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Hazardous Materials/Weapons of Mass Destruction Response Handbook

Seventh Edition

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Edited by

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With the complete text of the 2018 editions of NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, and NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents*, and the 2017 editions of NFPA 475, *Recommended Practice for Organizing, Managing, and Sustaining a Hazardous Materials/Weapons of Mass Destruction Response Program*, and NFPA 1072, *Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications*

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Preface

The National Fire Protection Association's NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, and NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents*, continue to be valued in emergency response communities as premier resources for training and operational procedures.

New to the cadre of hazardous materials/weapons of mass destruction personnel response documents are NFPA 1072, *Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications,* and NFPA 475, *Recommended Practice for Organizing, Managing, and Sustaining a Hazardous Materials/Weapons of Mass Destruction Response Program.*

NFPA 1072 was initiated by the Technical Committee on Hazardous Materials Response Personnel. The development of this hazardous materials professional qualifications document covers awareness, operations, operations mission-specific, technician, and incident commander, using the information of NFPA 472 as a framework.

NFPA 475 was established by the technical committee after discussion and determination that while information in the withdrawn NFPA 471, *Recommended Practice for Responding to Hazardous Materials Incidents,* had been relocated to NFPA 472, there was information that was needed beyond what is in NFPA 472 to communicate the uniqueness and challenges of organizing, maintaining, and sustaining a hazardous materials response program.

Because NFPA 1072 was developed with information from NFPA 472, the Introduction of the *Hazardous Materials/Weapons of Mass Destruction Response Handbook* is designed to give users insights into the correlation of the two documents. In Part I, the main text from NFPA 472 is presented in the chronological manner of the standard. Commentary is provided on particular sections, and information on the job performance requirements (JPRs) from NFPA 1072 are shown throughout this part of the handbook in NFPA 1072 Note boxes.

Because NFPA 475 and NFPA 1072 are new documents, limited commentary is offered in Part III and Part IV. Stakeholders and users are encouraged to become familiar with the documents and develop their perspectives on a hazardous materials response program.

The fundamentals for response to hazardous materials incidents are based on concepts that are tried and true. Vital to the concepts presented are the acts of responding to and mitigating dangers in a safe, efficient, and expert manner. Escalation of circumstances that include increased causalities, expanded geographical conditions, criminal intent, or implications of terrorism only solidifies the need for a firm base from which to manage such situations, and that base is promoted in both NFPA 472 and NFPA 473. While NFPA 472 was the original document designed for emergency responders, stakeholders encouraged the development of NFPA 1072. Emergency responders comprise fire, rescue, law enforcement, emergency medical services, private industry, and allied professionals. Allied professionals include certified industrial hygienists, certificated safety professionals, certified health physicists, certified hazardous materials managers, and similar credentialed and competent individuals as determined by the authority having jurisdiction (AHJ).

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Emergency responders should be trained to perform tasks expected of them in expanded roles, given the complexities and demands they experience today. EMS personnel may be called to respond to a difficult incident that involves one person with unusual signs and symptoms — or many people as a result of a mass casualty. NFPA 473 is intended to assist in the protection of EMS emergency responders as they manage the care of the patient.

This edition of the *Hazardous Materials/Weapons of Mass Destruction Response Handbook* complements NFPA 472 and NFPA 473 with accompanying commentary and follow-up information from the Technical Committee on Hazardous Materials Response Personnel. Part I covers NFPA 472 and includes competencies for awareness personnel, operations level responders, operations mission-specific, hazardous materials technicians, incident commanders, hazardous materials officers, hazardous materials safety officers, specialist employees, and specialty technicians. Part II covers NFPA 473 and includes competencies for basic life support (BLS) and advanced life support (ALS) responders. Part III covers NFPA 475 and organizing, maintaining, and sustaining hazardous materials/weapons of mass destruction response programs. Part IV covers NFPA 1072 and follows the first series of chapters (awareness, operations, operations mission-specific, technician, and incident commander) with corresponding JPRs.

Part V provides a glossary of terms that will be helpful when using all four of the documents. Part VI offers supplemental material that contains helpful information for the emergency responder.

The Technical Committee on Hazardous Materials Response Personnel continues to address the challenges facing hazardous materials response with new, relevant material. This edition of NFPA 472 includes information on operations mission-specific competencies in diving in contaminated water environment and evidence collection. The technical committee revised technician competencies for Chapter 7 and developed new chapters covering specialty competencies in the following areas:

- Chapter 19, Competencies for Hazardous Materials Technician with an Advanced Monitoring and Detection Specialty
- Chapter 20, Competencies for Hazardous Materials Technician with a Consequence
- Chapter 21, Competencies for Hazardous Materials Technician with an Advanced Chemical Risk Assessment and Analysis Specialty
- Chapter 22, Competencies for Hazardous Materials Technician with an Advanced Product Control Specialty
- Chapter 23, Competencies for Hazardous Materials Technician with a Weapons of Mass Destruction Specialty
- Chapter 24, Competencies for Hazardous Materials Technician with an Advanced Decontamination Specialty

Additionally, operations mission-specific competencies were developed for diving in contaminated water environment and evidence collection. The 2018 revision of NFPA 473 included a review and minor updates.

To be clear: NFPA 472 is not being withdrawn and replaced with NFPA 1072. That was never the intention. The Technical Committee on Hazardous Materials Response Personnel is committed to a competency-based approach by presenting necessary information for a safe, effective, and efficient response to hazardous materials/weapons of mass destruction incidents. To accomplish this task, the committee continues to meet the challenges by revising and modifying NFPA 472 and continues to lead with up-to-date and innovative hazardous materials information. NFPA 473, NFPA 475, and NFPA 1072 complement NFPA 472 with specific, relevant information for EMS response and hazardous materials program development to serve the EMS community and to supplement professional qualifications for those seeking certification.

