CANUTEC/SETIQ and local, state, and federal authorities
(c) Information to be furnished to CHEMTREC/CANUTEC/SETIQ and local, state, and federal authorities

(5) Identify two methods of contacting the manufacturer or shipper to obtain hazard and response information.
(6) Identify the type of assistance provided by local, state, and federal authorities with respect to criminal or terrorist activities involving hazardous materials.
(7) Identify the procedure for contacting local, state, and federal authorities as specified in the local emergency response plan (ERP) or the organization's standard operating procedures.
(8) Describe the properties and characteristics of the following:
(a) Alpha particles
(b) Beta particles
(c) Gamma rays
(d) Neutrons

5.2.3* 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 and also shall meet the following requirements:

(1) Given two examples of scenarios involving known hazardous materials, interpret the hazard and response information obtained from the current edition of the *Emergency Response Guidebook;* MSDS; CHEMTREC/CANUTEC/SETIQ; local, state, and federal authorities; and shipper/manufacturer contacts as follows:
(a) Match the following chemical and physical properties with their significance and impact on the behavior of the container and/or its contents:
i. Boiling point
ii. Chemical reactivity
iii. Corrosivity (pH)
iv. Flammable (explosive) range (LEL and UEL)
v. Flash point
vi. Ignition (autoignition) temperature
vii. Physical state (solid, liquid, gas)
viii. Specific gravity
ix. Toxic products of combustion
x. Vapor density
xi. Vapor pressure
xii. Water solubility
xiii. Radiation (ionizing and non-ionizing)
(b) Identify the differences between the following pairs of terms:
i. Exposure and hazard
ii. Exposure and contamination
iii. Contamination and secondary contamination
iv. Radioactive material exposure (internal and external) and radioactive contamination

(2) *Identify three types of stress that could cause a container system to release its contents.
(3) *Identify five ways in which containers can breach.
(4) *Identify four ways in which containers can release their contents.
(5) *Identify at least four dispersion patterns that can be created upon release of a hazardous material.
(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.
(7) *Identify the health and physical hazards that could cause harm.
(8) *Identify the health hazards associated with the following terms:
(a) Asphyxiant
(b) *Chronic health hazard
(c) Convulsant
(d) Irritant/corrosive
(e) Sensitizer/allergen
(f) Alpha, beta, gamma, and neutron radiation
(9) *Given the following types of warfare agents, identify the corresponding UN/DOT hazard class and division:
(a) Nerve agents
(b) Vesicants (blister agents)
(c) Blood agents
(d) Choking agents
(e) Irritants (riot control agents)
(f) Biological agents and toxins

5.2.4* 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 and also shall meet the following requirements:

(1) *Identify a resource for determining the size of an endangered area of a hazardous materials incident.
(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) Identify resources available for determining the concentrations of a released hazardous material within an endangered area.
(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.
(5) Describe the impact that time, distance, and shielding have on exposure to radioactive materials specific to the expected dose rate.
(6) Describe the prioritization of emergency medical care and removal of victims from the hazard area relative to exposure and contamination concerns.

5.3 Competencies — Planning the Response.

5.3.1 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 and also shall meet the following requirements:

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

5.3.2 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 and shall meet the following requirements:

(1) Identify the defensive options to accomplish a given response objective.
(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

5.3.3 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 and also shall meet the following requirements:

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

5.3.4* Identifying Emergency Decontamination Procedures. The first responder at the operational level shall identify emergency decontamination procedures and shall meet the following requirements:

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

5.4 Competencies — Implementing the Planned Response.

5.4.1 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 and shall meet the following requirements:

(1) Identify the procedures for establishing scene control through control zones.
(2) Identify the criteria for determining the locations of the control zones at hazardous materials incidents.
(3) Identify the basic techniques for the following protective actions at hazardous materials incidents:
    (a) Evacuation
    (b) Sheltering in-place protection
(4) Identify the considerations associated with locating emergency decontamination areas.
(5)*Demonstrate the ability to perform emergency decontamination.
(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

5.4.2* Initiating the Incident Management System. Given simulated facility and/or transportation hazardous materials incidents, the first responder at the operational level shall initiate the incident management system specified in the local emergency response plan and the organization's standard operating procedures and shall meet the following related requirements:

(1) Identify the role of the first responder at the operational level during hazardous materials incidents as specified in the local emergency response plan and the organization's standard operating procedures.
(2) Identify the levels of hazardous materials incidents as defined in the local emergency response plan.
(3) Identify the purpose, need, benefits, and elements of an incident management system at hazardous materials incidents.

(4) Identify the considerations for determining the location of the command post for a hazardous materials incident.
(5) Identify the procedures for requesting additional resources at a hazardous materials incident.
(6)*Identify the authority and responsibilities of the safety officer.

5.4.3 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, and shall meet the following related requirements:

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

5.4.4 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 and shall meet the following related requirements:

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

5.5 Competencies — Evaluating Progress.

5.5.1 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 and shall meet the following related requirements:

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

5.5.2 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 and shall meet the following related requirements:

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

5.6* Competencies — Terminating the Incident. (Reserved)

Chapter 6 Competencies for the Hazardous Materials Technician

6.1 General.

6.1.1 Introduction.

6.1.1.1 Hazardous materials technicians shall be trained to meet all competencies at the first responder awareness and operational levels and the competencies of this chapter.

6.1.1.2 Hazardous materials technicians also shall receive any additional training to meet applicable DOT, EPA, OSHA, and other state, local, or provincial occupational health and safety regulatory requirements.

6.1.2* Goal.

6.1.2.1 The goal of this chapter shall be to provide the hazardous materials technician with the knowledge and skills to perform the tasks in 6.1.2.2 safely.

6.1.2.2 In addition to being competent at both the first responder awareness and operational levels, the hazardous materials technician shall be able to perform the following tasks:

(1) Analyze a hazardous materials incident to determine the magnitude of the problem in terms of outcomes by completing the following tasks:
    (a) Survey the hazardous materials incident to identify special containers involved, to identify or classify unknown materials, and to verify the presence and con-

centrations of hazardous materials through the use of monitoring equipment
(b) Collect and interpret hazard and response information from printed resources, technical resources, computer databases, and monitoring equipment
(c) Determine the extent of damage to containers
(d) Predict the likely behavior of released materials and their containers when multiple materials are involved
(e) Estimate the size of an endangered area using computer modeling, monitoring equipment, or specialists in this field

(2) Plan a response within the capabilities of available personnel, personal protective equipment, and control equipment by completing the following tasks:
(a) Identify the response objectives for hazardous materials incidents
(b) Identify the potential action options available by response objective
(c) Select the personal protective equipment required for a given action option
(d) Select the appropriate decontamination procedures
(e) 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

(3) 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:
(a) Perform the duties of an assigned hazardous materials branch position within the local incident management system (IMS)
(b) Don, work in, and doff personal protective clothing, including, but not limited to, both liquid splash- and vapor-protective clothing with appropriate respiratory protection
(c) Perform the control functions identified in the plan of action

(4) Evaluate the progress of the planned response by evaluating the effectiveness of the control functions
(5) Terminate the incident by completing the following tasks:
(a) Assist in the incident debriefing
(b) Assist in the incident critique
(c) Provide reports and documentation of the incident

6.2 Competencies — Analyzing the Incident.

6.2.1 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, determine the concentration of hazardous materials, and meet the related requirements in 6.2.1.1 through 6.2.1.4.

6.2.1.1 Given examples of various specialized containers, the hazardous materials technician shall identify each container by name and identify the material, and its hazard class that is typically found in the container.

(A) Given examples of the following railroad cars, the hazardous materials technician shall identify each car by type and identify at least one material, and its hazard class that is typically found in each car as follows:

(1) Cryogenic liquid tank cars
(2) High-pressure tube cars
(3) Nonpressure tank cars
(4) Pneumatically unloaded hopper car
(5) Pressure tank cars

(B) Given examples of the following intermodal tanks, the hazardous materials technician shall identify each intermodal tank by type and identify at least one material, and its hazard class, that is typically found in each tank:

(1) Nonpressure intermodal tanks:
(a) IM-101 (IMO Type 1 internationally) portable tank
(b) IM-102 (IMO Type 2 internationally) portable tank
(2) Pressure intermodal tanks (DOT 51) (IMO Type 5 internationally)
(3) Specialized intermodal tanks:
(a) Cryogenic intermodal tanks (IMO Type 7 internationally)
(b) Tube modules

(C) Given examples of the following cargo tanks, the hazardous materials technician shall identify each cargo tank by type:

(1) Nonpressure liquid tanks
(2) Low pressure chemical tanks
(3) Corrosive liquid tanks
(4) High pressure tanks
(5) Cryogenic liquid tanks
(6) Tube trailers
(7) Cryogenic liquid tanks

(D) Given examples of the following tanks, the hazardous materials technician shall identify at least one material and its hazard that is typically found in each tank:

(1) Nonpressure tank
(2) Pressure tank
(3) Cryogenic liquid tank

(E) Given examples of the following nonbulk containers, the hazardous materials technician shall identify at least one material, and its hazard class, that is typically found in each container:

(1) Bags
(2) Carboys
(3) Cylinders
(4) Drums

(F) Given examples of the following radioactive materials packages, the hazardous materials technician shall identify each package by type and identify at least one typical material found in each package:

(1) Type A
(2) Type B
(3) Industrial
(4) Excepted
(5) Strong, tight containers

(G) The hazardous materials technician shall describe the basic identification tools and detection devices and where they are available locally for each of the following:

(1) Nerve agents
(2) Vesicants (blister agents)
(3) Biological agents and toxins
(4) Irritants (riot control agents)

6.2.1.2 Given three examples of facility and transportation containers, the hazardous materials technician shall identify the approximate capacity of each container.

(A) Using the markings on the container, the hazardous materials technician shall identify the capacity (by weight and/or volume) of the following examples of transportation vehicles:

(1) Cargo tanks
(2) Tank cars
(3) Tank containers

(B) Using the markings on the container and other available resources, the hazardous materials technician shall identify the capacity (by weight and/or volume) of each of the following facility containers:

(1) Nonpressure tank
(2) Pressure tank
(3) Cryogenic liquid tank

6.2.1.3* Given at least three unknown materials, one of which is a solid, one a liquid, and one a gas, the hazardous materials technician shall identify or classify by hazard each unknown material.

(A) The hazardous materials technician shall identify the steps in an analysis process for identifying unknown solid and liquid materials.

(B) The hazardous materials technician shall identify the steps in an analysis process for identifying an unknown atmosphere.

(C) The hazardous materials technician shall identify the type(s) of monitoring equipment, test strips, and reagents used to determine the following hazards:

(1) Corrosivity (pH)
(2) Flammability
(3) Oxidation potential
(4) Oxygen deficiency
(5) Radioactivity
(6) Toxic levels

(D)* The hazardous materials technician shall identify the capabilities and limiting factors associated with the selection and use of the following monitoring equipment, test strips, and reagents:

(1) Carbon monoxide meter
(2) Colorimetric tubes
(3) Combustible gas indicator
(4) Oxygen meter
(5) Passive dosimeter
(6) Photoionization detectors
(7) pH indicators and/or pH meters
(8) Radiation detection and measurement instruments
(9) Reagents
(10) Test strips

(E)* Given three hazardous materials, one of which is a solid, one is a liquid, and one is a gas, and the following monitoring equipment, test strips, and reagents, the hazardous materials technician shall select the equipment and demonstrate the proper techniques to identify and quantify the materials:

(1) Carbon monoxide meter
(2) Colorimetric tubes
(3) Combustible gas indicator
(4) Oxygen meter
(5) pH indicators and/or pH meters
(6) Radiation detection instruments
(7) Reagents
(8) Test strips

(F) The hazardous materials technician shall demonstrate the field maintenance and testing procedures for the monitoring equipment, test strips, and reagents provided by the authority having jurisdiction.

6.2.1.4 Given a label for a radioactive material, the hazardous materials technician shall identify vertical bars, contents, activity, and transport index, then describe the labeled item and its significance in surveying a radioactive materials incident.

6.2.2 Collecting and Interpreting Hazard and Response Information. Given access to printed resources, technical resources, computer databases, and monitoring equipment, the hazardous materials technician shall collect and interpret hazard and response information not available from the current edition of the *Emergency Response Guidebook* or a MSDS and shall meet the following related requirements in 6.2.2(A) through 6.2.2(G).

(A)* The hazardous materials technician shall 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:

(1) Hazardous materials databases
(2) Maps and diagrams
(3) Monitoring equipment
(4) Reference manuals
(5) Technical information centers (i.e., CHEMTREC/CANUTEC/SETIQ and local, state, and federal authorities)
(6) Technical information specialists

(B) The hazardous materials technician shall describe the following terms and explain their significance in the risk assessment process:

(1) Acid, caustic
(2) Air reactivity
(3) Biological agents and toxins
(4) Boiling point
(5) Catalyst
(6) Chemical interactions
(7) Chemical reactivity
(8) Compound, mixture
(9) Concentration
(10) Corrosivity (pH)
(11) Critical temperatures and pressure
(12) Dose
(13) Dose rate
(14) Expansion ratio
(15) Flammable (explosive) range (LEL and UEL)
(16) Fire point
(17) Flash point
(18) Half-life
(19) Halogenated hydrocarbon
(20) Ignition (autoignition) temperature
(21) Inhibitor
(22) Instability
(23) Ionic and covalent compounds
(24) Irritants (riot control agents)
(25) Maximum safe storage temperature (MSST)
(26) Melting point/freezing point

(27) Miscibility
(28) Nerve agents
(29) Organic and inorganic
(30) Oxidation potential
(31) pH
(32) Physical state (solid, liquid, gas)
(33) Polymerization
(34) Radioactivity
(35) Saturated, unsaturated, and aromatic hydrocarbons
(36) Self-accelerating decomposition temperature (SADT)
(37) Solution, slurry
(38) Specific gravity
(39) Strength
(40) Sublimation
(41) Temperature of product
(42) Toxic products of combustion
(43) Vapor density
(44) Vapor pressure
(45) Vesicants (blister agents)
(46) Viscosity
(47) Volatility
(48) Water reactivity
(49) Water solubility

(C) The hazardous materials technician shall describe the heat transfer processes that occur as a result of a cryogenic liquid spill.

(D)* Given five hazardous material scenarios and the associated reference materials, the hazardous materials technician shall identify the signs and symptoms of exposure to each material and the target organ effects of exposure to that material.

(E) Given the scenario of a domestic gas line break and the readings from a combustible gas indicator, the hazardous materials technician shall determine the area of evacuation.

(F) The hazardous materials technician shall identify two methods for determining the pressure in bulk packaging or facility containers.

(G) The hazardous materials technician shall identify one method for determining the amount of lading remaining in damaged bulk packaging or facility containers.

6.2.3* 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 and meet the related requirements in 6.2.3.1 through 6.2.3.6.

6.2.3.1* Given three examples of containers, DOT specification markings for nonbulk and bulk packaging, and the associated reference guide, the hazardous materials technician shall identify the basic design and construction features of each container.

(A) The hazardous materials technician shall identify the basic design and construction features, including closures, of the following bulk containers:

(1) Cargo tanks such as the following:
  (a) Nonpressure liquid tanks
  (b) Low pressure chemical tanks
  (c) Corrosive liquid tanks
  (d) High pressure tanks
  (e) Cryogenic liquid tanks
  (f) Dry bulk cargo tanks
  (g) Compressed gas tube trailers
(2) Fixed facility tanks such as the following:
  (a) Nonpressure tank
  (b) Pressure tank
(3) Intermodal tanks such as the following:
  (a) Nonpressure intermodal tanks:
    i. IM-101 portable tank
    ii. IM-102 portable tank
  (b) Pressure intermodal tanks (specification 51)
  (c) Specialized intermodal tanks:
    i. Cryogenic intermodal tanks
    ii. Tube modules
(4) One-ton containers
(5) Pipelines
(6) Railroad cars such as the following:
  (a) Cryogenic liquid tank cars
  (b) High-pressure tube cars
  (c) Nonpressure tank cars
  (d) Pneumatically unloaded hopper cars
  (e) Pressure tank cars
(7) Intermediate bulk containers (also known as tote tanks)

(B) The hazardous materials technician shall identify the basic design and construction features including closures of the following nonbulk containers:

(1) Carboys
(2) Drums
(3) Pressurized cylinders

(C) The hazardous materials technician shall identify the basic design and construction features of the following radioactive materials containers:

(1) Type A package
(2) Type B package
(3) Industrial
(4) Excepted
(5) Strong, tight containers

(D) The hazardous materials technician shall demonstrate a method for collecting samples of the following:

(1) Liquid
(2) Solid
(3) Gas

6.2.3.2 The hazardous materials technician shall describe how a liquid pipeline can carry different products.

6.2.3.3 Given an example of a pipeline, the hazardous materials technician shall identify the following:

(1) Ownership of the line
(2) Procedures for checking for gas migration
(3) Procedure for shutting down the line or controlling the leak
(4) Type of product in the line

6.2.3.4* The hazardous materials technician shall identify the types of damage that a pressure container could incur.