Ultimately, this seventh edition of the *Hazardous Materials/Weapons of Mass Destruction Response Handbook* aims to provide deeper engagement in the knowledge and skills for hazardous materials response. To accomplish this, NFPA provides a single educational and

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training reference work produced to deliver technically accurate knowledge and information that is linked to the efforts of the technical committee responsible for hazardous materials and weapons of mass destruction incidents to help save lives and reduce property loss. This handbook will assist and guide responders in training, education, and response to incidents involving hazardous materials and weapons of mass destruction for safe, effective, and efficient response.

Acknowledgments

I would like to express my sincere appreciation to the staff at NFPA for the opportunity to participate in the development of the 2018 edition of the *Hazardous Materials/Weapons of Mass Destruction Response Handbook*.

I'd like to convey a great deal of thanks to Chair Greg Noll and all the members of the Technical Committee on Hazardous Materials Response Personnel for their time, energy, effort, and commitment to the standards development process, all the meetings that took place in person, and so many conference call hours towards achieving documents that are comprehensive and useful to the responder community. NFPA 472 and NFPA 473 have a long and distinguished history and now coupled with NFPA 475 and NFPA 1072 create a library of information vital to safe responsiveness to not only hazardous materials incidents but all types of first response capabilities. Special thanks to the members of the technical committee who contributed their knowledge and expertise and who reviewed various portions of this handbook and contributed photos and artwork.

Thank you to all who have taken the time and effort to review NFPA 472, NFPA 473, and the new documents NFPA 475 and NFPA 1072 and submit public inputs and comments that when combined with the original standard offer the most value in operational methods and the professional competencies and qualifications to the hazardous materials/weapons of mass destruction emergency response community.

To all the hazardous materials teams throughout the country, and especially to Massachusetts Department of Fire Services Hazardous Materials Regional Response Team District Four, be safe!

I would like to thank members of the NFPA technical and editorial staff for their invaluable assistance: Debra Rose, Khela Thorne, Tracy Gaudet, Ellen Cosgrove, Cheryl Langway, and Josiane Domenici.

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—Tom McGowan

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Introduction

Comparison of NFPA 1072 to NFPA 472

The matrices shown here are designed to help stakeholders and users determine the correlation between what is offered in NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents,* and in NFPA 1072, *Standard on Hazardous Materials/Weapons of Mass Destruction Response Personnel Professional Qualifications,* and allows stakeholders and users to determine the best approach to meeting the needs of emergency response personnel when addressing hazardous materials incidents.

Until recently, NFPA 472 was the "go-to" standard for response personal to hazardous materials/weapons of mass destruction incidents. This continues to be the case, using *competence* as the key factor for determining readiness for the responder.

Competence is the combination of knowledge, skills, and ability of an individual to do a job effectively. A competency is a set of defined behaviors that provide a guide to enable the identification, evaluation, and continued professional development of employees who are required to perform in an accurate and effective manner within an assigned or specific role.

The Technical Committee on Hazardous Materials Response Personnel spent nearly 4 years developing NFPA 1072 in response to the growing need for an evaluation instrument for certification. This effort aligns chapters for awareness, operations, operations mission-specific, technician, and incident commander (Chapters 4–8 of NFPA 472) with the *qualifications* in NFPA 1072.

Qualification is work- or job-related knowledge, acquired through formal or informal education that is competency based, with skills and knowledge or abilities that are required to do a particular job in an accurate, efficient, and effective manner. These qualifications are based on national standards and are assessed in the workplace to verify that an individual is able to perform the task or achieve a level of performance specified in the job performance requirements (JPRs).

While there are subtle distinctions in competence and qualification, the knowledge, skills, and abilities for responders are established in NFPA 472 and evaluated through job performance reviews (JPRs) found in NFPA 1072.

Thus, the following matrices for awareness, operations, operations mission-specific, technician, and incident commander for hazardous materials/weapons of mass destruction incident response have been developed.

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Chapter 4 Awareness	
NFPA 1072	**NFPA 472**
***4.2 Recognition and Identification.**	**4.2.1 Recognizing the Presence of Hazardous Materials/WMD.**
Recognize and identify the hazardous materials/WMD and hazards involved in a hazardous materials/ WMD incident, given a hazardous materials/WMD incident, and approved reference sources, so that the presence of hazardous materials/WMD is recognized and the hazardous materials/WMD and their hazards are identified.	Given a hazardous materials/WMD incident, and approved reference sources, awareness level personnel shall recognize those situations where hazardous materials/WMD are present
4.2 (A) Requisite Knowledge	
What hazardous and WMD materials are	4.2.1 (1)* Define the terms *hazardous material* (or *dangerous goods*, in Canada) and *WMD*
Basic hazards associated with hazard classes and divisions	4.2.1 (2) Identify the hazard classes and divisions of hazardous materials/WMD and identify common examples of materials in each hazard class or division 4.2.1 (3)* Identify the primary hazards associated with each hazard class and division 4.4.1(3)(c)* Identify the ways hazardous materials/WMD are harmful to people, animals, the environment, and property
Indicators to the presence of hazardous materials includes container shapes, NFPA 704 markings, globally harmonized system (GHS) markings, placards, labels, pipeline markings, other transportation markings, shipping papers with emergency response information, and other indicators	4.2.1 (6) Identify typical container shapes that can indicate the presence of hazardous materials/WMD 4.2.1 (7)(b) NFPA 704 markings 4.2.1 (8) NFPA 704 markings to describe the significance of the colors, numbers, and special symbols 4.2.1 (7)(g) Globally harmonized system of classification and labeling of chemicals (GHS) 4.2.1 (9) Identify placards and labels that indicate hazardous materials/WMD 4.2.1 (9) Identify placards and labels that indicate hazardous materials/WMD 4.2.1 (7)(e) Pipeline markings 4.2.1 (7) Identify facility and transportation markings and colors that indicate hazardous materials/WMD, including the following: 4.2.1 (7)(a) Transportation markings, including UN/NA identification number marks, marine pollutant mark, elevated temperature (HOT) mark, commodity marking, and inhalation hazard mark 4.2.1 (11)(a) Identify the entries on shipping papers that indicate the presence of hazardous materials 4.2.1 (11)(b) Match the name of the shipping papers found in transportation (air, highway, rail, and water) with the mode of transportation 4.2.1 (11)(c) Identify the person responsible for having the shipping papers in each mode of transportation 4.2.1 (11)(d) Identify where the shipping papers are found in each mode of transportation 4.2.1 (11)(e) Identify where the papers can be found in an emergency in each mode of transportation 4.2.1 (4) Identify the difference between hazardous materials/WMD incidents and other emergencies 4.2.1 (5) Identify typical occupancies and locations in the community where hazardous materials/WMD are manufactured, transported, stored, used, or disposed of 4.2.1 (7)(c)* Military hazardous materials/WMD markings

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	4.2.1 (7)(d) Special hazard communication markings for each hazard class **4.2.1** (7)(f) Container markings
Accessing information from the Emergency Response Guidebook (ERG) (current edition) including name of the material, UN/NA identification number, container shape diagrams, types of hazard information available from the ERG, safety data sheets (SDS), and other approved reference sources	**4.2.3** (1)* Identify the three methods for determining the guidebook page for a hazardous material/WMD **4.2.3** (1)* Identify the three methods for determining the guidebook page for a hazardous material/WMD **4.2.3** (1)* Identify the three methods for determining the guidebook page for a hazardous material/WMD **4.2.3** (2) Identify the two general types of hazards found on each guidebook page **4.2.1** (10) Identify the following basic information on safety data sheets (SDS): **4.2.1** (10)(a) Identify where to find SDS **4.2.1** (10)(b) Identify major sections of an SDS **4.2.2** (3) Identify sources for obtaining the names of hazardous materials/WMD at a facility **4.2.2** (2) Identify sources for obtaining the names of, UN/NA identification numbers for, or types of placard associated with hazardous materials/WMD in transportation **4.2.2** (3) Identify sources for obtaining the names of hazardous materials/WMD at a facility **4.2.1 (**12) Identify examples of other clues, including the senses (sight, sound, and odor), which indicate the presence of hazardous materials/WMD **4.2.2** (1) Identify difficulties encountered in determining the specific names of hazardous materials/WMD at facilities and in transportation
4.2 (B) Requisite Skills	
Recognizing indicators to the presence of hazardous materials/WMD	
Identifying hazardous materials/WMD by name, UN/NA identification number, placard applied, or container shape diagrams	**4.2.2** Given examples of hazardous materials/WMD incidents, awareness level personnel shall, from a safe location, identify the hazardous material(s)/WMD involved in each situation by name, UN/NA identification number, or type placard applied
Using the following to identify hazardous materials/WMD and potential fire, explosion, and health hazards includes ERG, SDS, shipping papers with emergency response information, and other approved reference sources	**4.2.3** Given the identity of various hazardous materials/WMD (name, UN/NA identification number, or type placard), awareness level personnel shall identify the fire, explosion, and health hazard information for each material by using the current edition of the ERG or equivalent document, safety data sheet (SDS), and manufacturer, shipper and carrier documents (including shipping papers) and contacts

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4.3* Initiate Protective Actions.	**4.4.1 Isolate the Hazard Area.**
Isolate the hazard area and deny entry at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, policies and procedures, and approved reference sources, so that the hazard area is isolated and secured, personal safety procedures are followed, hazards are avoided or minimized, and additional people are not exposed to further harm.	**4.4.1** (1) Identify the location of both the emergency response plan and/or standard operating procedures **4.4.2** (2) Identify the role of the awareness level personnel during hazardous materials/WMD incidents **4.4.1** (3) Identify the following basic precautions to be taken to protect themselves and others in hazardous materials/WMD incidents: **4.4.1** (3)(a) Identify the precautions necessary when providing emergency medical care to victims of hazardous materials/WMD incidents **4.4.1** (3)(b) Identify typical ignition sources found at the scene of hazardous materials/WMD incidents **4.4.1** (3)(d)* Identify the general routes of entry for human exposure to hazardous materials/WMD
4.3 (A) Requisite Knowledge	
Use of the following to identify precautions to be taken to protect responders and the public: ERG, SDS, shipping papers with emergency response information, and other approved reference sources	**4.4.1** (4)* Given examples of hazardous materials/WMD and the identity of each hazardous material/WMD (name, UN/NA identification number, or type placard), identify the following response information: **4.4.1** (4)(a) Emergency action (fire, spill, or leak and first aid) **4.4.1** (4)(b) Personal protective equipment from the following list: i. Street clothing and work uniforms ii. Structural fire-fighting protective clothing iii. Positive pressure self-contained breathing apparatus **4.4.1** (4)(c) Initial isolation and protective action distances Chemical-protective clothing and equipment **4.4.1** (5) Identify the definitions for each of the following protective actions: (a) Isolation of the hazard area and denial of entry (b) Evacuation (c)* Shelter-in-place **4.4.1** (4)(a) Emergency action (fire, spill, or leak and first aid) **4.4.1** (4)(b) Personal protective equipment from the following list: i. Street clothing and work uniforms ii. Structural fire-fighting protective clothing iii. Positive pressure self-contained breathing apparatus iv. Chemical-protective clothing and equipment
Policies and procedures for isolating the hazard area and denying entry	**4.4.1** (6) Identify the size and shape of recommended initial isolation and protective action zones **4.4.1** (7) Describe the difference between small and large spills as found in the Table of Initial Isolation and Protective Action Distances in the ERG or equivalent document **4.4.1** (8) Identify the circumstances under which the following distances are used at hazardous materials/WMD incidents: **4.4.1** (8)(a) Table of Initial Isolation and Protective Action Distances **4.4.1** (8)(b) Isolation distances in the numbered guides **4.4.1** (9) Describe the difference between the isolation distances on the orange-bordered guidebook pages and the protective action distances on the green-bordered ERG pages