6.2.3.5 Given examples of tank car damage, the hazardous materials technician shall identify the type of damage in each example by name.

6.2.3.6 Given a scenario involving radioactive materials, the hazardous materials technician shall determine if the integrity of any container has been breached, using available survey and monitoring equipment.

6.2.4 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 and meet the related requirements in 6.2.4.1 and 6.2.4.2.

6.2.4.1 The hazardous materials technician shall identify at least three resources available that indicate the effects of mixing various hazardous materials.

6.2.4.2 The hazardous materials technician shall 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:

(1) Fire protection systems
(2) Monitoring and detection systems
(3) Product spillage and control (impoundment and diking)
(4) Tank spacing
(5) Tank venting and flaring systems
(6) Transfer operations

6.2.5 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, and meet the related requirements in 6.2.5.1 through 6.2.5.3.

6.2.5.1 The hazardous materials technician shall identify local resources for dispersion pattern prediction and modeling including computers, monitoring equipment, or specialists in the field.

6.2.5.2 Given the quantity, concentration, and release rate of the released material, the hazardous materials technician shall identify the steps for determining the extent of the physical, safety, and health hazards within the endangered area of a hazardous materials incident.

(A) The hazardous materials technician shall describe the following terms and explain their significance in the risk assessment process:

(1) Parts per million (ppm)
(2) Parts per billion (ppb)
(3) Lethal dose (LD_{50})
(4) Lethal concentrations (LC_{50})
(5) Permissible exposure limit (PEL)
(6) Threshold limit value time-weighted average (TLV-TWA)
(7) Threshold limit value short-term exposure limit (TLV-STEL)
(8) Threshold limit value ceiling (TLV-C)
(9) Immediately dangerous to life and health (IDLH) value
(10) Rad
(11) Roentgen equivalent Man (Rem); Millirem (mrem)
(12) Roentgen

(B)* The hazardous materials technician shall describe the following radiological terms and explain their significance in predicting the extent of health hazards and environmental impact in a hazardous materials incident:

(1) Types
(2) Measurement
(3) Protection

(C) The hazardous materials technician shall identify two methods for predicting the areas of potential harm within the endangered area of a hazardous materials incident.

6.2.5.3* The hazardous materials technician shall identify a method for estimating the outcomes within an endangered area of a hazardous materials incident.

6.3 Competencies — Planning the Response.

6.3.1 Identifying Response Objectives.

6.3.1.1 Given simulated facility and transportation problems, the hazardous materials technician shall describe the response objectives for each problem.

6.3.1.2 The hazardous materials technician shall be able to describe the steps for determining response objectives (defensive, offensive, and nonintervention) given an analysis of a hazardous materials incident.

6.3.2 Identifying the Potential Action Options.

6.3.2.1 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.

6.3.2.2 The hazardous materials technician shall be able to identify the possible action options to accomplish a given response objective.

6.3.3 Selecting Personal Protective Equipment. Given situations with known and unknown hazardous materials, the hazardous materials technician shall determine the personal protective equipment for the action options specified in the plan of action in each situation and meet the related requirements in 6.3.3.1 through 6.3.3.3(G).

6.3.3.1 The hazardous materials technician shall identify the four levels of personal protective equipment as specified by the Environmental Protection Agency (EPA) and the National Institute for Occupational Safety and Health (NIOSH) and as detailed in NFPA 471, *Recommended Practice for Responding to Hazardous Materials Incidents.*

6.3.3.2 The hazardous materials technician shall identify the factors to be considered in selecting respiratory protection for a specified action option.

(A) The hazardous materials technician shall describe the advantages, limitations, and uses of the following types of respiratory protection at hazardous materials incidents:

(1) Positive pressure self-contained breathing apparatus
(2) Positive pressure air-line respirators with required escape unit
(3) Air-purifying respirators

(B) The hazardous materials technician shall identify the process for selecting respiratory protection at hazardous materials incidents.

(C) The hazardous materials technician shall identify the operational components of air-purifying respirators and air-line respirators by name and describe their functions.

6.3.3.3 The hazardous materials technician shall identify the factors to be considered in selecting chemical-protective clothing for a specified action option.

(A) The hazardous materials technician shall describe the following terms and explain their impact and significance on the selection of chemical-protective clothing:

(1) Degradation
(2) Penetration
(3) Permeation

(B) The hazardous materials technician shall identify at least three indications of material degradation of chemical-protective clothing.

(C)* The hazardous materials technician shall identify the three types of vapor-protective and splash-protective clothing and describe the advantages and disadvantages of each type.

(D) The hazardous materials technician shall identify the relative advantages and disadvantages of the following heat exchange units used for the cooling of personnel in chemical-protective clothing:

(1) Air cooled
(2) Ice cooled
(3) Water cooled

(E) The hazardous materials technician shall identify the process for selecting protective clothing at hazardous materials incidents.

(F) Given three examples of various hazardous materials, the hazardous materials technician shall determine the protective clothing construction materials for a given action option using chemical compatibility charts.

(G) The hazardous materials technician shall identify the physical and psychological stresses that can affect users of specialized protective clothing.

6.3.4 Selecting Decontamination Procedures. Given a simulated hazardous materials incident, the hazardous materials technician shall select a decontamination procedure, determine the equipment required to implement that procedure, and shall meet the following related requirements:

(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
(2) Identify three sources of technical information for selecting decontamination procedures and identify how to contact those sources in an emergency.

6.3.5 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 that are 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, and meet the related requirements in 6.3.5(A) through 6.3.5(F).

(A) The hazardous materials technician shall describe the purpose of, procedures for, equipment required, and safety precautions used with the following techniques for hazardous materials control:

(1) Adsorption
(2) Neutralization
(3) Overpacking
(4) Patching
(5) Plugging

(B) Given MC-306/DOT-406, MC-307/DOT-407, MC-312/DOT-412, MC-331, and MC-338 cargo tanks, the hazardous materials technician shall identify the common methods for product transfer from each type of cargo tank.

(C) Given a simulated hazardous materials incident, the hazardous materials technician shall develop the safety considerations that must be included in the plan of action as follows:

(1) The hazardous materials technician shall list and describe the safety considerations to be included.
(2) The hazardous materials technician shall identify the points that should be made in a safety briefing prior to working at the scene.

(D)* The hazardous materials technician shall identify the atmospheric and physical safety hazards associated with hazardous materials incidents involving confined spaces.

(E) The hazardous materials technician shall identify the preentry activities to be performed.

(F) The hazardous materials technician shall identify the procedures, equipment, and safety precautions for collecting legal evidence at hazardous materials incidents.

6.4 Competencies — Implementing the Planned Response.

6.4.1 Performing Incident Management Duties. Given the local emergency response plan or the 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 and shall meet the following related requirements:

(1) Identify the role of the hazardous materials technician during an incident involving hazardous materials.
(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
(3) Demonstrate setup of the decontamination corridor as specified in the planned response.
(4) Demonstrate the decontamination process specified in the planned response.

6.4.2 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 respiratory protection and shall meet the following related requirements:

(1) Describe three safety procedures for personnel wearing vapor-protective clothing.
(2)*Describe three emergency procedures for personnel wearing vapor-protective clothing.
(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) Demonstrate donning, working in, and doffing chemical-protective clothing in addition to any other specialized protective equipment provided by the authority having jurisdiction.
(5) Demonstrate the ability to record the use, repair, and testing of chemical-protective clothing according to the manufacturer's specifications and recommendations.
(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.

6.4.3 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 and shall meet the following related requirements:

(1)*Given a pressure vessel, select the 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
(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
(3) Given a 208-L (55-gal) drum and appropriate tools and materials, demonstrate the ability to contain the following types of leaks using:
  (a) Bung leak
  (b) Chime leak
  (c) Forklift puncture
  (d) Nail puncture
(4) Given a 208-L (55-gal) drum and an overpack drum, demonstrate the ability to place the 208-L drum into the overpack drum using the following methods:
  (a) Rolling slide-in
  (b) Slide-in
  (c) Slip-over
(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.
(6) Identify three considerations for assessing a leak or spill inside a confined space without entering the area.
(7)*Identify three safety considerations for product transfer operations.
(8) Given an MC-306/DOT-406 cargo tank and a dome cover clamp, demonstrate the ability to install the clamp on the dome.
(9) Identify the methods and precautions used when controlling a fire involving an MC-306/DOT-406 aluminum shell cargo tank.
(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
(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.

6.5 Competencies — Evaluating Progress.

6.5.1 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.

6.6 Competencies — Terminating the Incident.

6.6.1 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 and shall meet the following related requirements:

(1) Describe three components of an effective debriefing.
(2) Describe the key topics of an effective debriefing.
(3) Describe when a debriefing should take place.
(4) Describe who should be involved in a debriefing.

6.6.2 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 and shall meet the following related requirements:

(1) Describe three components of an effective critique.
(2) Describe who should be involved in a critique.
(3) Describe why an effective critique is necessary after a hazardous materials incident.
(4) Describe which written documents should be prepared as a result of the critique.

6.6.3 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 and shall meet the following related requirements:

(1) Identify the reports and supporting documentation required by the local emergency response plan and the organization's standard operating procedures.
(2) Demonstrate completion of the reports required by the local emergency response plan and the organization's standard operating procedures.
(3) Describe the importance of personnel exposure records.
(4) Describe the importance of debriefing records.
(5) Describe the importance of critique records.
(6) Identify the steps in keeping an activity log and exposure records.
(7) Identify the steps to be taken in compiling incident reports that meet federal, state, local, and organizational requirements.
(8) Identify the requirements for compiling hot zone entry and exit logs.
(9) Identify the requirements for compiling personal protective equipment logs.
(10) Identify the requirements for filing documents and maintaining records.

Chapter 7 Competencies for the Incident Commander

7.1 General.

7.1.1 Introduction.

7.1.1.1 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.

7.1.1.2 Incident commanders also shall receive any additional training to meet applicable DOT, EPA, OSHA, and other state, local, or provincial occupational health and safety regulatory requirements.

7.1.2* Goal.

7.1.2.1 The goal of this chapter shall be to provide the incident commander with the knowledge and skills to perform the tasks in 7.1.2.2 safely.

7.1.2.2 In addition to being competent at the awareness and operational levels, the incident commander shall be able to perform the following tasks:

(1) Analyze a hazardous materials incident to determine the magnitude of the problem in terms of outcomes by completing the following tasks:
   (a) Collect and interpret hazard and response information from printed resources, technical resources, computer databases, and monitoring equipment
   (b) Estimate the potential outcomes within the endangered area at a hazardous materials incident
(2) Plan response operations within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by completing the following tasks:
   (a) Identify the response objectives for hazardous materials incidents
   (b) Identify the potential action options (defensive, offensive, and nonintervention) available by response objective
   (c) Approve the level of personal protective equipment required for a given action option
   (d) 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
(3) 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:
   (a) Implement an incident management system, including the specified procedures for notification and utilization of nonlocal resources (e.g., private, state, and federal government personnel)
   (b) 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
   (c) Provide a focal point for information transfer to media and local elected officials through the incident management system structure
(4) 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
(5) Terminate the incident by completing the following tasks:
   (a) Transfer command (control) when appropriate
   (b) Conduct an incident debriefing
   (c) Conduct a multi-agency critique
   (d) Report and document the hazardous materials incident and submit the report to the designated entity

7.2 Competencies — Analyzing the Incident.

7.2.1 Collecting and Interpreting Hazard and Response Information.

7.2.1.1 Given access to printed and technical resources, computer databases, and monitoring equipment, the incident commander shall collect and interpret hazard and response information not available from the current edition of the *Emergency Response Guidebook* or a MSDS.

7.2.1.2 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:

(1) Reference manuals
(2) Hazardous materials databases
(3) Technical information centers
(4) Technical information specialists
(5) Monitoring equipment

7.2.2 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 and shall meet the following related requirements:

(1) Identify the steps for estimating the number of exposures within the endangered area.
(2) Describe the following toxicological terms and exposure values and explain their significance in the risk assessment process:

(a) Parts per million
(b) Parts per billion
(c) Lethal dose
(d) Lethal concentrations
(e) Permissible exposure limit
(f) Threshold limit value time-weighted average
(g) Threshold limit value short-term exposure limit
(h) Threshold limit value ceiling
(i) Immediately dangerous to life and health value
(j) Rad
(k) Roentgen equivalent Man; Millirem
(l) Roentgen

(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

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

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

(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

(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)

7.3 Competencies — Planning the Response.

7.3.1 Identifying Response Objectives.

7.3.1.1 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.

7.3.1.2 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.

7.3.2 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 and shall meet the following related requirements:

(1) Identify the possible action options to accomplish a given response objective.
(2) Identify the purpose of each of the following techniques for hazardous materials control:
(a) Adsorption
(b) Neutralization
(c) Overpacking
(d) Patching
(e) Plugging

7.3.3 Approving the Level of Personal Protective Equipment. Given situations with known and unknown hazardous materials, the incident commander shall approve the personal protective equipment for the action options specified in the plan of action in each situation and shall meet the following related requirements:

(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.
(2) Describe the following terms and explain their impact and significance on the selection of chemical-protective clothing:
(a) Degradation
(b) Penetration
(c) Permeation
(3) Describe three safety considerations for personnel wearing vapor-protective, liquid splash–protective, and high temperature–protective clothing.
(4) Identify the physical and psychological stresses that can affect users of personal protective equipment.
(5) Identify the limitations of military chemical/biological protective clothing.

7.3.4 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 and within the capability of the available personnel, personal protective equipment, and control equipment, and also shall meet the related requirements in 7.3.4.1 through 7.3.4.5(E).

7.3.4.1 The incident commander shall identify the steps for developing a plan of action.

7.3.4.2 The incident commander shall identify the factors to be evaluated in selecting public protective actions including evacuation and sheltering in-place.

7.3.4.3 Given the local emergency response plan and/or the organization's standard operating procedures, the incident commander shall identify which agency will perform the following:

(1) Receive the initial notification
(2) Provide secondary notification and activation of response agencies
(3) Make ongoing assessments of the situation
(4) Command on-scene personnel (incident management system)
(5) Coordinate support and mutual aid
(6) Provide law enforcement and on-scene security (crowd control)
(7) Provide traffic control and rerouting
(8) Provide resources for public safety protective action (evacuation or shelter in-place)
(9) Provide fire suppression services
(10) Provide on-scene medical assistance (ambulance) and medical treatment (hospital)
(11) Provide public notification (warning)
(12) Provide public information (news media statements)

(13) Provide on-scene communications support
(14) Provide emergency on-scene decontamination
(15) Provide operational-level hazard control services
(16) Provide technician-level hazard mitigation services
(17) Provide environmental remedial action (cleanup) services
(18) Provide environmental monitoring
(19) Implement on-site accountability
(20) Provide on-site responder identification
(21) Provide command post security
(22) Provide crime scene investigation
(23) Provide evidence collection and sampling

7.3.4.4 The incident commander shall identify the process for determining the effectiveness of an action option on the potential outcomes.

7.3.4.5 The incident commander shall identify the safe operating practices/procedures that are required to be followed at a hazardous materials incident.

(A) The incident commander shall identify the importance of pre-incident planning relating to safety during responses to specific sites.

(B) The incident commander shall identify the procedures for presenting a safety briefing prior to allowing personnel to work on a hazardous materials incident.

(C)* The incident commander shall identify at least three safety precautions associated with search and rescue missions at hazardous materials incidents.

(D) The incident commander shall identify the advantages and limitations of the following and describe an example where each decontamination method would be used:

(1) Absorption
(2) Adsorption
(3) Chemical degradation
(4) Dilution
(5) Disposal
(6) Evaporation
(7) Neutralization
(8) Solidification
(9) Vacuuming
(10) Washing

(E)* The incident commander shall identify the atmospheric and physical safety hazards associated with hazardous materials incidents involving confined spaces.

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 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), and also shall meet the following related requirements:

(1) Identify the role of the incident commander during an incident involving hazardous materials.
(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
(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.
(4) Given the local emergency response planning documents, identify the elements of each of the documents.
(5) Identify the elements of the incident management system necessary to coordinate response activities at hazardous materials incidents.
(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.
(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.

7.4.2* 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.

7.4.3 Providing a Focal Point for Information Transfer to Media and Elected Officials. Given a simulated hazardous materials incident, the incident commander shall identify information to provide to the media and local, state, and federal officials and shall meet the following related requirements:

(1) Identify the local policy for providing information to the media.
(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 incident commander shall evaluate the progress of the plan of action to determine whether the efforts are accomplishing the response objectives and shall meet the following related requirements:

(1) Identify the procedures for evaluating whether the action options are effective in accomplishing the objectives.
(2) Identify the steps for comparing actual behavior of the material and the container to that predicted in the analysis process.
(3) Determine the effectiveness of the following:
    (a) Personnel being used
    (b) Personal protective equipment
    (c) Established control zones
    (d) Decontamination process

7.6 Competencies — Terminating the Incident.

7.6.1* Transferring Command/Control. Given the details of a simulated incident, the local emergency response plan, and the organization's standard operating procedures, the inci-

dent commander shall be able to identify the steps to be taken to transfer command/control of the incident and shall be able to demonstrate the transfer of command/control.

7.6.2 Conducting a Debriefing. Given the details of a simulated hazardous materials incident, the incident commander shall conduct a debriefing of the incident and shall meet the following related requirements:

(1) Describe three components of an effective debriefing.
(2) Describe the key topics in an effective debriefing.
(3) Describe when a debriefing should take place.
(4) Describe who should be involved in a debriefing.
(5) Identify the procedures for conducting incident debriefings at a hazardous materials incident.

7.6.3 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 and shall meet the following related requirements:

(1) Describe three components of an effective critique.
(2) Describe who should be involved in a critique.
(3) Describe why an effective critique is necessary after a hazardous materials incident.
(4) Describe what written documents should be prepared as a result of the critique.
(5) Implement the procedure for conducting a critique of the incident.

7.6.4 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 and shall meet the following related requirements:

(1) Identify the reporting requirements of the federal, state, and local agencies.
(2) Identify the importance of documentation for a hazardous materials incident, including training records, exposure records, incident reports, and critique reports.
(3) Identify the steps in keeping an activity log and exposure records for hazardous materials incidents.
(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) Identify the requirements for filing documents and maintaining records found in the local emergency response plan and the organization's standard operating procedures.
(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.

Chapter 8 Competencies for Private Sector Specialist Employees

8.1 Introduction. This chapter shall address competencies for the following private sector specialist employees:

(1) Private sector specialist employee C
(2) Private sector specialist employee B
(3) Private sector specialist employee A

8.2 Private Sector Specialist Employee C.

8.2.1 General.

8.2.1.1 Introduction. The private sector specialist employee C shall meet the competencies at the first responder awareness level *(see Chapter 4)* relative to the organization's area of specialization and the additional competencies in Section 8.2.

8.2.1.2 Goal.

8.2.1.2.1 The private sector specialist employee C shall be competent at the first responder awareness level relative to the organization's area of specialization.

8.2.1.2.2 The private sector specialist employee C shall have the knowledge and skills to perform the following duties and tasks safely:

(1) Assist the incident commander in analyzing the magnitude of an emergency involving chemicals or containers for chemicals by completing the following tasks:
   (a) Provide information on the hazards and harmful effects of specific chemicals
   (b) Provide information on the characteristics of specific containers for chemicals
(2) Assist the incident commander in planning a response to an emergency involving chemicals or containers for chemicals by providing information on the potential response options for chemicals or containers for chemicals

8.2.2 Competencies — Analyzing the Incident.

8.2.2.1 Providing Information on the Hazards and Harmful Effects of Specific Chemicals. Given a specific chemical(s) used in the organization's area of specialization and the corresponding MSDS or other appropriate resource, the private sector specialist employee C shall advise the incident commander of the chemical's hazards and harmful effects and shall meet the following related requirements:

(1) Identify the following hazard information from the MSDS or other 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
(2) Identify how to contact CHEMTREC/CANUTEC/SETIQ, and local, state, and federal authorities.
(3) Identify the resources available from CHEMTREC/CANUTEC/SETIQ, and local, state, and federal authorities.
(4) Given the organization's emergency response plan and standard operating procedures, identify additional resources of hazard information, including a method of contact.

8.2.2.2 Providing Information on Characteristics of Specific Containers. Given examples of facility and transportation containers for chemicals in the organization's area of specialization, the private sector specialist employee C shall advise the incident commander of the characteristics of the containers and shall meet the following related requirements:

(1) Identify each container by name.
(2) Identify the markings that differentiate one container from another.
(3) Given the organization's emergency response plan and standard operating procedures, identify the resources available that can provide information about the characteristics of the container.

8.2.3 Competencies — Planning the Response.

8.2.3.1 Providing Information on Potential Response Options for Specific Chemicals. Given a specific chemical used in the organization's area of specialization and a corresponding MSDS or other resource, the private sector specialist employee C shall advise the incident commander of the response information for that chemical by being able to meet the following related requirements:

(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
(2) Identify additional resources for obtaining response information.

8.3 Private Sector Specialist Employee B.

8.3.1 General.

8.3.1.1 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 8.3.

8.3.1.2* Goal.

8.3.1.2.1* The goal of these competencies shall be to ensure that the private sector specialist employee B has the knowledge and skills to safely perform the duties and responsibilities assigned in the organization's emergency response plan and standard operating procedures.

8.3.1.2.2 Within the employee's individual area of specialization, the private sector specialist employee B shall be able to perform the following tasks:

(1) Assist the incident commander in analyzing the magnitude of an incident involving chemicals or containers for chemicals by completing the following tasks:
   (a) Provide and interpret information on the hazards and harmful effects
   (b) Provide and interpret information on the characteristics of specific containers
   (c) Provide information on concentrations of chemicals from exposure monitoring, dispersion modeling, or any other predictive method
(2) Assist the incident commander in planning a response to an incident involving chemicals or containers for chemicals by completing the following tasks:
   (a) Provide information on the potential response options and their consequences for specific chemicals or containers for chemicals
   (b) Provide information on the personal protective equipment requirements for a specific chemical
   (c) Provide information on the decontamination methods for a specific chemical
   (d) Provide information on the federal/provincial regulations that relate to the handling and disposal of a specific chemical
   (e) Develop a plan of action (within the capabilities of the available resources), including safety considerations, for handling chemicals or containers for chemicals consistent with the organization's emergency response plan and standard operating procedures
(3) Implement the planned response, as developed with the incident commander, for chemicals or containers for chemicals, consistent with the organization's emergency response plan and standard operating procedures and within the capabilities of the available resources, by completing the following tasks:
   (a) Perform response options specified in the plan of action, as agreed upon with the incident commander and consistent with the organization's emergency response plan and standard operating procedures (within the capabilities of the available resources)
   (b) Don, work in, and doff personal protective equipment needed to implement the response options
(4) Assist the incident commander to evaluate the results of implementing the planned response by completing the following tasks:
   (a) Provide feedback on the effectiveness of the response options taken
   (b) Provide reporting and subsequent documentation of the incident involving chemicals as required

8.3.2 Competencies — Analyzing the Incident.

8.3.2.1 Providing and Interpreting Information on Hazards of Specific Chemicals. Given a specific chemical within the individual area of specialization and a corresponding MSDS or other 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 and shall meet the following related requirements:

(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
(2) Given examples of specific chemicals and the appropriate resources, predict the potential behavior of the chemicals based on the damage found, including the consequences of that behavior.
(3) Identify the general types of hazard information available from the other resources identified in the organization's emergency response plan and standard operating procedures.

8.3.2.2 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 and shall meet the following related requirements:

(1) Given examples of containers for specific chemicals, identify the purpose and operation of the closures found on those containers.
(2) Given a chemical container, list the types of damage that could occur.
(3) Given examples of containers for specific chemicals and the appropriate resources, predict the potential behavior of the containers and the consequences, based on the damage found.
(4) Given the 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.

8.3.2.3 Providing Information on Concentrations of Chemicals. Given a chemical and the applicable monitoring equipment provided by the 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 and shall meet the following related requirements:

(1) Identify the appropriate monitoring equipment.
(2) Use the monitoring equipment provided by the organization to determine the actual concentrations of a specific chemical.
(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.
(4) Demonstrate field calibration and testing procedures, as necessary, for the monitoring equipment provided by the organization.
(5) Given the 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.

8.3.3 Competencies — Planning the Response.

8.3.3.1 Providing Information on Potential Response Options and Consequences for Specific Chemicals. Given specific chemicals or containers within the employee's individual area of specialization and the associated resources, the private sector specialist employee B shall advise the incident commander of the potential response options and their consequences and shall meet the following related requirements:

(1) Given a specific chemical and a corresponding 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
(2) Given the organization's emergency response plan and standard operating procedures, identify additional resources for interpreting response information for a chemical.
(3) Describe the advantages and limitations of the potential response options for a specific chemical.
(4) Given the 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) Cleaning and disposing of chemicals or containers for chemicals

8.3.3.2 Providing Information on Personal Protective Equipment Requirements. Given specific chemicals or containers for chemicals within the employee's individual area of specialization and the associated resources, the private sector specialist employee B shall advise the incident commander of the personal protective equipment necessary for various response options and shall meet the following related requirements:

(1) Given a specific chemical and a corresponding MSDS, identify personal protective equipment, including the materials of construction, that will be compatible with that chemical.
(2) Given the organization's emergency response plan and standard operating procedures, identify other resources (including a method of contact) capable of identifying the personal protective equipment that is compatible with a specific chemical.
(3) Given an incident involving a specific chemical and the response options for that problem, determine whether the personal protective equipment is appropriate for the options presented.

8.3.3.3 Providing Information on Decontamination Methods. Given a specific chemical within the employee's individual area of specialization and the available resources, the private sector specialist employee B shall identify appropriate decontamination methods for various response options and shall meet the following related requirements:

(1) Given a specific chemical and a corresponding MSDS or other resource, obtain the potential methods for removing or neutralizing that chemical.
(2) Given a specific chemical and a corresponding MSDS or other resource, identify the circumstances under which disposal of contaminated equipment would be necessary.
(3) Given the organization's emergency response plan and standard operating procedures, identify resources (including a method of contact) capable of identifying potential decontamination methods.

8.3.3.4 Providing Information on Handling and Disposal Regulations. Given a specific chemical within the employee's individual 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 and shall meet the following related requirements:

(1) Given a specific chemical and a corresponding MSDS or other resource, identify federal or provincial regulations that apply to the handling, transportation, and disposal of that chemical.
(2) Given a specific chemical and a corresponding 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.
(3) Given the organization's emergency response plan and standard operating procedures, identify resources for in-

formation pertaining to federal or provincial regulations relative to the handling and disposal of a specific chemical.

8.3.3.5 Developing a Plan of Action. Given a simulated incident involving chemicals or containers used in the employee's individual area of specialization, the private sector specialist employee B shall (in conjunction with the incident commander) develop a plan of action, consistent with the organization's emergency response plan and standard operating procedures, and within the capabilities of the available resources, for handling chemicals or containers in that incident and shall meet the following related requirements:

(1) The plan of action developed shall be within the capabilities of the available resources and shall include safety considerations.
(2) Given the organization's emergency response plan and standard operating procedures, identify the process for development of a plan of action, including safety considerations.

8.3.4 Competencies — Implementing the Planned Response.

8.3.4.1 Performing Response Options Specified in the Plan of Action. Given an assignment by the incident commander in the employee's individual area of specialization, the private sector specialist employee B shall perform the assigned actions consistent with the organization's emergency response plan and standard operating procedures and shall meet the following related requirements:

(1) Perform assigned tasks consistent with the 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
(2) *Identify factors that can affect an individual's ability to perform the assigned tasks.

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

(1) Don, work in, and doff the appropriate respiratory protection and protective clothing for the assigned tasks.
(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
(3) Identify the procedures for cleaning, sanitizing, and inspecting personal protective equipment provided by the organization.

8.3.5 Competencies — Evaluating Progress.

8.3.5.1 Providing an Evaluation of the Effectiveness of Selected Response Options. Given an incident involving specific chemicals or containers for chemicals within the employee's individual area of specialization, the private sector specialist employee B shall advise the incident commander of the effectiveness of the selected response options and shall meet the following related requirements:

(1) Identify the criteria for evaluating whether or not the selected response options are effective in accomplishing the objectives.
(2) Identify the circumstances when it would be prudent to withdraw from a chemical incident.

8.3.5.2 Reporting and Documenting the Incident. Given a simulated incident involving chemicals or containers for chemicals used in the employee's individual area of specialization, the private sector specialist employee B shall complete the reporting and subsequent documentation requirements consistent with the organization's emergency response plan and standard operating procedures and shall meet the following related requirements:

(1) Identify the importance of documentation (including training records, exposure records, incident reports, and critique reports) for an incident involving chemicals.
(2) Identify the steps used in keeping an activity log and exposure records.
(3) Identify the requirements for compiling incident reports.
(4) Identify the requirements for compiling hot zone entry and exit logs.
(5) Identify the requirements for compiling personal protective equipment logs.
(6) Identify the requirements for filing documents and maintaining records.

8.4 Private Sector Specialist Employee A.

8.4.1 General.

8.4.1.1 Introduction. The private sector specialist employee A shall be trained to meet the competencies at the private sector specialist employee C level *(see Section 8.2)* and hazardous materials technician level *(see Chapter 4)* relative to the chemicals and containers used in the organization's area of specialization.

8.4.1.2 Goal.

8.4.1.2.1 The goal of this level of competence shall be to ensure that the private sector specialist employee A has the knowledge and skills to safely perform the duties and responsibilities assigned in the organization's emergency response plan and standard operating procedures.

8.4.1.2.2 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, perform the following tasks:

(1) Analyze an incident involving chemicals and containers for chemicals used in the organization's area of specialization to determine the magnitude of the incident by completing the following tasks:
    (a) Survey an incident involving chemicals and containers for chemicals, including the following:
        i. Identify the containers involved
        ii. Identify or classify unknown materials
        iii. Verify the identity of the chemicals

(b) Collect and interpret hazard and response information from printed resources, technical resources, computer databases, and monitoring equipment for chemicals
(c) Determine the extent of damage to containers of chemicals
(d) Predict the likely behavior of the chemicals and containers for chemicals
(e) Estimate the potential outcomes of an incident involving chemicals and containers for chemicals

(2) Plan a response (within the capabilities of available resources) to an incident involving chemicals and containers for chemicals used in the organization's area of specialization by completing the following tasks:
(a) Identify the response objectives for an incident involving chemicals and containers for chemicals
(b) Identify the potential action options for each response objective for an incident involving chemicals and containers for chemicals
(c) Select the personal protective equipment required for a given response option for an incident involving chemicals and containers for chemicals
(d) Select the appropriate decontamination procedures, as necessary, for an incident involving chemicals and containers for chemicals
(e) 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 the organization's emergency response plan and standard operating procedures

(3) Implement the planned response (as developed with the incident commander) to an incident involving chemicals and containers for chemicals used in the organization's area of specialization consistent with the organization's emergency response plan and standard operating procedures by completing the following tasks:
(a) Don, work in, and doff appropriate personal protective equipment for use with chemicals
(b) Perform control functions, as agreed upon with the incident commander, for chemicals and containers for chemicals

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

Chapter 9 Competencies for the Hazardous Materials Branch Officer

9.1 General.

9.1.1 Introduction.

9.1.1.1 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.