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Purpose of and methods for isolating the hazard area and denying entry	**4.4.1** (10) Identify the techniques used to isolate the hazard area and deny entry to unauthorized persons at hazardous materials/WMD incidents
4.3 (B) Requisite Skills	
Recognizing precautions for protecting responders and the public	
Identifying isolation areas	
Denying entry	
Avoiding and minimizing hazards	
4.4 Initiate Required Notifications.	**4.4.2 Initiating the Notification Process.**
Initiate required notifications at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, policies and procedures, and approved communications equipment, so that the notification process is initiated and the necessary information is communicated.	Given a hazardous materials/WMD incident, policies and procedures, and approved communications equipment, awareness level personnel shall initiate required notifications at a hazardous materials/WMD incident
4.4 (A) Requisite Knowledge	
Policies and procedures for notification, reporting, and communications	(1) Identify policies and procedures for notification, reporting, and communications
Types of approved communications equipment	(2) Identify types of approved communications equipment
Operation of that equipment	(3) Describe how to operate approved communications equipment
4.4 (B) Requisite Skills	
Operating approved communication equipment and communicating in accordance with policies and procedures	

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5.2 Identify Potential Hazards.	**5.2.1 Surveying Hazardous Materials/WMD Incidents.**
Identify the scope of the problem at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment, policies and procedures, and approved reference sources, so that container types, materials, location of the release, and surrounding conditions are identified, hazard information is collected, the potential behavior of a material and its container is identified, and the potential hazards, harm, and outcomes associated with that behavior are identified.	Given scenarios involving hazardous materials/WMD incidents, the operations level responder shall collect information about the incident to identify the containers, the materials involved, leaking containers, and the surrounding conditions by completing the requirements of 5.2.1.1 through 5.2.1.6
5.2 (A) Requisite Knowledge	
Definitions of hazard classes and divisions	**5.2.2** (1) Match the definitions associated with the UN/DOT hazard classes and divisions of hazardous materials/WMD, including refrigerated liquefied gases and cryogenic liquids, with the class or division

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Types of containers	**5.2.1.1*** Given examples of the following pressure containers, the operations level responder shall identify each container by type, as follows: (1) Bulk fixed facility pressure containers (2) Pressure tank cars (3) High-pressure cargo tanks (4) Compressed gas tube trailers (5) High-pressure intermodal tanks (6) Ton containers (7) Y-cylinders (8) Compressed gas cylinders (9) Portable and horizontal propane cylinders (10) Vehicle-mounted pressure containers **5.2.1.1.1** Given examples of the following cryogenic containers, the operations level responder shall identify each container by type, as follows: (1) Bulk fixed facility cryogenic containers (2) Cryogenic liquid tank cars (3) Cryogenic liquid cargo tanks (4) Intermodal cryogenic containers (5) Cryogenic cylinders (6) Dewar flasks **5.2.1.1.2** Given examples of the following liquids-holding containers, the operations level responder shall identify each container by type, as follows: (1) Bulk fixed facility tanks (2) Low-pressure tank cars (3) Nonpressure liquid cargo tanks (4) Low-pressure chemical cargo tanks (5) 01 and 102 intermodal tanks (6) FIBCs/RIBCs (7) Flexible bladders (8) Drums (9) Bottles, flasks, carboys **5.2.1.1.3** Given examples of the following solids-holding containers, the operations level responder shall identify each container by type, as follows: (1) Bulk fixed facilities (2) Railway gondolas, coal cars (3) Dry bulk cargo trailers (4) Intermodal containers (reactive solids) (5) FIBCs/RIBCs (6) Drums (7) Bags, bottles, boxes **5.2.1.1.4** Given examples of the following mixed-load containers, the operations level responder shall identify each container by type, as follows: (1) Box cars (2) Mixed cargo trailers (3) Freight containers **5.2.1.1.5** Given examples of the following packaging, the operations level responder shall identify the characteristics of each container or package by type as follows:

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	(1) Intermediate bulk container (IBC) (2) Ton container **5.2.1.1.6*** Given examples of the following radioactive material packages, the operations level responder shall identify the characteristics of each container or package by type, as follows: (1) Excepted (2) Industrial (3) Type A (4) Type B (5) Type C
Container identification markings	**5.2.1.2** Given examples of containers, the operations level responder shall identify the markings that differentiate one container from another. **5.2.1.2.1** Given examples of the following marked transport vehicles and their corresponding shipping papers, the operations level responder shall identify marking used for identifying the specific transport vehicle: (1) Highway transport vehicles, including cargo tanks (2) Intermodal equipment, including tank containers (3) Rail transport vehicles, including tank cars **5.2.1.2.2** Given examples of facility storage tanks, the operations level responder shall identify the markings indicating container size, product contained, and/or site identification numbers. **5.2.1.3.2** Given a pesticide label, the operations level responder shall identify the active ingredient, hazard statement, name of pesticide, and pest control product (CPC) number (in Canada). **5.2.1.3** Given examples of hazardous materials incidents, the operations level responder shall identify the name(s) of the hazardous material(s) in 5.2.1.3.1 through 5.2.1.3.3.
	5.2.1.3.3 Given a label for a radioactive material, the operations level responder shall identify the type or category of label, contents, activity, transport index, and criticality safety index as applicable.
Piping and pipeline markings	**5.2.1.3.1** Given a pipeline marker, the operations level responder shall identify the emergency telephone number, owner, and product as applicable.
Contact information	
Types of information to be collected during the hazardous materials/WMD incident survey	
Shipping papers in transportation, safety data sheets (SDS) at facilities	**5.2.2** (2) Identify two ways to obtain an SDS in an emergency
Types of hazard information available from, and how to contact CHEMTREC, CANUTEC, and SETIQ, governmental authorities, manufacturers, shippers, and carriers	**5.2.2** Given scenarios involving known hazardous materials/WMD, the operations level responder shall collect hazard and response information from SDS; CHEMTREC/CANUTEC/SETIQ; governmental authorities; and manufacturers, shippers, and carriers by completing the following requirements: **5.2.2** (4) Identify the types of assistance provided by, procedure for contacting, and information to be provided to CHEMTREC/CANUTEC/SETIQ and governmental authorities **5.2.2** (4) and governmental authorities