9.1.1.2 The hazardous materials branch officer also shall receive training to meet applicable DOT, EPA, OSHA, and other state, local, or provincial occupational health and safety regulatory requirements.

9.1.2 Goal.

9.1.2.1 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.

9.1.2.2 In addition to being competent at the awareness, operational, and technician levels, the hazardous materials branch officer shall be able to perform the following tasks:

(1) Analyze a hazardous materials incident to determine the magnitude of the problem by estimating the potential outcomes within the endangered area
(2) Plan a response within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by completing the following tasks:
(a) Identify the response objectives for hazardous materials incidents
(b) Identify the potential action options (defensive, offensive, and nonintervention) available by response objective
(c) Determine the level of personal protective equipment required for a given action option
(d) 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
(3) 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:
(a) Implement the incident management system as it directly relates to the specified procedures for hazardous materials branch operations
(b) 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
(4) 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
(5) Terminate the incident by completing the following:
(a) Conduct a debriefing for hazardous materials branch personnel
(b) Conduct a critique for hazardous materials branch personnel
(c) Report and document the hazardous materials branch operations

9.2 Competencies — Analyzing the Incident.

9.2.1 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.

9.3 Competencies — Planning the Response.

9.3.1 Selecting the Level of Personal Protective Equipment. Given situations with known and unknown hazardous materi-

als, the hazardous materials branch officer shall select the personal protective equipment for the action options specified in the plan of action in each situation.

9.3.2 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 and shall meet the following related requirements:

(1) Identify the order of the steps for developing a plan of action.
(2) Identify the factors to be evaluated in selecting public protective actions, including evacuation and shelter in-place.
(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 medical assistance (ambulance) and medical treatment (hospital)
   (h) Coordinate on-scene decontamination
   (i) Coordinate activities with those of the environmental remedial action (cleanup) services
(4) Identify the process for determining the effectiveness of an action option on the potential outcomes.
(5) Identify the procedures for presenting a safety briefing prior to allowing personnel to work on a hazardous materials incident.

9.4 Competencies — Implementing the Planned Response.

9.4.1 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), and shall meet the following related requirements:

(1) Identify the process and procedures for obtaining cleanup and restoration services in the local emergency response plan or organization's standard operating procedures.
(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.
(3) Given the local emergency planning documents, identify the elements of each of the documents.
(4) Identify the elements of the incident management system necessary to coordinate response activities at hazardous materials incidents.
(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.
(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.

9.4.2* 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.

9.4.3 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 and shall meet the following related requirements:

(1) Identify the local policy for providing information to the media.
(2) Identify the responsibilities of the public information officer at a hazardous materials incident.

9.5 Competencies — Evaluating Progress.

9.5.1 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 and shall meet the following related requirements:

(1) Identify the procedures for evaluating whether the action options are effective in accomplishing the objectives.
(2) Identify the steps for comparing actual behavior of the material and the container to that predicted in the analysis process.
(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

9.6 Competencies — Terminating the Incident.

9.6.1 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 and shall meet the following related requirements:

(1) Identify the steps required in terminating the emergency phase of a hazardous materials incident.
(2) Identify the procedures for conducting incident debriefings at a hazardous materials incident.
(3) Identify the steps in transferring authority as prescribed in the local emergency response plan or the organization's standard operating procedures.

9.6.2 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 and shall meet the following related requirements:

(1) Describe three components of an effective debriefing.
(2) Describe the key topics in an effective debriefing.
(3) Describe when a debriefing should take place.
(4) Describe who should be involved in a debriefing.
(5) Identify the procedures for conducting incident debriefings at a hazardous materials incident.

9.6.3 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 and shall meet the following related requirements:

(1) Describe three components of an effective critique.
(2) Describe who should be involved in a critique.
(3) Describe why an effective critique is necessary after a hazardous materials incident.
(4) Describe what written documents should be prepared as a result of the critique.
(5) Identify the procedure for conducting a critique of the incident.
(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 local, state, and federal regulations.

9.6.4 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 and shall meet the following related requirements:

(1) Identify the reporting requirements of federal, state, and local agencies.
(2) Identify the importance of documentation for a hazardous materials incident, including training records, exposure records, incident reports, and critique reports.
(3) Identify the steps in keeping an activity log and exposure records for hazardous materials incidents.
(4) Identify the requirements found in the local emergency response plan and the organization's standard operating procedures for compiling hazardous materials incident reports.
(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 10 Competencies for the Hazardous Materials Branch Safety Officer

10.1 General.

10.1.1* Introduction.

10.1.1.1* 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.

10.1.1.2 The hazardous materials branch safety officer also shall receive any additional training to meet applicable DOT, EPA, OSHA, and other state, local, or provincial occupational health and safety regulatory requirements.

10.1.2 Goal.

10.1.2.1 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.

10.1.2.2 In addition to being knowledgeable at the level of operations being performed, the hazardous materials branch safety officer shall be able to perform the following tasks:

(1) 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
(2) Assist in planning a safe response within the capabilities of available response personnel, personal protective equipment, and control equipment by completing the following tasks:
    (a) Identify the safety precautions for potential action options
    (b) Provide recommendations regarding safety considerations
    (c) Assist in the development of a plan of action
    (d) Review the plan of action and provide recommendations regarding safety
    (e) Review the selection of personal protective equipment required for a given action option
    (f) Review the decontamination operations
    (g) Ensure that emergency medical services are provided
(3) 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:
    (a) Perform the duties of the hazardous materials branch safety officer within the local incident management system
    (b) Identify safety considerations for personnel performing the control functions identified in the plan of action
    (c) Conduct safety briefings for personnel performing the control functions identified in the plan of action
    (d) Assist in the implementation and enforcement of safety considerations
    (e) Maintain communications within the incident command structure during the incident
    (f) Monitor status reports of activities in the hot and warm zones
    (g) Ensure the implementation of exposure monitoring (personnel and environment)
(4) Evaluate the progress of the planned response to ensure that the response objectives are being met safely by completing the following tasks:
    (a) Identify deviations from safety considerations and any dangerous situations
    (b) Alter, suspend, or terminate any activity that can be judged to be unsafe
(5) Assist in terminating the incident by completing the following tasks:

(a) Perform the reporting, documentation, and follow-up required of the hazardous materials branch safety officer
(b) Assist in the debriefing of hazardous materials branch personnel
(c) Assist in the incident critique

10.2 Competencies — Analyzing the Incident.

10.2.1 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 and meet the related requirements in 10.2.1(A) through 10.2.1(I)(6).

(A)* The hazardous materials branch safety officer shall 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:

(1) Types
(2) Measurement
(3) Protection

(B) The hazardous materials branch safety officer shall describe the following toxicological terms and exposure values and explain their significance in the risk assessment process:

(1) Parts per million
(2) Parts per billion
(3) Lethal dose
(4) Lethal concentrations
(5) Permissible exposure limit
(6) Threshold limit value time-weighted average
(7) Threshold limit value short-term exposure limit
(8) Threshold limit value ceiling
(9) Immediately dangerous to life and health value
(10) Rad
(11) Roentgen equivalent Man; Millirem
(12) Roentgen

(C) The hazardous materials branch safety officer shall explain the basic toxicological principles relative to assessment and treatment of personnel exposed to hazardous materials, including the following:

(1) Acute and delayed toxicity
(2) Dose-response
(3) Local and systemic effects
(4) Routes of exposure to toxic materials
(5) Synergistic effects

(D)* The hazardous materials branch safety officer shall identify five conditions where the hazards from flammability would require chemical-protective clothing with thermal protection.

(E)* The hazardous materials branch safety officer shall identify five conditions where personnel would not be allowed to enter the hot zone.

(F) Given the names of five hazardous materials and at least three reference sources, the hazardous materials branch safety officer shall identify the physical and chemical properties and their potential impact on the safety of personnel at an incident involving each of the materials.

(G) Given the names of five hazardous materials and at least three reference sources, the hazardous materials branch safety officer shall identify the health concerns and their potential impact on the safety and health of personnel at an incident involving each of the materials.

(H)* Given the names of five hazardous materials and a description of their containers, the hazardous materials branch safety officer shall identify five hazards or physical conditions that would impact the safety of personnel at an incident involving each of the materials.

(I) Given at least three unknown materials, one of which is a solid, one is a liquid, and one is a gas, the hazardous materials branch safety officer shall identify or classify by hazard each unknown material as follows:

(1) Identify steps in an analysis process for identifying unknown solid and liquid materials.
(2) Identify steps in an analysis process for identifying an unknown atmosphere.
(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)* 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
(5) Given three hazardous materials, one of which is a solid, one is a liquid, and one is a gas, and the following monitoring equipment, the hazardous materials branch safety officer shall 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
(6) The hazardous materials branch safety officer shall demonstrate the field maintenance and testing procedures for the monitoring equipment, test strips, and reagents provided by the authority having jurisdiction.

10.3 Competencies — Planning the Response.

10.3.1* 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 and shall meet the following related requirements:

(1)*Identify five specific safety precautions to observe while mitigating each of the hazards or conditions identified in 10.2.1(H).
(2)*Identify five safety precautions associated with search and rescue missions at hazardous materials incidents.

10.3.2 Providing Recommendations Regarding Safety Considerations.

10.3.2.1 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.

10.3.2.2 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 10.2.1(H).

10.3.3 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 and shall meet the following related requirements:

(1)*Identify the importance and list five benefits of pre-emergency planning relating to specific sites.
(2)*Identify and name five hazards and precautions to be observed when approaching a hazardous materials incident.
(3)*List the elements of safety considerations.
(4) Given an organization's pre-incident plan and a simulated hazardous materials incident involving one of the hazardous materials and containers described in 10.2.1(H), develop safety considerations for the incident.

10.3.4 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 10.2.1(H), 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 and shall meet the following related requirements:

(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.
(2) Make recommendations to the incident commander on the safety considerations in the proposed plan of action.

10.3.5 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 and shall meet the following related requirements:

(1) Identify the four levels of chemical protection (EPA/NIOSH), describe the equipment required for each level, and the conditions under which each level is used.
(2) Identify five safety considerations for personnel wearing vapor-protective, liquid splash-protective, and high temperature-protective clothing.
(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 protection from the identified hazards to the wearer for each of the five substances.
(4)*Given the names of five different hazardous materials, identify chemical-protective clothing levels for typical action options.
(5) Identify the recommended methods for donning, doffing, and using all personal protective equipment provided by the authority having jurisdiction for use in hazardous materials response activities.

10.3.6 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 and shall meet the following related requirements:

(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
(2) Identify how personnel, personal protective equipment, apparatus, tools, and equipment become contaminated, as well as the importance and limitations of decontamination procedures.
(3) Explain the need for decontamination procedures at hazardous materials incidents.
(4) Identify three sources of technical information for selecting decontamination procedures and identify how to contact those sources in an emergency.
(5) Identify the considerations associated with the placement, location, and setup of the decontamination corridor.
(6) Identify the decontamination procedures as defined by the authority having jurisdiction for personnel and personal protective equipment at hazardous materials incidents.
(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 procedures.

10.3.7 Ensuring Provision of 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 and shall meet the following related requirements:

(1)*Identify the elements required in an emergency medical services plan.
(2) Identify the importance of an on-site medical monitoring program.
(3) Identify three resources for the transportation and care of the injured persons exposed to hazardous materials.

10.4 Competencies — Implementing the Planned Response.

10.4.1 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 the position in a manner consistent with the local emergency response plan, the organization's standard operating procedures, and safety considerations and shall meet the following related requirements:

(1) Identify the duties of the hazardous materials branch safety officer as defined in the organization's standard operating procedures.
(2) Demonstrate performance of the duties of the hazardous materials branch safety officer as defined in the organization's standard operating procedures.

10.4.2 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 and shall meet the following related requirements:

(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.
(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 personal protective equipment
  (f) Physical fitness
(3) Identify the methods that will minimize the potential harm from heat and cold stresses.
(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.
(5) Describe five conditions where it would be prudent to withdraw from a hazardous materials incident.

10.4.3 Conducting Safety Briefings.

10.4.3.1 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.

10.4.3.2 The hazardous materials branch safety officer shall be able to demonstrate the procedure for conducting a safety briefing to personnel for an incident involving one of the hazardous materials and its container identified in 10.2.1(H), as specified by the organization's standard operating procedures.

10.4.4 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 and shall meet the following related requirements:

(1) Identify whether the boundaries of the established control zones are clearly marked, consistent with the safety considerations, and are being maintained.
(2) Identify whether the on-site medical monitoring that is required by the authority having jurisdiction is being performed.
(3) Given an entry team, a backup team, and a decontamination team wearing personal protective clothing and equipment, identify that each team is protected and prepared to safely perform its assigned tasks as follows:
  (a) Identify whether the selection of clothing and equipment is consistent with safety considerations.
  (b) Identify whether each team has examined the clothing for barrier integrity and the equipment to ensure correct working order.
  (c) Identify whether protective clothing and equipment have been donned in accordance with the organization's standard operating procedures and the manufacturer's recommendations.
(4) Identify whether each person entering the hot zone has a specific task assignment, understands the assignment, is trained to perform the assigned task(s), and is working with a designated partner at all times during the assignment.
(5) Identify whether a backup team is prepared at all times for immediate entry into the hot zone during entry team operations.
(6) Identify whether the decontamination process specified in the safety considerations is in place before any entry into the hot zone.
(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) Demonstrate the 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.
(9)*Identify three safety considerations that can minimize secondary contamination.

10.4.5 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 and shall meet the following related requirements:

(1)*Identify three types of communications systems used at hazardous materials incident sites.
(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.

10.4.6 Monitoring Status Reports.

10.4.6.1 Given a simulated hazardous materials incident and the safety considerations, the hazardous materials branch safety officer shall monitor routine and emergency communi-

cations within the incident command structure at all times during the incident.

10.4.6.2 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.

10.4.7 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.

10.4.8 Verifying Exposure Monitoring. 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.

10.5 Competencies — Evaluating Progress.

10.5.1 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 and shall meet the following related requirements:

(1) Identify those actions that deviate from the safety considerations or otherwise violate accepted safe operating practices, organizational policies, or applicable occupational safety and health laws, regulations, codes, standards, or guidelines.
(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.
(3) Identify the signs and symptoms of psychological and physical stresses on personnel wearing vapor-protective, liquid splash–protective, and high temperature–protective clothing.

10.5.2 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 and shall meet the following related requirements:

(1) Send emergency communications to, and receive emergency communications from, the incident safety officer, entry team personnel, the hazardous materials branch officer, and others regarding safe working practices and conditions as follows:
    (a) *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.
    (b) 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.
(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.
(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.
(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.

10.6 Competencies — Terminating the Incident.

10.6.1 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 and shall meet the following related requirements:

(1) Identify the safety reports and supporting documentation required by the local emergency response plan and the organization's standard operating procedures.
(2) Demonstrate completion of the safety reports required by the local emergency response plan and the organization's standard operating procedures.
(3) Describe the importance of personnel exposure records.

10.6.2 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.

10.6.2.1* The hazardous materials branch safety officer shall be able to identify five health and safety topics to be addressed in an incident debriefing.

10.6.2.2 The hazardous materials branch safety officer shall be able to demonstrate the 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.

10.6.3 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.

10.6.4 Information to be Presented. 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 procedure for verbally presenting the following information in accordance with the local emergency response plan and the organization's standard operating procedures:

(1) Safety and health-related critical observations of the activities that were performed in the hot and warm zones during the incident

(2) 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
(3) Injuries or deaths that occurred as a result of reasonably unforeseen dangerous conditions that developed during the incident
(4) 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
(5) The course of action(s) that would likely have prevented the injuries or deaths that occurred as a result of the safety violations identified in 10.6.4(4)
(6) Deficiencies or weaknesses in the safety considerations, local emergency response plan, and the organization's standard operating procedures that were noted during or following the incident

Chapter 11 Competencies for the Technician with a Tank Car Specialty

11.1 General.

11.1.1 Introduction.

11.1.1.1 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.

11.1.1.2 The technician with a tank car specialty also shall receive training to meet applicable DOT, EPA, OSHA, and other state, local, or provincial occupational health and safety regulatory requirements.

11.1.2 Goal.

11.1.2.1 The goal of this chapter shall be to provide the technician with a tank car specialty with the knowledge and skills to perform the tasks in 11.1.2.2 safely.

11.1.2.2 In addition to being competent at the hazardous materials technician level, the technician with a tank car specialty shall be able to perform the following tasks:

(1) Analyze a hazardous materials incident involving tank cars to determine the magnitude of the problem in terms of outcomes by completing the following tasks:
  (a) Determine the type and extent of damage to tank cars
  (b) Predict the likely behavior of tank cars and their contents in an emergency
(2) 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:
  (a) Determine the response options (offensive, defensive, and nonintervention) for a hazardous materials emergency involving tank cars
  (b) Ensure that the options are within the capabilities and competencies of available personnel, personal protective equipment, and control equipment
(3) Implement the planned response to a hazardous materials incident involving tank cars

11.1.3 Mandating of Competencies. This standard shall not mandate that hazardous materials response teams performing offensive operations on tank cars have technicians with a tank car specialty.

11.1.3.1 Technicians operating within the bounds of their training as listed in Chapter 6 of this standard shall be able to intervene in railroad incidents.

11.1.3.2 If a hazardous materials response team desires to train some or all its technicians to have in-depth knowledge of tank cars, this chapter shall set out the required competencies.

11.2 Competencies — Analyzing the Incident.

11.2.1 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 and shall meet the following related requirements:

(1) Given the specification mark for a tank car and the reference materials, describe the car's basic construction and features.
(2) Point out the "B" end of the car.
(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)
(4) Given examples of tank cars (some jacketed and some not jacketed), point out the jacketed tank cars.
(5) Describe the difference between "insulation" and "thermal protection" on tank cars.
(6) Describe the difference between "jacketed" and "sprayed-on" thermal protection on tank cars.
(7) Describe the difference between "interior" and "exterior" heater coils on tank cars.
(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:
    i. Bottom outlet valves (top operated with stuffing box, bottom operated — internal or external ball, wafersphere)
    ii. Liquid valve/vapor valve (ball vs. plug type)
    iii. Excess flow valve
    iv. Air valve
    v. Bottom outlet nozzle
    vi. Quick fill hole cover
    vii. Flange for manway, valves, and so forth
    viii. CO_2 tank car fittings
    ix. Cryogenic liquid tank car fittings
  (b) Fittings for pressure relief, including the following:
    i. Safety relief devices (safety valve, safety vent, combination safety valve)

ii. Pressure regulators on CO_2 cars and liquefied atmospheric gases in cryogenic liquid tank cars
iii. Staged safety relief system for a CO_2 car
iv. Vacuum relief valve (negative pressure or vacuum)

(c) Fittings for gauging, including the following:
i. Open gauging devices (e.g., slip tube)
ii. Closed gauging devices (e.g., magnetic)
iii. Other gauging devices (T-bar, long/short pole)

(d) Miscellaneous fittings, including the following:
i. Thermometer well
ii. Sample line
iii. Manway, manway cover plate, hinged and bolted manway cover, protective housing
iv. Washout
v. Sump

(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, and so forth
(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

(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

(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

(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

(13) Given examples of damaged tank car fittings, describe the extent of damage to those fittings.
(14) Given examples of tank car tank damage, describe the extent of damage to the tank car tank.
(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) Pressure gauge
(b) Temperature of the contents

(16)*Given a tank car, use the tank car's gauging device to determine the amount of lading in it.

11.2.2 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 and shall meet the following related requirements:

(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

(2) Describe the difference in the following types of construction materials used in tank cars and their significance in assessing tank damage:
(a) Carbon steel
(b) Alloy steel
(c) Aluminum

(3) Discuss the significance of selection of lading for compatibility with tank car construction material.
(4) Describe the significance of "lining" and "cladding" on tank cars in assessing tank damage.
(5) Describe the significance of the jacket on tank cars in assessing tank damage.
(6) Describe the significance of "insulation" and "thermal protection" on tank cars in assessing tank damage.
(7) Describe the significance of "jacketed" and "sprayed-on" thermal protection on tank cars in assessing tank damage.
(8) Describe the significance of "interior" and "exterior" heater coils on tank cars in assessing tank damage.
(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

(10) Describe the significance of the depth of scores, gouges, wheel burns, and rail burns on tank cars in assessing tank damage.
(11) Describe the significance of scores, gouges, wheel burns, and rail burns crossing a weld on a pressure tank car in assessing tank damage.

(12) Describe the significance of damage to the "heat-affected" zone of a weld on a tank car in assessing tank damage.
(13) Describe the significance of a condemning dent of a tank car in assessing tank damage.
(14) Given various types of tank cars, describe the significance of pressure increases in assessing tank damage.
(15) Given various types of tank cars, describe the significance of the amount of lading in the tank in assessing tank damage.
(16) Describe the significance of flame impingement on a tank car.

11.3 Competencies — Planning the Response.

11.3.1 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 and shall meet the following related requirements:

(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
(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.
(3) Describe the effect flaring or venting gas or liquid has on the pressure in the tank (flammable gas or flammable liquid product).
(4) Describe the inherent risks associated with, procedures for, equipment required to implement, and safety precautions for lifting of tank cars.
(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
(6) Describe the hazards associated with working on railroad property during emergencies.

11.4 Competencies — Implementing the Planned Response.

11.4.1 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 and shall meet the following related requirements:

(1) Given a leaking manway cover plate (loose bolts), control the leak.
(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
(3) Given an open bottom outlet valve with a defective gasket in the cap, control the leak.
(4) Given a leaking top-operated bottom outlet valve, close valve completely to control leak.
(5) Given leaking fittings on a chlorine tank car, use the Chlorine C kit to control the leak.
(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
(7) Given the appropriate equipment and resources, demonstrate the following:
  (a) Transferring of liquids and vapors
  (b) Flaring of liquids and vapors
  (c) Venting
(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)*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 equipment
  (b) Sequence of bonding and grounding connections
  (c) Testing of bonding and grounding connections
(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 12 Competencies for the Technician with a Cargo Tank Specialty

12.1 General.

12.1.1 Introduction.

12.1.1.1 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.

12.1.1.2 The technician with a cargo tank specialty also shall receive training to meet applicable DOT, EPA, OSHA, and other state, local, or provincial occupational health and safety regulatory requirements.

12.1.2 Goal.

12.1.2.1 The goal of this chapter shall be to provide the technician with a cargo tank specialty with the knowledge and skills to perform the tasks in 12.1.2.2 safely.

12.1.2.2 In addition to being competent at the technician level, the technician with a cargo tank specialty shall be able to perform the following tasks:

(1) Analyze a hazardous materials incident involving cargo tanks to determine the magnitude of the problem in terms of outcomes by completing the tasks:
  (a) Determine the type and extent of damage to cargo tanks
  (b) Predict the likely behavior of cargo tanks and their contents in an emergency

(2) 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
(3) Implement the planned response to a hazardous materials incident involving cargo tanks

12.1.3* Mandating of Competencies. This standard shall not mandate that hazardous materials response teams performing offensive operations on cargo tanks have technicians with a cargo tank specialty.

12.1.3.1 Technicians operating within the bounds of their training as listed in Chapter 6 of this standard shall be able to intervene in cargo tank incidents.

12.1.3.2 If a hazardous materials response team desires to train some or all of the technicians to have in-depth knowledge of cargo tanks, this chapter shall set out the required competencies.

12.2 Competencies — Analyzing the Incident.

12.2.1 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 and shall meet the following related requirements:

(1) Given the specification mark for a cargo tank and the reference materials, describe the tank's basic construction and features.
(2) Given examples of cargo tanks (some jacketed and some not jacketed), point out the jacketed cargo tanks.
(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)
(4) Given simulated damage to an MC-331 cargo tank, determine the extent of damage to the heat-affected zone.
(5) *Given an MC-331 cargo tank containing a liquefied gas, determine the amount of liquid in the tank.
(6) Given MC-306/DOT-406, MC-307/DOT-407, and MC-312/DOT-412 cargo tanks, 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
(7) Given MC-331 and MC-338 cargo tanks, 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
(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
(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) Describe the normal and emergency methods of activation for the following types of cargo tank truck valve systems:
  (a) Air
  (b) Cable
  (c) Hydraulic
(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)
  (f) Container stress applied to the cargo tank
  (g) Type and nature of tank damage (e.g., puncture, dome cover leak, valve failure)
  (h) Amount of product both released and remaining in the cargo tank

12.2.2 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 and shall meet the following related requirements:

(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
(2) Describe the difference in types of construction materials used in cargo tanks and their significance in assessing tank damage.
(3) Describe the significance of the jacket on cargo tanks in assessing tank damage.
(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)

(5) Given simulated damage to the heat-affected zone on an MC-331 cargo tank, describe the significance of the damage in assessing tank damage.

12.3 Competencies — Planning the Response.

12.3.1 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 and shall meet the following related requirements:

(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.
(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

12.4 Competencies — Implementing the Planned Response.

12.4.1 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 and shall meet the following related requirements:

(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)
(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)
   (c) Piping failure
(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 equipment
   (b) Sequence of bonding and grounding connections
   (c) Testing of bonding and grounding connections
(4) Given the following product transfer and recovery equipment, demonstrate the safe 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
(5) Given a simulated overturned MC-306/DOT-406 cargo tank, demonstrate the safe procedures for the following methods of product removal and transfer:
   (a) Drilling
   (b) Unloading lines
   (c) Vapor recovery lines
   (d) Internal safety valve
(6) Given a simulated overturned MC-307/DOT-407 cargo tank, demonstrate the safe procedures for product removal and transfer.
(7) Given a simulated overturned MC-331 cargo tank, demonstrate the safe procedures for product removal and transfer.
(8) Given the necessary resources, demonstrate the flaring of an MC-331 flammable gas cargo tank.
(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 13 Competencies for the Technician with an Intermodal Tank Specialty

13.1 General.

13.1.1 Introduction.

13.1.1.1 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.

13.1.1.2 The technician with an intermodal tank specialty also shall receive any additional training to meet applicable DOT, EPA, OSHA, and other state, local, or provincial occupational health and safety regulatory requirements.

13.1.2 Goal.

13.1.2.1 The goal of this chapter shall be to provide the technician with an intermodal tank specialty with the knowledge and skills to perform the tasks in 13.1.2.2 safely.

13.1.2.2 In addition to being competent at the technician level, the technician with an intermodal tank specialty shall be able to perform the following tasks:

(1) 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:
   (a) Determine the type and extent of damage to an intermodal tank
   (b) Predict the likely behavior of an intermodal tank and its contents in an emergency
(2) 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.
(3) Implement the planned response to a hazardous materials incident involving intermodal tanks.

13.1.3 Mandating of Competencies. This standard shall not mandate that hazardous materials response teams performing offensive operations on intermodal tanks have technicians with an intermodal tank specialty.

13.1.3.1 Technicians operating within the bounds of their training as listed in Chapter 6 of this standard shall be able to intervene in intermodal tank incidents.

13.1.3.2 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 shall set out the required competencies.

13.2 Competencies — Analyzing the Incident.

13.2.1 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 and shall meet the following related requirements:

(1) Given the specification mark for an intermodal tank and the reference materials, describe the tank's basic construction and features.
(2) Given examples of intermodal tanks (some jacketed and some not jacketed), point out the jacketed intermodal tanks.
(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
(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
(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
(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)
(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.
(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
(9) *Given a pressure intermodal tank containing a liquefied gas, determine the amount of liquid in the tank.
(10) *Given simulated damage to a pressure intermodal tank, determine the extent of damage to the heat-affected zone.

13.2.2 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 and shall meet the following related requirements:

(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)
(2) Describe the difference in types of construction materials used in intermodal tanks relative to assessing tank damage.

13.3 Competencies — Planning the Response.

13.3.1 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 and shall meet the following related requirements:

(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
(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.

13.4 Competencies — Implementing the Planned Response.

13.4.1 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 and shall meet the following related requirements:

(1) Given leaks from the following fittings on intermodal tanks, control the leaks using approved methods and procedures:
   (a) Manway cover
   (b) Bottom outlet
   (c) Liquid/vapor valve
   (d) Safety relief device
   (e) Tank

(2) Demonstrate appropriate procedures for the following types of emergency product removal:
   (a) Gas/liquid transfer (pressure/pump)
   (b) Flaring
   (c) Venting

(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 equipment
   (b) Sequence of bonding and grounding connections
   (c) Testing of bonding and grounding connections

(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)

(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)
   (c) Piping failure

(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 driven pumps
   (c) Pressure transfer
   (d) Vacuum trucks

(7)*Given a simulated overturned liquid intermodal tank, demonstrate the safe procedures for product removal and transfer.

(8)*Given a simulated overturned pressure intermodal tank, demonstrate the safe procedures for product removal and transfer.

(9)*Given the necessary resources, demonstrate the flaring of a pressure flammable gas intermodal tank.

(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.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.3.2.1 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.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, 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.3.2.3 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.3.3.6 Confined Space. Additionally, a confined space is further defined as having one or more of the following characteristics:

(1) The area contains or has a potential to contain a hazardous atmosphere, including an oxygen-deficient atmosphere.
(2) The area contains a material with a potential to engulf a member.
(3) The area has an internal configuration such that a member could be trapped by inwardly converging walls or a floor that slopes downward and tapers to a small cross section.
(4) The area contains any other recognized serious hazard.

A.3.3.8 Container. Containers include the following:

(1) Nonbulk packaging, such as bags, bottles, boxes, carboys, cylinders, drums, jerricans, multicell packages, and wooden barrels
(2) 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

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

A.3.3.13 Control Zones. 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.

A.3.3.13.3 Warm Zone. The warm zone includes control points for the decontamination corridor, thus helping to reduce the spread of contamination.

A.3.3.18 Demonstrate. This performance can be supplemented by simulation, explanation, illustration, or a combination of these.

A.3.3.24 Exposure. 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. The exposure may be external, internal, or both.

A.3.3.27 Gross Decontamination. This phase can include mechanical removal or initial rinsing.

A.3.3.30 Hazardous Materials Branch. It is directed by a hazardous materials branch officer and deals principally with the technical aspects of the incident.

A.3.3.32 Hazardous Materials Branch Safety Officer. 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.

A.3.3.33 Hazardous Materials Response Team. The team members respond to releases or potential releases of hazardous materials for the purpose of control or stabilization of the incident.

A.3.3.34.3 Hazardous Materials Technician with an Intermodal Tank Specialty. These technicians are expected to use specialized chemical-protective clothing and specialized control equipment.

A.3.3.38 Incident Commander. This is equivalent to the on-scene incident commander.

A.3.3.39 Incident Management System. The system is also referred to as an incident command system (ICS). For more information, see NFPA 1561, *Standard on Emergency Services Incident Management System.*

A.3.3.47 Packaging. Packaging for hazardous materials includes bulk and nonbulk packaging.

A.3.3.47.1 Bulk Packaging. 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.3.3.50 Personal Protective Equipment. 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.

A.3.3.51 Planned Response. The following site safety plan considerations are referenced from the EPA's *Standard Operating Safety Guides* of June 1992:

(1) Site description
(2) Entry objectives
(3) On-site organization
(4) On-site control
(5) Hazard evaluations
(6) Personal protective equipment
(7) On-site work plans
(8) Communication procedures
(9) Decontamination procedures
(10) Site safety and health plan

A.3.3.52 Private Sector Specialist Employee A. 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 should receive training or demonstrate competency in their area of specialization annually. Private sector specialist employees also should receive any additional training to meet applicable DOT, OSHA, 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, inside 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 definition and in Chapter 8. When responding to incidents away from their assigned work area, private sector specialist employees should 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 should be addressed in the emergency response plan. Once the emergency response team arrives, these persons should be restricted to the actions that their training level allows and should operate under the incident command structure.