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	5.2.2 (6) Identify the type of assistance provided by governmental authorities with respect to criminal or terrorist activities involving the release or potential release of hazardous materials/WMD **5.2.2** (5) Identify two methods of contacting manufacturers, shippers, and carriers to obtain hazard and response information
How to communicate with carrier representatives to reduce impact of a release	
Basic physical and chemical properties, including boiling point, chemical reactivity, corrosivity (pH), flammable (explosive) range [LFL (LEL) and UFL (UEL)], flash point, ignition (autoignition) temperature, particle size, persistence, physical state (solid, liquid, gas), radiation (ionizing and non-ionizing), specific gravity, toxic products of combustion, vapor density, vapor pressure, and water solubility	**5.2.3*** (1)(a) Chemical and physical properties significance and impact on behavior of container: i. Boiling point ii. Chemical reactivity iii. Corrosivity (pH) iv. Flammable (explosive) range [lower explosive limit (LEL) and upper explosive limit (UEL)] v. Flash point vi. Ignition (autoignition) temperature vii. Particle size viii. Persistence ix. Physical state (solid, liquid, gas) x. Radiation (ionizing and nonionizing) xi. Specific gravity xii. Toxic products of combustion xiii. Vapor density xiv. Vapor pressure xv. Water solubility xvi. Polymerization xvii. Expansion ratio xviii. Biological agents and toxins
How to identify the behavior of a hazardous material/WMD and its container based on the material's physical and chemical properties	**5.2.3*** Predicting the Likely Behavior of a Material and Its Container. Given scenarios involving hazardous materials/WMD incidents, each with a single hazardous material/WMD, the operations level responder shall describe the likely behavior of the material or agent and its container by completing the following requirements: (2)*Identify types of stress that can cause a container system to release its contents (thermal, mechanical, and chemical) (3)*Identify ways containers can breach (disintegration, runaway cracking, closures open up, punctures, and splits or tears) (4)*Identify ways containers can release their contents (detonation, violent rupture, rapid relief, spill or leak) (5)*Identify dispersion patterns that can be created upon release of a hazardous material (hemispherical, cloud, plume, cone, stream, pool, and irregular) (6)*Identify the time frames for estimating the duration that hazardous materials/WMD will present an exposure risk (short-term, medium -term, and long-term) **5.2.3** (1)(b) Identify the differences between the following terms: iii. Exposure and hazard iv. Infectious and contagious v. Acute effects and chronic effects vi. Acute exposures and chronic exposures

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Hazards associated with the identified behavior	**5.2.3** (7)* Identify the health and physical hazards that could cause harm
Examples of potential criminal and terrorist targets	**5.2.1.6.1** Identify at least four types of locations that could be targets for criminal or terrorist activity using hazardous materials/WMD
Indicators of possible criminal or terrorist activity for each of the following: chemical agents, biological agents, radiological agents, explosives, illicit laboratories, clandestine laboratories, weapons labs, and ricin labs	**5.2.1.6.2** Describe the difference between a chemical and a biological incident **5.2.1.6.3** Identify at least four indicators of possible criminal or terrorist activity involving chemical agents **5.2.1.6.4** Identify at least four indicators of possible criminal or terrorist activity involving biological agents **5.2.1.6.5** Identify at least four indicators of possible criminal or terrorist activity involving radiological agents **5.2.1.6.7** Identify at least four indicators of possible criminal or terrorist activity involving explosives **5.2.1.6.6** Identify at least four indicators of possible criminal or terrorist activity involving illicit laboratories (e.g., clandestine laboratories, weapons lab, or ricin lab)
Additional hazards associated with terrorist or criminal activities such as secondary devices	**5.2.1.6*** The operations level responder shall identify at least three additional hazards that could be associated with an incident involving terrorist or criminal activities. **5.2.1.6.8** Identify at least four indicators of secondary devices **5.2.4** (6)* Describe the potential for secondary threats and devices at criminal or terrorist events
	5.2.1.6.9 Identify at least four specific actions necessary when an incident is suspected to involve criminal or terrorist activity
How to determine the likely harm and outcomes associated with the identified behavior and surrounding conditions	**5.2.3** (7)* Identify the health and physical hazards that could cause harm **5.2.4** Given scenarios involving hazardous materials/WMD incidents, the operations level responder shall describe the potential harm within the endangered area at each incident by completing the following requirements: (1)*Identify a resource for determining the size of an endangered area of a hazardous materials/WMD incident (2) Given the dimensions of the endangered area and the surrounding conditions at a hazardous materials/WMD incident, describe the number and type of exposures within that endangered area (3) Identify resources available for determining the concentrations of a released hazardous materials/WMD within an endangered area (4)*Given the concentrations of the released material, describe the factors for determining the extent of physical, health, and safety hazards within the endangered area of a hazardous materials/WMD incident (5) Describe the impact that time, distance, and shielding have on exposure to radioactive materials specific to the expected dose rate

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5.2(B) Requisite Skills	
Identify at a hazmat/WMD incident container types, materials, location of release, and surrounding conditions	
Collecting hazard information	
Communicating with pipeline operator or carrier representatives	
Describing the likely behavior of the hazardous materials or WMD and its container	
Describing the potential hazards, harm, and outcomes associated with the known behavior and the surrounding conditions	
5.3 Identify Action Options	**5.3.2 Identifying Action Options.**
Identify the action options for a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment, policies and procedures, approved reference sources, and the scope of the problem, so that response objectives, action options, safety precautions, suitability of approved personal protective equipment (PPE) available, and emergency decontamination needs are identified.	Given examples of hazardous materials/WMD incidents (facility and transportation), the operations level responder shall identify the action options for each response objective
5.3(A) Requisite Knowledge	
Policies and procedures for hazardous materials/WMD incident operations	
Basic components of an incident action plan (IAP)	
Modes of operation (offensive, defensive, and nonintervention)	
Types of response objectives	5.3.1 Describing Response Objectives. Given at least two scenarios involving hazardous materials/WMD incidents, the operations level responder shall describe the response objectives for each example by completing the following requirements: (1) Given an analysis of a hazardous materials/WMD incident and the exposures, describe the number of exposures that could be saved with the resources provided by the AHJ (2) Given an analysis of a hazardous materials/WMD incident, describe the steps for determining response objectives (3) Describe how to assess the risk to a responder for each hazard class in rescuing injured persons at a hazardous materials/WMD incident
Types of action options	5.3.1 (1) Identify the options to accomplish a given response objective (2) Describe the prioritization of emergency medical care and removal of victims from the hazard area relative to exposure and contamination concerns

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Types of response information available from the ERG, SDS, shipping papers with emergency response information and other resources	**5.2.2** (3) Using an SDS for a specified material, identify the following hazard and response information: (a) Identification, including supplier identifier and emergency telephone number (b) Hazard identification (c) Composition/information on ingredients (d) First aid measures (e) Fire-fighting measures (f) Accident release measures (g) Handling and storage (h) Exposure controls/personal protection (i) Physical and chemical properties (j) Stability and reactivity (k) Toxicological information (l) Ecological information (nonmandatory) (m) Disposal considerations (nonmandatory) (n) Transport information (nonmandatory) (o) Regulatory information (nonmandatory) (p) Other information
Types of information available from and how to contact CHEMTREC, CANUTEC, and SETIQ, governmental authorities, manufacturers, shippers, and carriers (highway, rail, water, air, pipeline)	**5.2.3** (1) CHEMTREC, CANUTEC, and SETIQ **5.2.2** (4) and governmental authorities **5.2.3** (1) Manufacturers, shippers, and carriers **5.4.4** (1) Identify the importance of the buddy system (2) Identify the importance of the backup personnel
Safety procedures	
Risk analysis concepts	
Purpose, advantages, limitations, and uses of approved PPE to determine if PPE is suitable for the incident conditions	**5.3.3** Determining Suitability of Personal Protective Equipment (PPE). Given examples of hazardous materials/WMD incidents, including the names of the hazardous materials/WMD involved and the anticipated type of exposure, the operations level responder shall determine whether available PPE is applicable to performing assigned tasks by completing the following requirements: (1)*Identify the respiratory protection required for a given response option and the following: (a) Describe the advantages, limitations, uses, and operational components of the following types of respiratory protection at hazardous materials/WMD incidents: i. Self-contained breathing apparatus (SCBA) ii. Supplied air respirators iii. Powered air-purifying respirators iv. Air-purifying respirators (b) Identify the required physical capabilities and limitations of personnel working in respiratory protection (2) Identify the personal protective clothing, required for a given action option and the following: (a) Identify skin contact hazards encountered at hazardous materials/WMD incidents (b) Identify the purpose, advantages, and limitations of the following types of protective clothing at hazardous materials/WMD incidents:

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	i. Chemical-protective clothing, including liquid splash–protective ensembles and vapor-protective ensembles ii. High temperature–protective clothing, including proximity suits and entry suits iii. Structural fire-fighting protective clothing
Difference between exposure and contamination	**5.2.3** (1)(b) Identify the differences between 2. Exposure and contamination
Contamination types, including sources and hazards of carcinogens at incident scenes	
Routes of exposure	
Types of decontamination (emergency, mass, and technical)	
Purpose, advantages, and limitations of emergency decontamination Procedures, tools, and equipment for performing emergency decontamination	**5.3.4** (3) Explain the importance and limitations of emergency decontamination procedures at hazardous materials incidents (4) Identify the procedure for emergency decontamination procedures at hazardous materials incidents
5.3(B) Requisite Skills	
Identifying response action options based on the scope of the problem and available resources	
Identifying whether approved PPE is suitable for the incident conditions	
Identifying emergency decontamination needs based on the scope of the problem	
5.4 Action Plan Implementation	**5.4 Implementing the Planned Response**
Perform assigned tasks at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment with limited potential of contact with hazardous materials/WMD; policies and procedures; the scope of the problem; and approved tools, equipment, and PPE, so that protective actions and scene control are established and maintained; on-scene incident command is described; evidence is preserved; approved PPE is selected and used in the proper manner; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; assignments are completed; and gross decontamination of personnel, tools, equipment, and PPE is conducted in the field.	**5.4.3* Initiating the Incident Command System.** Given scenarios involving hazardous materials/WMD incidents, the operations level responder shall implement the incident command system as required by the AHJ
5.4(A) Requisite Knowledge	
Scene control procedures	**5.4.1** (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/WMD incidents
Procedures for protective actions, including evacuation and sheltering-in-place	**5.4.1** (3) Identify the basic techniques for the following protective actions at hazardous materials/WMD incidents: (a) Evacuation (b) Shelter-in-place
Procedures for ensuring coordinated communications between responders and to the public	**5.4.1** (6) Identify the procedures for ensuring coordinated communication between responders and to the public

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Evidence recognition and preservation procedures	**5.4.2* Preserving Evidence.** Given two scenarios involving hazardous materials/WMD incidents, the operations level responder shall describe the process to preserve evidence as listed in the emergency response plan and/or standard operating procedures.
Incident command organization	**5.4.3** (4) Identify the duties and responsibilities of the following functions within the incident management system: (a) Incident safety officer (b) Hazardous materials branch or group
Purpose, importance, benefits, and organization of incident command at hazardous materials/WMD incidents	**5.4.3** (3) Identify the purpose, need, benefits, and elements of the incident command system for hazardous materials/WMD incidents
Policies and procedures for implementing incident command at hazardous materials/WMD incidents	
	5.4.3 (1) Identify the role of the operations level responder during hazardous materials/WMD incidents as specified in the emergency response plan and/or standard operating procedures
Capabilities, limitations, inspection, donning, working in, going through decontamination while wearing, and doffing approved PPE	**5.3.3** (1)* Identify the respiratory protection required for a given response option and the following: (a) Describe the advantages, limitations, uses, and operational components of the following types of respiratory protection at hazardous materials/WMD incidents: i. Self-contained breathing apparatus (SCBA) ii. Supplied air respirators iii. Powered air-purifying respirators iv. Air-purifying respirators (b) Identify the required physical capabilities and limitations of personnel working in respiratory protection
	(2) Identify the personal protective clothing, required for a given action option and the following: (a) Identify skin contact hazards encountered at hazardous materials/WMD incidents (b) Identify the purpose, advantages, and limitations of the following types of protective clothing at hazardous materials/WMD incidents: i. Chemical-protective clothing, including liquid splash–protective ensembles and vapor-protective ensembles ii. High temperature–protective clothing, including proximity suits and entry suits iii. Structural fire-fighting protective clothing **5.4.4** Using Personal Protective Equipment (PPE). Given the PPE provided by the AHJ, the operations level responder shall describe considerations for the use of PPE provided by the AHJ by completing the following requirements: **5.4.4** (5) Identify the capabilities and limitations of personnel working in the PPE provided by the AHJ
Signs and symptoms of thermal stress	**5.4.4** (4) Identify the signs and symptoms of heat and cold stress and procedures for their control
Safety precautions when working at hazardous materials/WMD incidents	**5.4.4** (3) Identify the safety precautions to be observed when approaching and working at hazardous materials/WMD incidents
Purpose, advantages, and limitations of gross decontamination	