A.3.3.53 Private Sector Specialist Employee B. See A.3.3.52.

A.3.3.54 Private Sector Specialist Employee C. See A.3.3.52.

A.3.3.55 Protective Clothing. Protective clothing is divided into three types:

(1) Structural fire–fighting protective clothing
(2) High temperature–protective clothing
(3) Chemical-protective clothing
    (a) Liquid splash–protective clothing
    (b) Vapor-protective clothing.

A.3.3.55.1 Structural Fire–Fighting Protective Clothing. Structural fire fighters' protective clothing provides limited protection from heat but might not provide adequate protec-

tion from the harmful gases, vapors, liquids, or dusts that are encountered during hazardous materials incidents.

A.3.3.55.2 High Temperature–Protective Clothing. This type of clothing is usually of limited use in dealing with chemical commodities.

A.3.3.55.3 Chemical-Protective Clothing. 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.

A.3.3.55.3.1 Liquid Splash–Protective Clothing. This type of protective clothing is a component of EPA Level B chemical protection. Liquid splash-protective clothing should meet the requirements of NFPA 1992, *Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies*.

A.3.3.55.3.2 Vapor-Protective Clothing. This type of protective clothing is a component of EPA Level A chemical protection. Vapor-protective clothing should meet the requirements of NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies*.

A.3.3.58 Respiratory Protection. Respiratory protection is divided into three types: (1) Positive pressure self-contained breathing apparatus; (2) Positive pressure air-line respirators; (3) Air-purifying respirators.

A.3.3.59 Response. 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.

A.3.3.64 State. Use of the noun "state" also implies "provinces and territories" in Canada.

A.3.3.65 Termination. Termination is divided into three phases: debriefing the incident, post-incident analysis, and critiquing the incident.

A.4.2.1(1) See Annex F.

A.4.2.1(3) See Annex G.

A.4.2.1(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.4.2.1(13) The following are some examples of potential criminal or terrorist targets:

(1) Public assembly
(2) Public buildings
(3) Mass transit systems
(4) Places with high economic impact
(5) Telecommunications facilities
(6) Places with historical or symbolic significance
(7) Military installations
(8) Airports
(9) Industrial facilities

A.4.2.1(14) A chemical incident is characterized by a rapid onset of medical symptoms (minutes to hours) and can have observed signatures such as colored residue, dead foliage, pungent odor, and dead insect and animal life.

With biological incidents, the onset of symptoms usually require days to weeks and there are typically no characteristic signatures because biological agents are usually odorless and colorless. The area affected can be greater due to the migration of infected individuals because of the delayed onset of symptoms. An infected person could transmit the disease to another person.

A.4.2.1(15) The following are some examples of indicators of possible criminal or terrorist activity involving chemical agents:

(1) The presence of hazardous materials or laboratory equipment that is not relevant to the occupancy
(2) Intentional release of hazardous materials
(3) Unexplained patterns of sudden onset of similar, nontraumatic illnesses or deaths (The pattern could be geographic, by employer, or associated with agent dissemination methods.)
(4) Unexplained odors or tastes that are out of character with the surroundings
(5) Multiple individuals exhibiting unexplained signs of skin, eye, or airway irritation
(6) Unexplained bomb/munitions-like material, especially if it contains a liquid
(7) Unexplained vapor clouds, mists, and plumes
(8) Multiple individuals exhibiting unexplained health problems such as nausea, vomiting, twitching, tightness in chest, sweating, pin-point pupils (miosis), runny nose (rhinorrhea), disorientation, difficulty breathing, convulsions, or death
(9) Trees, shrubs, bushes, food crops, and/or lawns that are dead, discolored, abnormal in appearance, or withered (No current drought or not just a patch of dead weeds.)
(10) Surfaces exhibiting oily droplets/films and unexplained oily film on water surfaces
(11) An abnormal number of sick or dead birds, animals, and/or fish
(12) Unusual security, locks, bars on windows, covered windows, and barbed wire

A.4.2.1(16) The following are some examples of indicators of possible criminal or terrorist activity involving biological agents:

(1) Unusual number of sick or dying people or animals (Any number of symptoms could occur. The time required before symptoms are observed is dependent on the agent used, but usually requires days to weeks.)
(2) Health care facilities reporting multiple casualties with similar signs or symptoms
(3) Unscheduled or unusual spray being disseminated, especially if outdoors during period of darkness
(4) Abandoned spray devices (Devices will have no distinct odors.)

A.4.2.3 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 *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 *Emergency Response Guidebook*, the responder

should identify hazard information similar to that found in the current edition of the *Emergency Response Guidebook*.

A.4.2.3(1) Three methods for determining the appropriate guide page include the following:

(1) Using the numerical index for UN/NA identification numbers
(2) Using the alphabetical index for chemical names
(3) Using the "Table of Placards and Initial Response Guides"

A.4.3 No competencies currently required at this level.

A.4.4.1 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 (NRT).

The National Response Team, composed of 16 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.4.4.1(3)(c) This would include thermal, mechanical, poisonous, corrosive, asphyxiation, radiation, and etiologic. This can also include psychological harm.

A.4.4.1(3)(d) General routes of human exposure are contact, absorption, inhalation, and ingestion. Absorption includes entry through the eyes and through punctures.

A.4.4.1(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 *Emergency Response Guidebook*, the responder should identify response information similar to that found in the current edition of the *Emergency Response Guidebook*.

A.4.4.1(6)(c) "In-place protection," "sheltering in-place," and "protection in-place" all mean the same thing.

A.4.4.1(12) The following are some examples of actions required to be taken:

(1) Take the appropriate actions to protect yourself and other responders
(2) Communicate the suspicion during the notification process
(3) Isolate potentially exposed people or animals
(4) Document the initial observation
(5) Attempt to preserve evidence while performing operational duties
(6) Be alert for booby traps and/or explosive devices
(7) Establish control zones and access control points
(8) Prevent secondary contamination, including from handling patients

A.4.5 No competencies currently required at this level.

A.4.6 No competencies currently required at this level.

A.5.2.1 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.5.2.1.1 Examples should include all containers, including nonbulk packaging, bulk packaging, vessels, and facility containers such as piping, open piles, reactors, and storage bins.

A.5.2.1.4 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, and air returns, also should be included when appropriate.

A.5.2.1.6 The following are some examples of hazards:

(1) Secondary events intended to incapacitate or delay emergency responders
(2) Armed resistance
(3) Use of weapons
(4) Booby traps
(5) Secondary contamination from handling patients

A.5.2.3 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. References can be made to the book *Hazardous Materials Incident Analysis*, which accompanies the National Fire Academy's training program, or the chapter titled "Managing the Hazardous Materials Incident" in the *Fire Protection Handbook*.

A.5.2.3(2) The three types of stress that could cause a container to release its contents are thermal stress, mechanical stress, and chemical stress.

A.5.2.3(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 5.2.3(3) through 5.2.3(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.5.2.3(4) The four ways in which containment systems can release their contents are detonation, violent rupture, rapid relief, and spill or leak.

A.5.2.3(5) The seven dispersion patterns that can be created upon release of hazardous materials are hemisphere, cloud, plume, cone, stream, pool, and irregular.

A.5.2.3(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.5.2.3(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.5.2.3(8) Terms used to explain health hazards are defined as follows:

(1) *Carcinogen.* A chemical that falls within any of the following categories:
   (a) It has been evaluated by the International Agency for Research on Cancer (IARC) and found to be a carcinogen or potential carcinogen.
   (b) It is listed as a carcinogen or potential carcinogen in the latest edition of the "Annual Report on Carcinogens" published by the National Toxicology Program (NTP).
   (c) It is regulated by federal OSHA as a carcinogen (can be regulated additionally by states).

(2) *Corrosive.* A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact.

(3) *Highly Toxic.* A chemical that falls within any of the following categories:
   (a) 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
   (b) 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
   (c) 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

(4) *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.

(5) *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.

(6) *Toxic.* A chemical that falls within any of the following categories:
   (a) 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
   (b) A chemical that has a median lethal dose (LD_{50}) of more than 200 mg per kg but not more than 1000 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
   (c) A chemical that has a median lethal concentration (LD_{50}) in air of more than 200 parts per million but not more than 3000 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

(7) *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.
   (a) *Hepatotoxins.* Chemicals that produce liver damage (signs and symptoms: jaundice, liver enlargement; chemicals: carbon tetrachloride, nitrosamines)
   (b) *Nephrotoxins.* Chemicals that produce kidney damage (signs and symptoms: edema, protein urea; chemicals: halogenated hydrocarbons, uranium)
   (c) *Neurotoxins.* Chemicals that produce their primary toxic effects on the nervous system:
      i. *Central Nervous System Hazards.* Chemicals that cause depression or stimulation of consciousness or otherwise injure the brain (signs and symptoms: drooping of upper eyelids, respiratory difficulty, seizures, unconsciousness)
      ii. *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)
   (d) Agents that decrease hemoglobin in the blood of function; deprive the hematopolatic body tissues of oxygen (signs and symptoms: cyanosis, loss of consciousness; chemicals: carbon monoxide, benzene)
   (e) Agents that irritate the lung or damage the pulmonary tissue (signs and symptoms: cough, tightness in chest, shortness of breath; chemicals: silica, asbestos, HCl)
   (f) *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)
   (g) *Cutaneous Hazards.* Chemicals that affect the dermal layer of the body (signs and symptoms: defatting of the skin, rashes, irritation; chemicals: ketones, chlorinated compounds)
   (h) *Eye Hazards.* Chemicals that affect the eye or visual capacity (signs and symptoms: conjunctivitis, corneal damage; chemicals: organic solvents, acids)

A.5.2.3(8)(b) Chronic health hazards include carcinogen, mutagen, and teratogen.

A.5.2.3(9) Some examples of hazard class are found in Table A.5.2.3(9).

A.5.2.4 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.5.2.4(1) Resources for determining the size of an endangered area of a hazardous materials incident is the current

Table A.5.2.3(9) Examples of Hazard Class

Common Name	Military Abbreviation	UN/DOT Hazard Class
Nerve agents		
Tabun	GA	6.1
Sarin	GB	6.1
Soman	GD	6.1
V agent	VX	6.1
Vesicants (blister agents)		
Mustard	H	6.1
Distilled mustard	HD	6.1
Nitrogen mustard	HN	6.1
Lewisite	L	6.1
Blood agents		
Hydrogen cyanide	AC	6.1
Cyanogen chloride	CK	2.3
Choking agents		
Chlorine	CL	2.3
Phosgene	CG	2.3
Irritants		
Tear gas	CS	6.1
Dibenzoxazepine	CR	6.1
Chloroacetophone	CN	6.1
Pepper spray, mace	OC	2.2 (subsequent risk 6.1)
Mace, phenylchloro-methylketone, chloropicrin	PS	6.1
Biological agents and toxins		
Anthrax		6.2
Mycotoxin		6.1 or 6.2
Plague		6.2
Viral hemorrhagic fevers		6.2
Smallpox		6.2
Ricin		6.2

edition of the *Emergency Response Guidebook* and plume dispersion modeling results from facility pre-incident plans.

A.5.2.4(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.5.3.3(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.5.3.4 Refer to *Hazardous Materials Response Handbook*.

A.5.4.1(5) Refer to *Hazardous Materials Response Handbook*.

A.5.4.1(6) Refer to NIOSH/OSHA/USCG/EPA *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*.

A.5.4.1(6)(b) See A.5.2.1.6.

A.5.4.2 See A.4.4.1.

A.5.4.2(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 (29 CFR 1910.120). The hazardous materials safety officer has the following responsibilities:

(1) Obtains a briefing from the incident commander or incident safety officer and the hazardous materials branch safety officer
(2) 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)
(3) Advises the incident commander/sector officer of deviations from the incident safety considerations and of any dangerous situations
(4) Alters, suspends, or terminates any activity that is judged to be unsafe

A.5.6 No competencies currently required at this level.

A.6.1.2 The following site safety plan considerations are referenced from the *Standard Operating Safety Guides*:

(1) Site description
(2) Entry objectives
(3) On-site organization
(4) On-site control
(5) Hazard evaluation
(6) Personal protective equipment
(7) On-site work plans
(8) Communication procedures
(9) Decontamination procedures
(10) Site safety and health plan

A.6.2.1.3 Suggested materials to identify can include the most commonly released materials that are identified on several lists annually, such as those from the EPA or the state of California's Environmental Protection Agency.

A.6.2.1.3(D) 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*.

A.6.2.1.3(E) 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.6.2.2(A) 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.6.2.2(D) The selection of scenarios to test the knowledge and ability to identify exposure symptoms should consider the following:

(1) 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, and aliphatic and aromatic solvents).
(2) Select concentrations and formulation of the materials common to the jurisdiction. It is especially important with pesticides to select realistic scenarios because the state of matter, behavior, and exposure routes can vary considerably from technical-grade materials to common-use formulations.
(3) Select weather conditions and release conditions appropriate to the jurisdiction because the behavior and the exposure hazards can vary considerably from summer conditions in the deep south to winter conditions in the north.

A.6.2.3 The condition of the container should be described using one of the following terms:

(1) Undamaged, no product release
(2) Damaged, no product release
(3) Damaged, product release
(4) Undamaged, product release

A.6.2.3.1 See Annex H for the appropriate reference guides.

A.6.2.3.4 Some of the types of damage that containers can incur include the following:

(1) *Cracks.* A crack is a narrow split or break in the container metal that can penetrate through the metal of the container.
(2) *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.
(3) *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.
(4) *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.6.2.5.2(B) Examples of types, measurement, and protection include the following:

(1) Types:
  (a) Alpha
  (b) Beta
  (c) Gamma
(2) Units of measurement:
  (a) Activity
  (b) Quantity gamma
  (c) Absorbed dose
(3) Protection factors:
  (a) Half-life
  (b) Inverse square law
  (c) 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' Unites, 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.

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.

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 gram of air.

A.6.2.5.3 See A.5.2.4.

A.6.3.3.3(C) Refer to the American Chemistry Council and Association of American Railroads Hazardous Materials Technical Bulletin, *Recommended Terms for Personal Protective Equipment,* issued in October 1985. Also refer to NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies,* and NFPA 1992, *Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies.*

A.6.3.5(D) Safety hazards associated with confined spaces could include the following:

(1) Atmospheric hazards, such as the following:
  (a) Oxygen-deficient atmosphere
  (b) Oxygen-enriched atmosphere
  (c) Flammable/explosive atmosphere
  (d) Toxic atmosphere
(2) Physical hazards, such as the following:
  (a) Engulfment hazards
  (b) Falls/slips
  (c) Electrical hazards
  (d) Structural hazards
  (e) Mechanical hazards

A.6.4.2(2) Emergency procedures for personnel wearing vapor-protective clothing should include procedures for the following:

(1) Loss of air supply
(2) Loss of suit integrity
(3) Loss of verbal communications
(4) Buddy down in hot zone

A.6.4.2(3) Competency for wearing positive pressure self-contained breathing apparatus should have been met as part of Chapter 5.

A.6.4.3(1) Contact the Chlorine Institute for assistance in obtaining training on the use of the various chlorine kits.

A.6.4.3(2) See A.6.4.3(1).

A.6.4.3(7) The safety considerations for product transfer operations should include the following:

(1) Bonding
(2) Grounding
(3) Elimination of ignition sources and shock hazards

A.6.4.3(11) Product removal and transfer considerations should include the following:

(1) Inherent risks associated with such operations
(2) Procedures and safety precautions
(3) Equipment required

A.7.1.2 The following site safety plan considerations are referenced from the *Standard Operating Safety Guides*:

(1) Site description
(2) Entry objectives
(3) On-site organization
(4) On-site control
(5) Hazard evaluation
(6) Personal protective equipment
(7) On-site work plans
(8) Communication procedures
(9) Decontamination procedures
(10) Site safety and health plan

A.7.2.2(3) Examples of types, measurements, and protection include the following:

(1) Types:
  (a) Alpha
  (b) Beta
  (c) Gamma
(2) Units of measurement:
  (a) Activity
  (b) Quantity gamma
  (c) Absorbed dose
(3) Protection factors:
  (a) Half-life
  (b) Inverse square law
  (c) Time, distance, and shielding

A.7.2.2(7) Some examples are shown in Table A.7.2.2(7)(a) and Table A.7.2.2(7)(b).