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NFPA 1072	**NFPA 472**
The need for gross decontamination in the field based on the task(s) performed and contamination received, including sources and hazards of carcinogens at incident scenes	
Gross decontamination procedures for personnel, tools, equipment, and PPE	
Cleaning, disinfecting, and inspecting tools, equipment, and PPE	**5.4.4** (6) Identify the procedures for cleaning, disinfecting, and inspecting PPE provided by the AHJ (7) Maintain and store PPE following the instructions provided by the manufacturer on the care, use, and maintenance of the protective ensemble elements
	5.4.1 (5)* Identify the items to be considered in a safety briefing prior to allowing personnel to work at the following: (a) Hazardous material incidents (b)* Hazardous materials/WMD incidents involving criminal activities
	5.4.3 (2) Identify the levels of hazardous materials/WMD incidents as defined in the emergency response plan
	5.4.3 (5) Identify the considerations for determining the location of the incident command post for a hazardous materials/WMD incident
	5.4.3 (6) Identify the procedures for requesting additional resources at a hazardous materials/WMD incident
	5.4.3 (7) Describe the role and response objectives of other agencies that respond to hazardous materials/WMD incidents
5.4(B) Requisite Skills	
Establishing and maintaining scene control; recognizing and preserving evidence	
Inspecting, donning, working in, going through decontamination while wearing, and doffing approved PPE	
Isolating contaminated tools, equipment, and PPE	
Conducting gross decontamination of contaminated personnel, tools, equipment, and PPE in the field	
Cleaning, disinfecting, and inspecting approved tools, equipment, and PPE	
5.5 Emergency Decontamination	**5.3.4* Identifying Emergency Decontamination Issues.**
Perform emergency decontamination at a hazardous materials/WMD incident, given a hazardous materials/WMD incident that requires emergency decontamination; an assignment; scope of the problem; policies and procedures; and approved tools, equipment, and PPE for emergency decontamination, so that emergency decontamination needs are identified, approved PPE is selected and used, exposures and personnel are protected, safety procedures are followed, hazards are avoided or minimized, emergency decontamination is set up and implemented, and victims and responders are decontaminated.	Given scenarios involving hazardous materials/WMD incidents, the operations level responder shall identify when emergency decontamination is needed

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5.5(A) Requisite Knowledge	
Contamination	5.2.3 (1)(b) Identify the differences between i. Contamination and secondary contamination 5.3.4 (1) Identify ways that people, PPE, apparatus, tools, and equipment become contaminated
Cross contamination	5.3.4 (2) Describe how the potential for secondary contamination determines the need for emergency decontamination
Exposure	5.2.3 (1)(b) Identify the differences between 2. Exposure and contamination
Contamination types	5.2.3 (1) (b) Identify the differences between i. Contamination and secondary contamination
Routes of exposure	
Types of decontamination (emergency, mass, and technical)	
Emergency decontamination purpose, advantages, limitations, policies and procedures for performing, approved tools and equipment, and hazard avoidance.	5.3.4 (3) Explain the importance and limitations of emergency decontamination procedures at hazardous materials incidents 5.3.4 (4) Identify the procedure for emergency decontamination procedures at hazardous materials incidents 5.3.4 (3) limitations 5.3.4 (5) Identify the tools and equipment required for emergency decontamination
5.5(B) Requisite Skills	
Selecting an emergency decontamination method, Setting up emergency decontamination in a safe area using PPE in the proper manner, implementing emergency decontamination, preventing spread of contamination, and avoiding hazards during emergency decontamination	5.4.1 (4)* Perform emergency decontamination while preventing spread of contamination and avoiding hazards while using PPE 5.4.1 (4)* while using PPE 5.4.1 (4)* Perform emergency decontamination 5.4.1 (4)* while preventing spread of contamination 5.4.1 (4)* and avoiding hazards
5.6* Progress Evaluation and Reporting	**5.5.1 Evaluating the Status of Planned Response.**
Evaluate and report the progress of the assigned tasks for a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment, policies and procedures, status of assigned tasks, and approved communication tools and equipment, so that the effectiveness of the assigned tasks is evaluated and communicated to the supervisor, who can adjust the IAP as needed.	Given two scenarios involving hazardous materials/WMD incidents, including the incident action plan, the operations level responder shall determine the effectiveness of the actions taken in accomplishing the response objectives
5.6* (A)* Requisite Knowledge	
Components of progress reports	
Policies and procedures for evaluating and reporting progress	5.5.2 (1) Identify the procedures for reporting the status of the planned response 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.
Use of approved communication tools and equipment	