A.7.3.4.5(C) Safety precautions should include the following:

(1) Buddy systems
(2) Backup team
(3) Personal protective equipment

A.7.3.4.5(E) See A.6.3.5(D).

A.7.4.2 Criteria/factors should include the following:

(1) Task assignment (based upon strategical and tactical options)
(2) Operational safety
(3) Operational effectiveness
(4) Planning support
(5) Logistical support
(6) Administrative support

A.7.6.1 The appropriate steps to transfer command/control of the incident include the following:

Table A.7.2.2(7)(a) Examples of Health Risk for Chemical Agents

Common Name of Chemical Agents	Military Abbreviation	NFPA 704 Ratings*		
		H	F	R
Nerve Agents				
Sarin	GB	4	1	1
Soman	GD	4	1	1
Tabun	GA	4	2	1
V agent	VX	4	1	1
Vesicants (blister agents)				
Mustard	H, HD	4	1	1
Lewisite	L	4	1	1
Blood agents				
Hydrogen cyanide	AC	4	4	2
Cyanogen chloride	CK	3	0	2
Choking agents				
Chlorine	CL	3	0	0
Phosgene	CG	4	0	0

*H represents Health Hazard, F represents Flammability Hazard, and R represents Reactivity Hazard.

Table A.7.2.2(7)(b) Examples of Health Risk for Biological Agents and Toxins

Common Name of Biological Agents and Toxins	Days/Latency	Fatal?
Anthrax	1–5	Yes
Mycotoxin	2–4 hrs	Often
Plague	1–3	Yes
Ricin	18–24	Yes
Viral hemorrhagic fevers	4–21	Yes
Smallpox	7–17	Yes

(1) Fully brief the incoming command/control person on the details of the incident
(2) Communicate the transfer of command/control to all other interests involved in the incident

A.8.3.1.2 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.8.3.1.2.1 The following site safety plan considerations are referenced from the *Standard Operating Safety Guides*:

(1) Site description

(2) Entry objectives
(3) On-site organization
(4) On-site control
(5) Hazard evaluation
(6) Personal protective equipment
(7) On-site work plans
(8) Communication procedures
(9) Decontamination procedures
(10) Site safety and health plan

A.8.3.4.1(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.9.4.2 These abilities should include the following:

(1) Task assignment (based upon strategical and tactical options)
(2) Operational safety
(3) Operational effectiveness
(4) Planning support
(5) Information/research
(6) Logistical support
(7) Administrative support

A.10.1.1 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 should be trained to at least the operational level and in addition should 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 should meet the competencies of this chapter.

A.10.1.1.1 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.10.2.1(A) See A.6.2.5.2(B).

A.10.2.1(D) Conditions where protective clothing with thermal protection could be required if entry was made into an area where flammability was a concern can include the following:

(1) Unknown materials involved
(2) Oxygen-enriched atmosphere
(3) Detectable percent of LEL on monitoring instruments
(4) Materials with a wide flammable range present
(5) Reactive materials present

A.10.2.1(E) Conditions under which personnel would not be allowed in the hot zone include the following:

(1) Decontamination procedures not established or in place
(2) Advanced first-aid and transportation not available
(3) Flammable atmosphere present
(4) Oxygen-enriched atmosphere of 23.5 percent or greater present
(5) Runaway reaction occurring
(6) Appropriate personal protective clothing not available
(7) No effective action can be taken
(8) Risk outweighs benefit
(9) Personnel not properly trained
(10) Insufficient personnel to perform tasks

A.10.2.1(H) Examples of scenarios that would help prepare emergency responders for situations they could encounter in the field include the following:

(1) Ammonia leaking from a fitting or valve of a railroad tank car
(2) Chlorine leaking from the valve stem of a 68-kg (150-lb) cylinder
(3) Lacquer thinner leaking from a hole in a 208-L (55-gal) drum
(4) Gasoline leaking from a hole in the side of an aluminum tank truck
(5) Carbaryl, a powdered insecticide, found stored in a broken cardboard drum

A.10.2.1(I)(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*.

A.10.3.1 Potential action options are either defensive or offensive in nature. See NFPA 471, *Recommended Practice for Responding to Hazardous Materials Incidents*.

A.10.3.1(1) Safety precautions to observe while mitigating hazards or conditions can include the following:

(1) Elimination of ignition sources
(2) Using monitoring instruments
(3) Stabilizing the container
(4) Establishing emergency evacuation procedures
(5) Ensuring availability of hose lines and foam, when appropriate
(6) Evacuating exposures
(7) Isolating the area
(8) Protecting in place
(9) Wearing proper protective equipment

A.10.3.1(2) Safety precautions to be observed during search and rescue missions at hazardous materials incidents can include the following:

(1) Ensuring availability of appropriate personal protective clothing for all personnel
(2) Using monitoring instruments
(3) Maintaining an escape path
(4) Knowledge of approved hand signals by all personnel
(5) Ensuring availability of communications equipment for each team
(6) Preplanning the search sequence prior to entry

A.10.3.3(1) Benefits of pre-emergency planning include the following:

(1) Identifies and mitigates hazards during the planning process
(2) Familiarizes personnel with facility
(3) Identifies 24-hour responsible parties
(4) Identifies built-in containment systems
(5) Identifies the location of utility and other shutoff/shutdown valves and switches
(6) Identifies location of facility map
(7) Identifies location and quantities of hazardous materials
(8) Identifies vulnerable populations
(9) Identifies facility response capabilities

A.10.3.3(2) Hazards to observe when approaching a hazardous materials incident include the following:

(1) Inhalation hazard
(2) Dermal hazard
(3) Flammable hazard
(4) Reactive hazard
(5) Electrical hazard
(6) Mechanical hazard

A.10.3.3(3) The following are the elements of a site safety plan referenced from the *Standard Operating Safety Guides*:

(1) Site description
(2) Entry objectives
(3) On-site organization
(4) On-site control
(5) Hazard evaluation
(6) Personal protective equipment
(7) On-site work plans
(8) Communication procedures
(9) Decontamination procedures
(10) Site safety and health plan

A.10.3.5(4) Typical action options can include surveying the scene, sampling, monitoring, plugging, and patching.

A.10.3.7(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:

(1) EMS control activities
(2) EMS component of an incident management system
(3) Medical monitoring of personnel utilizing chemical-protective and high temperature-protective clothing
(4) Triage of hazardous materials victims
(5) Medical treatment for chemically contaminated individuals
(6) Product and exposure information gathering and documentation

A.10.4.4(9) Safety considerations that can minimize secondary contamination include the following:

(1) Control zones are established and enforced
(2) All people and equipment exiting the hot zone are decontaminated
(3) Personnel performing decontamination are properly trained
(4) Personnel performing decontamination are properly protected

See NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents.*

A.10.4.5(1) Communications systems include in-suit radio communications, hand-held portable radios, air horns, and hand signals.

A.10.5.2(1)(a) Examples of such situations or conditions can include, but are not limited to, the following:

(1) Fire or explosion
(2) Container failure
(3) Sudden change in weather conditions
(4) Failure of entry team personal protective clothing and/or equipment
(5) Updated information on identification of hazardous material(s) involved warranting reassessment of level of protective clothing and equipment being used

A.10.6.2.1 Topics can include, but are not limited to, the following:

(1) Identity of the hazardous materials to which personnel have been or may have been exposed
(2) Signs and symptoms of exposure to the hazardous material(s) involved in the incident
(3) Signs and symptoms of critical incident stress
(4) Duration of a recommended observation period for such signs and symptoms
(5) Procedures to follow in the event of delayed presentation of such signs or symptoms
(6) Name of the individual responsible for post-incident medical contact
(7) Safety and health hazards remaining at the site

A.11.2.1(11)(d) 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.11.2.1(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.11.4.1(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.12.1.3 Technicians operating within the bounds of their training as listed in Chapter 6 of this standard are able to intervene in cargo tank incidents. However, if a hazardous materials response team desires to train some or all of the technicians to have in-depth knowledge of cargo tanks, this chapter sets out the required competencies.

A.12.2.1(5) See A.11.2.1(16).

A.12.4.1(3) See A.11.4.1(9).

A.13.2.1(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.13.2.1(10) See A.11.2.1(11)(d).

A.13.4.1(3) See A.11.4.1(9).

A.13.4.1(7) See A.11.4.1(9).

A.13.4.1(8) See A.11.4.1(9).

A.13.4.1(9) See A.11.4.1(9).

Annex B Competencies for the Technician with a Flammable Liquids Bulk Storage Specialty

This annex 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 annex. 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 Annex B 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 perform the following tasks:

(1) Analyze an incident involving a bulk flammable liquid storage tank to determine the magnitude of the problem by completing the following tasks:
   (a) Determine the type and extent of damage to the bulk liquid storage tank
   (b) Predict the likely behavior of the bulk liquid storage tank and its contents in an incident
(2) 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:
   (a) Determine the response options (offensive, defensive, and nonintervention) for a hazardous materials incident involving flammable liquid bulk storage tanks
   (b) Ensure that the options are within the capabilities and competencies of available personnel, personal protective equipment, and control equipment
(3) 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 6 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 annex 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 perform the tasks in B.2.1.1 through B.2.1.5.

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:

(1) Cone roof tank
(2) Open (external) floating roof tank
(3) Open floating roof tank with a geodesic dome external roof
(4) 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:

(1) Horizontal tank
(2) 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:

(1) Tank shell material of construction
(2) Type of roof and material of construction
(3) Primary and secondary roof seals (as applicable)
(4) Incident venting/pressure relief devices
(5) Tank valves
(6) Tank gauging devices
(7) Tank overfill device
(8) Secondary containment methods (as applicable)
(9) Tank piping and piping supports
(10) 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 perform the tasks in B.2.2.1 through B.2.2.4.

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:

(1) Tank spacing
(2) Product spillage and control (impoundment and diking)
(3) Tank venting and flaring systems
(4) Transfer and product movement capabilities
(5) Monitoring and detection systems
(6) 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:

(1) Type of storage tank
(2) Product involved
(3) Amount of product within the storage tank
(4) Nature of the incident (e.g., seal fire, tank overfill, and full-surface fire)
(5) Tank spacing and exposures
(6) 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 sunken internal roof, tank or piping failures, and full surface fire.

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:

(1) Frothover
(2) Slopover
(3) 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 perform the tasks in B.3.1.1 through B.3.1.11:

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:

(1) Flammable liquid spill (no fire)
(2) Flammable liquid spill (with fire)
(3) 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:

(1) Foam chambers
(2) Catenary systems
(3) Subsurface injection system
(4) Fixed foam monitors
(5) 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:

(1) Pressure vent fire
(2) Seal fire on an open floating roof tank
(3) Seal fire on an internal floating roof tank
(4) Full-surface fire on an internal floating roof tank
(5) Full-surface fire on an external floating roof tank
(6) Dike fire
(7) Pipeline manifold fire

B.3.1.8 Given the size, dimensions, and products involved for a flammable liquid-spill fire, determine the following:

(1) Appropriate extinguishing agent
(2) Appropriate application method (both portable and fixed system application)
(3) Appropriate application rate and duration
(4) Required amount of Class B foam concentrate and required amount of water
(5) 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:

(1) Appropriate extinguishing agent
(2) Appropriate application method (both portable and fixed system application)
(3) Appropriate application rate and duration
(4) Required amount of Class B foam concentrate and required amount of water
(5) 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:

(1) Appropriate extinguishing agent
(2) Appropriate application method (both portable and fixed system application)
(3) Appropriate application rate and duration
(4) Required amount of Class B foam concentrate and required amount of water

(5) 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:

(1) Appropriate extinguishing agent
(2) Appropriate application method (both portable and fixed system application)
(3) Appropriate application rate and duration
(4) Amount of Class B foam concentrate and water required
(5) 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 perform the tasks in B.4.1.1 through B.4.1.4.

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:

(1) Valve and/or flange fire
(2) Pump fire (horizontal or vertical)
(3) Pressure vent fire
(4) Large spill fire
(5) 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:

(1) Selection of proper equipment
(2) Sequence of bonding and grounding connections
(3) 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.

Annex C Competencies for the Technician with a Flammable Gases Bulk Storage Specialty

This annex 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 annex. 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, firefighting 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 Annex C 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 perform the following tasks:

(1) Analyze an incident involving a bulk flammable gas storage tank to determine the magnitude of the problem by completing the following tasks:
   (a) Determine the type and extent of damage to the bulk storage tank
   (b) Predict the likely behavior of the bulk storage tank and its contents in an incident
(2) 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:
   (a) Determine the response options (offensive, defensive, and nonintervention) for a hazardous materials incident involving flammable gas bulk storage tanks
   (b) Ensure that the options are within the capabilities and competencies of available personnel, personal protective equipment, and control equipment
(3) 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 6 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 annex 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 perform the tasks in C.2.1.1 through C.2.1.3.

C.2.1.1 Given examples of various flammable gas bulk storage operations, identify and describe the procedures for the nor-

mal 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.

(1) Horizontal (bullet) tank
(2) Spherical tank

Additional information on the design and construction of high pressure bulk gas storage tanks can be referenced from NFPA 58, *Liquefied Petroleum Gas Code,* 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:

(1) Liquid valve and vapor valve
(2) Safety relief valve
(3) Gauging device
(4) Tank piping and piping supports
(5) 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 perform the tasks in C.2.2.1 through C.2.2.3.

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:

(1) Tank spacing
(2) Product spillage and control (impoundment and diking)
(3) Tank venting and flaring systems
(4) Transfer and product movement capabilities
(5) Monitoring and detection systems
(6) 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:

(1) Water spray systems
(2) Fixed foam monitors
(3) 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 perform the tasks in C.3.1.1 through C.3.1.6.

C.3.1.1 Describe the hazards, safety, and tactical considerations required for the following types of flammable gas incidents:

(1) Flammable vapor release (no fire)
(2) Flammable vapor release (with fire)
(3) Liquefied flammable gas release (no fire)
(4) 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:

(1) Transfer of liquids and vapors
(2) Flaring of liquids and vapors
(3) Venting
(4) 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 perform the tasks in C.4.1.1 through C.4.1.4.

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:

(1) Unignited vapor release
(2) Valve and/or flange vapor release (no fire)
(3) Valve and/or flange fire
(4) 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:

(1) Unignited vapor release
(2) Flange fire
(3) Pump seal fire

C.4.1.3 Demonstrate bonding and grounding procedures for the transfer of flammable gases, including the following:

(1) Selection of proper equipment
(2) Sequence of bonding and grounding connections
(3) 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.

Annex D Competencies for the Technician with a Radioactive Material Specialty

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

D.1 General.

D.1.1 Introduction. Technicians with a radioactive material specialty should be trained to meet all competencies of the first responder awareness, operational, and hazardous materials technician levels and the competencies of this annex. The technician with a radioactive material specialty also should 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.

D.1.2 Definition. Technicians with a radioactive material specialty are those persons who provide support to the hazardous materials technician on the use of radiation detection instruments and would be expected to have the ability to manage the control of radiation exposure and conduct hazards assessment at an incident involving radioactive materials. These technicians are expected to use specialized radiological-protective clothing and survey instrumentation.

D.1.3 Goal. The goal of Annex D should be to provide the technician with a radioactive material 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 radioactive material specialty should be able to perform the following tasks:

(1) Analyze a hazardous materials incident involving radioactive materials to determine the magnitude of the problem in terms of outcomes by completing the following tasks:
   (a) Determine the type and extent of damage to the radioactive material containers
   (b) Predict the likely behavior of the radioactive material container and its contents
(2) Plan a response for an emergency involving radioactive materials within the capabilities and competencies of available personnel, personal protective equipment, and control equipment based on an analysis of the radioactive material incident
(3) Implement the planned response to a hazardous materials incident involving radioactive materials

D.1.4 Mandating of Competencies. This standard does not mandate that hazardous materials response teams performing offensive operations on radioactive material incidents have technicians with a radioactive material specialty. Technicians operating within the bounds of their training as listed in this standard are able to intervene in radioactive material incidents. However, if a hazardous materials response team desires to train some or all of its technicians to have in-depth knowledge of radioactive materials, this annex sets out the required competencies.

D.2 Competencies — Analyzing the Incident.

D.2.1 Determining the Type and Extent of Damage to Containers. Given examples of facility and transportation incidents involving radioactive materials, technicians with a radioactive material specialty should identify the type and extent of damage to the radioactive material packaging.

D.2.2 Estimating the Likely Harm in the Endangered Area. Given various facility and transportation incidents involving radioactive materials, technicians with a radioactive material specialty should estimate the potential harm within the endangered area. The technician with a radioactive material specialty should be able to perform the tasks in D.2.2.1 through D.2.2.2.9.

D.2.2.1 Given existing and projected data/information concerning surrounding conditions (e.g., weather, topography, or vegetation), estimate size and shape of the engulfed area using computer modeling, monitoring equipment, and specialists in this field.

D.2.2.1.1 Identify a resource for determining the size of an endangered area at a radioactive materials incident.

D.2.2.1.2 Identify locally available and additional/augmentation resources and capabilities for dispersion pattern prediction and modeling including computers, monitoring equipment, or specialists accredited in the field.

D.2.2.1.3 Given radiological survey data of released material, identify the steps for determining the extent of the hazards (e.g., physical, safety, and health) within the endangered area of a radioactive materials incident.

D.2.2.2 Given size and shape of the engulfed area and the contamination levels and/or the dose rates from the released material, estimate the potential harm within the endangered area at a radioactive material incident using computer modeling, monitoring equipment, and/or specialists in this field.

D.2.2.2.1 Identify resources available for determining the contamination levels and/or the dose rates from a released radioactive material within an endangered area.

D.2.2.2.2 Identify the factors for determining the extent of physical, health, and safety hazards within the endangered area of a radioactive materials incident over time.

D.2.2.2.3 Identify resources available that can indicate the effects of mixing various radioactive materials on damaged/undamaged containers.

D.2.2.2.4 Given the appropriate reference materials, identify the signs and symptoms of exposure to radioactive materials and the target organ effects of exposure to that material.

D.2.2.2.5 Explain the basic toxicological principles relative to assessment and treatment of personnel exposed to radiological materials, including the following:

(1) Acute and chronic exposures
(2) Local and systemic effects
(3) Dose response
(4) Synergistic effects

D.2.2.2.6 Describe the following terms and explain their significance in the risk assessment process:

(1) External exposure/dose
(2) Internal exposure/dose
(3) Lens of the eye dose equivalent

(4) Committed effective dose equivalent
(5) Effective dose equivalent
(6) Total effective dose equivalent
(7) Half-life
(8) High radiation area
(9) Very high radiation area

D.2.2.2.7 Identify limitations associated with use of on-scene survey and monitoring equipment/data.

D.2.2.2.8 Explain why direct readings of packages using contamination survey instrumentation do not confirm or deny the presence of contamination.

D.2.2.2.9 Describe the difference between contamination survey instruments and dose or dose rate survey instruments.

D.3 Competencies — Planning the Response.

D.3.1 Determining the Response Options. Given the analysis of an emergency involving transportation of radioactive materials, technicians with a radioactive material specialty should determine the response options for each container (and radioactive material) involved. The technician with a radioactive material specialty should be able to perform the tasks in D.3.1.1.

D.3.1.1 Identify considerations associated with conducting continuous radiation monitoring and assessments during the conduct of the response. The technician with a radioactive material specialty should be able to describe the following:

(1) Type, frequency, and scope of monitoring required
(2) Type, frequency, and scope of assessments required
(3) Resources required to conduct continuous monitoring and assessments

Procedures for ensuring monitoring and assessments are conducted as required.

D.4 Competencies — Implementing the Planned Response.

D.4.1 Implementing the Planned Response. Given an analysis of an emergency involving radioactive materials and the planned response, technicians with a radioactive material specialty should implement or oversee the implementation of the selected response options safely and effectively. The technician with a radioactive material specialty should be able to perform the following tasks:

(1) Identify the criteria for determining the locations of the control zones at radioactive materials incidents
  (a) Radiation surveys (initial and periodic)
  (b) Contamination surveys (initial and periodic)
(2) Identify the items to be considered in a safety briefing prior to allowing personnel to work on a radioactive materials incident
  (a) Allowable exposure limits
  (b) Exposure control
  (c) Contamination control
  (d) Exposure reporting and tracking system
(3) Determine the appropriate radiation detection instruments to identify and quantify the materials
  (a) Beta and gamma dose rate and count rate instruments
  (b) Alpha count rate instruments
  (c) Air samplers

Annex E Overview of Responder Levels and Tasks at Hazardous Materials Incidents

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

E.1 Responder Levels.

E.1.1 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.

E.1.2 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.

E.1.3 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.

E.1.4 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.

E.2 Responder Tasks

E.2.1 The list of analysis tasks by responder level is as follows:

(1) *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:
  (a) Detect the presence of the hazardous materials
  (b) 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
  (c) Collect hazard and response information from the current edition of the *Emergency Response Guidebook*
(2) *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:
  (a) Survey the hazardous materials incident to identify the containers and materials involved, determine whether hazardous materials have been released, and evaluate the surrounding conditions
  (b) Collect hazard and response information from material safety data sheets (MSDS), CHEMTREC/CANUTEC/SETIQ, and shipper/manufacturer contacts
  (c) Predict the likely behavior of a material and its container

(d) Estimate the potential harm at a hazardous materials incident

(3) *Technician Level.* The hazardous materials technician should be competent at the awareness and operational levels 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:
   (a) 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
   (b) Collect and interpret hazard and response information from printed resources, technical resources, computer databases, and monitoring equipment
   (c) Determine the extent of damage to containers
   (d) Predict the likely behavior of released materials and their containers when multiple materials are involved
   (e) Estimate the size of an endangered area using computer modeling, monitoring equipment, or specialists in this area

(4) *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:
   (a) Collect and interpret hazard and response information from printed resources, technical resources, computer databases, and monitoring equipment
   (b) Estimate the potential outcomes within the endangered area at a hazardous materials incident

E.2.2 The list of planning tasks by responder level is as follows:

(1) *Awareness Level.* No requirements.

(2) *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:
   (a) Describe the response objectives for hazardous materials incidents
   (b) Describe the defensive options available by response objective
   (c) Determine if the personal protective equipment provided is appropriate for implementing each action option
   (d) Identify the emergency decontamination procedures

(3) *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:
   (a) Identify the response objectives for hazardous materials incidents
   (b) Identify the potential action options available by response objective
   (c) Select the personal protective equipment required for a given action option
   (d) Select the appropriate decontamination procedures
   (e) 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

(4) *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:
   (a) Identify the response objectives for hazardous materials incidents
   (b) Identify the potential action options (defensive, offensive, and nonintervention) available by response objective
   (c) Approve the level of personal protective equipment required for a given action option
   (d) 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

E.2.3 The list of implementation tasks by responder level is as follows:

(1) *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 *Emergency Response Guidebook* by completing the following tasks:
   (a) Initiate protective actions
   (b) Initiate the notification process

(2) *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:
   (a) Establish and enforce scene control procedures, including control zones, decontamination, and communications
   (b) Initiate an incident management system (IMS)
   (c) Don, work in, and doff personal protective equipment provided by the authority having jurisdiction
   (d) Perform the defensive control actions identified in the plan of action

(3) *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:
   (a) Perform the duties of an assigned position within the local incident management system
   (b) 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
   (c) Perform the control functions identified in the plan of action

(4) *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:

(a) Implement the incident management system, including the specified procedures for notification and utilization of nonlocal resources (including private, state, and federal government personnel)
(b) 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
(c) Provide a focal point for information transfer to media and local elected officials through the incident management system structures

E.2.4 The list of evaluation tasks by responder level is as follows:

(1) *Awareness Level.* No requirements.
(2) *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:
   (a) Evaluate the status of the defensive actions taken in accomplishing the response objectives
   (b) Communicate the status of the planned response
(3) *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.
(4) *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.

E.2.5 The list of termination tasks by responder level is as follows:

(1) *Awareness Level.* No requirements.
(2) *Operational Level.* No requirements.
(3) *Technician Level.* The hazardous materials technician should be competent to terminate an incident by completing the following tasks:
   (a) Assist in the incident debriefing
   (b) Assist in the incident critique
   (c) Provide reports and documentation of the incident
(4) *Command Level.* The incident commander should be competent to terminate an incident by completing the following tasks:
   (a) Transfer of command (control) when appropriate
   (b) Conduct an incident debriefing
   (c) Conduct a multi-agency critique
   (d) Report and document the hazardous materials incident and submit the reports to the proper entity

Annex F Definitions of Hazardous Materials

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

F.1 General. 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.

F.2 Hazardous Materials Terms. The following hazardous materials terms, as used by the indicated government agencies, show the variety of definitions that can be applied.

F.2.1 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.

F.2.2 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 Table 302.4 of 40 CFR, 302. The U.S. Occupational Safety and Health Administration (OSHA) uses the term *hazardous substance* in 29 CFR 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.

F.2.3 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 (40 CFR 355).

F.2.4 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.

F.2.5 Hazardous Wastes. EPA uses the term *hazardous wastes* for chemicals that are regulated under the Resource, Conservation, and Recovery Act (40 CFR 261.33). Hazardous wastes in transportation are regulated by DOT (49 CFR 170–180).

F.2.6 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.

F.2.7 Dangerous Goods. In Canadian transportation, hazardous materials are called *dangerous goods*.

F.2.8 Highly Hazardous Chemicals. OSHA uses the term *highly hazardous chemicals* for those chemicals that fall under the requirements of 29 CFR 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.

Annex G UN/DOT Hazard Classes and Divisions

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

G.1 General. The definitions of UN/DOT hazard classes and divisions (49 CFR 170–180) are as follows.

G.2 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.

G.2.1 Division 1.1. 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.

G.2.2 Division 1.2. 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.

G.2.3 Division 1.3. 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.

G.2.4 Division 1.4. Division 1.4 consists of explosive devices that present a minor explosion hazard. No device in the division can 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.

G.2.5 Division 1.5. 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).

G.2.6 Division 1.6. 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.

G.3 Class 2 — Gases.

G.3.1 Division 2.1. 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, has a boiling point of 20°C (68°F) or less at 101.3 kPa (14.7 psi), and has the following properties:

(1) Is ignitable at 101.3 kPa (14.7 psi) when in a mixture of 13 percent or less by volume with air
(2) 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.

G.3.2 Division 2.2. 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.

G.3.3 Division 2.3. 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), has a boiling point of 20°C (68°F) or less at 101.3 kPa (14.7 psi), and has the following properties:

(1) Is known to be so toxic to humans as to pose a hazard to health during transportation
(2) 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 5000 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:

(1) Hazard zone A — LC_{50} less than or equal to 200 ppm
(2) Hazard zone B — LC_{50} greater than 200 ppm and less than or equal to 1000 ppm
(3) Hazard zone C — LC_{50} greater than 1000 ppm and less than or equal to 3000 ppm
(4) Hazard zone D — LC_{50} greater than 3000 ppm and less than or equal to 5000 ppm

G.4 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.

G.4.1 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.

G.5 Class 4 — Flammable Solids.

G.5.1 Division 4.1. Division 4.1 (flammable solid) consists of any of the following three types of materials:

(1) Wetted explosives — explosives wetted with sufficient water, alcohol, or plasticizers to suppress explosive properties
(2) 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
(3) 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.

G.5.2 Division 4.2. Division 4.2 (spontaneously combustible material) consists of any of the following materials:

(1) Pyrophoric material — a liquid or solid that, even in small quantities and without an external ignition source, can ignite within 5 minutes after coming in contact with air
(2) 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.

G.5.3 Division 4.3. 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.

G.6 Class 5 — Oxidizers and Organic Peroxides.

G.6.1 Division 5.1. 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.

G.6.2 Division 5.2. 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 the following seven types:

(1) Type A — organic peroxide that can detonate or deflagrate rapidly as packaged for transport. Transportation of Type A organic peroxides is forbidden.
(2) Type B — organic peroxide that neither detonates nor deflagrates rapidly, but that can undergo a thermal explosion.
(3) Type C — organic peroxide that neither detonates nor deflagrates rapidly and cannot undergo a thermal explosion.
(4) Type D — organic peroxide that detonates only partially or deflagrates slowly, with medium to no effect when heated under confinement.
(5) Type E — organic peroxide that neither detonates nor deflagrates and shows low, or no, effect when heated under confinement.
(6) 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.
(7) 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.

G.7 Class 6 — Poisonous Materials.

G.7.1 Division 6.1. 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.

G.7.2 Division 6.2. 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 as follows:

(1) Hazard zone A — LC_{50} less than or equal to 200 ppm
(2) Hazard zone B — LC_{50} greater than 200 ppm and less than or equal to 1000 ppm

G.8 Class 7 — Radioactive Materials. Radioactive material is any material having a specific activity greater than 0.002 microcuries per gram (μCi/g). Examples of Class 7 materials include cobalt, uranium hexafluoride, and "yellow cake."

G.9 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.

G.10 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:

(1) 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
(2) 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.

G.11 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.

G.12 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.

G.13 Marine Pollutant. A marine pollutant is a material that has an adverse effect on aquatic life.

G.14 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:

(1) Liquid at or above 100°C (212°F)
(2) 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
(3) Solid at a temperature at or above 240°C (464°F)

Annex H Informational References

H.1 The following documents or portions thereof are referenced within this standard for informational purposes only and are thus not part of the requirements of this document unless also listed in Chapter 2.

H.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*, 1998 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2000 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2001 edition.

NFPA 471, *Recommended Practice for Responding to Hazardous Materials Incidents*, 2002 edition.

NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents*, 2002 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System*, 2002 edition.

NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies*, 2000 edition.

NFPA 1992, *Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies*, 2000 edition.

Hazardous Materials Response Handbook, 1997.

H.1.2 Other Publications.

H.1.2.1 API Publications. American Petroleum Institute, 1220 L Street, NW, Washington, DC 2005-4070.

API 2021, *Guide for Fighting Fires in and Around Flammable and Combustible Liquid Atmospheric Petroleum Storage Tanks*, 2001.

API 2510-A, *Fire Protection Considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities*, 1996.

H.1.2.2 American Chemistry Council (formerly Chemical Manufacturers Association) Publication. American Chemistry Council, 1300 Wilson Blvd., Arlington, VA 22209.

Recommended Terms for Personal Protective Equipment, 1985.

H.1.2.3 National Fire Academy Publication. National Fire Academy, Federal Emergency Management Agency, Emmitsburg, MD 21727.

Hazardous Materials Incident Analysis, 1984.

H.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*, 2001.

H.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 170–180.

Emergency Response Guidebook, U.S. Department of Transportation, 2000 edition.

H.1.2.6 Additional Publications.

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.

National Toxicology Program, U.S. Department of Health and Human Services, 9th Report on Carcinogens, Washington, DC, 2001.

H.2 Informational References (Reserved).

H.3 References for Extracts. The following documents are listed here to provide reference information, including title and edition, for extracts given throughout this standard as indicated by a reference in brackets [ ] following a section or paragraph. These documents are not a part of the requirements of this document unless also listed in Chapter 2 for other reasons.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2002 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2000 edition.

NFPA 295, *Standard for Wildfire Control*, 1998 edition.

NFPA 306, *Standard for the Control of Gas Hazards on Vessels*, 2001 edition.

NFPA 424, *Guide for Airport/Community Emergency Planning*, 1996 edition.

NFPA 471, *Recommended Practice for Responding to Hazardous Materials Incidents*, 2002 edition.

NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents*, 2002 edition.

NFPA 600, *Standard on Industrial Fire Brigades*, 2000 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 2002 edition.

NFPA 1581, *Standard on Fire Department Infection Control Program*, 2000 edition.

Index