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Signs indicating improving, static, or deteriorating conditions based on the objectives of the action plan	5.5.1 (1) Identify the factors to be evaluated to determine if actions taken were effective in accomplishing the objectives
Circumstances under which it would be prudent to withdraw from a hazardous materials/WMD incident	5.5.1 (2) Describe the circumstances under which it would be prudent to withdraw from a hazardous materials/WMD incident
5.6 Requisite Skills	**5.5.2 Communicating the Status of Planned Response.**
Determining incident status, determining whether the response objectives are being accomplished, using approved communications tools and equipment, and communicating the status of assigned tasks	Given two scenarios involving hazardous materials/WMD incidents, including the incident action plan, the operations level responder shall report the status of the planned response through the normal chain of command

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NFPA 1072	**NFPA 472**
6.2 Personal Protective Equipment	**6.2 Personal Protective Equipment**
Select, don, work in, go through decontamination while wearing, and doff approved PPE at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, a mission-specific assignment in an IAP that requires use of PPE, the scope of the problem, response objectives and action options for the incident, access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, approved PPE, and policies and procedures, so that under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, approved PPE is selected, inspected, donned, worked in, decontaminated, and doffed; exposures and personnel are protected; safety procedures are followed, hazards are avoided or minimized, and PPE use is reported and documented.	6.2.3.1 Selecting Personal Protective Equipment (PPE). Given scenarios involving hazardous materials/WMD incidents with known and unknown hazardous materials/WMD and the PPE provided by the AHJ, the operations level responder assigned to use PPE provided by the AHJ shall select the PPE required to support assigned mission-specific tasks at hazardous materials/WMD incidents based on AHJ policies and procedures
6.2 (A) Requisite Knowledge	
Policies and procedures for PPE selection and use	6.2.3.1 (1) Describe the importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures
Importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures when selecting and using PPE	6.2.3.1 (2) Describe the purpose of each type of PPE provided by the AHJ for response to hazardous materials/WMD incidents based on NFPA standards and how these items relate to EPA levels of protection
Components of an incident action plan (IAP) requiring the use of PPE	6.2.3.1 (3) Describe capabilities and limitations of PPE for the following hazards: (a) Thermal (b) Radiological (c) Asphyxiating (d) Chemical (corrosive, toxic) (e) Etiological/biological (f) Mechanical
Purpose, capabilities, and limitations of approved PPE	6.2.3.1 (4)(c) Identify the different designs of vapor-protective clothing and liquid splash–protective clothing, and describe the advantages and disadvantages of each type

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Safety precautions for wearing PPE including buddy systems, backup personnel, accountability systems, safety briefings, and evacuation/escape procedures	**6.2.4.1** (1) Describe safety precautions for personnel wearing PPE, including **6.2.4.1** (1) buddy system **6.2.4.1** (1) backup systems, **6.2.4.1** (1) accountability systems, **6.2.4.1** (1) safety briefings, **6.2.4.1** (1) evacuation/escape procedures
Impact and significance of degradation on chemical protective clothing, penetration on chemical protective clothing, and permeation on chemical protective clothing	**6.2.3.1** (4)(a) Describe the following terms and explain their impact and significance on the selection of chemical-protective clothing (CPC): i. Degradation **6.2.3.1** (4)(b) Identify at least three indications of material degradation of CPC **6.2.3.1** (4)(a) ii. Penetration **6.2.3.1** (4)(a) iii. Permeation
Specialized donning for approved PPE	
Specialized doffing for approved PPE	
Specialized usage procedures for approved PPE	
Types of cooling measures for personnel wearing PPE	
	6.2.3.1 (4)(d) Identify the advantages and disadvantages of the following cooling measures: i. Air cooled ii. Ice cooled iii. Water cooled iv. Phase change cooling technology
Advantages of cooling measures for personnel wearing PPE	**6.2.3.1** (4)(d) advantages
Limitations of cooling measures for personnel wearing PPE	**6.2.3.1** (4)(d) disadvantages
	6.2.3.1 (4)(e) Identify the physiological and psychological stresses that can affect users of PPE
Procedures for decontamination, inspection, maintenance, storage of approved PPE	**6.2.3.1** (4)(f) Describe AHJ policies and procedures for going through the emergency and technical decontamination process while wearing PPE
Process for being decontaminated while wearing PPE	**6.2.3.1** (4)(f) Describe AHJ policies and procedures for going through the emergency and technical decontamination process while wearing PPE
Importance of personnel exposure records	**6.2.6.1** (2) Describe the importance of personnel exposure records
Steps in keeping an activity log and exposure records	**6.2.6.1** (3) Identify the steps in keeping an activity log and exposure records
Requirements for reporting and documenting the use of PPE	**6.2.6.1** (1) Identify the reports and supporting documentation required by the AHJ pertaining to PPE use
Requirements for filing documents and maintaining records	**6.2.6.1** (4) Identify the requirements for filing documents and maintaining records
6.2 (B) Requisite Skills	
Selecting PPE for the assignment	**6.2.3.1** (4) Select PPE provided by the AHJ for assigned mission-specific tasks at hazardous materials/WMD incidents based on AHJ policies and procedures

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Inspecting, maintaining, storing, donning, working in, and doffing PPE	**6.2.4.1** Given the PPE provided by the AHJ, the operations level responder assigned to use PPE shall demonstrate the ability to inspect, don, work in, go through decontamination while wearing, and doff the PPE provided to support assigned mission-specific tasks by completing the following requirements **6.2.4.1** (2) Inspect, don, work in, and doff PPE provided by the AHJ following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards **6.2.4.1** (4) Maintain and store PPE according to AHJ policies and procedures
Going through decontamination (emergency and technical) while wearing the PPE	**6.2.4.1** (3) Go through the process of being decontaminated (emergency and technical) while wearing PPE
Completing required reports and supporting documentation for the use of PPE	**6.2.6.1** Given a scenario involving a hazardous materials/WMD incident and AHJ policies and procedures, the operations level responder assigned to use PPE shall report and document use of PPE as required by the AHJ by completing the following: (1) Identify the reports and supporting documentation required by the AHJ pertaining to PPE use (2) Describe the importance of personnel exposure records (3) Identify the steps in keeping an activity log and exposure records (4) Identify the requirements for filing documents and maintaining records
6.3 Mass Decontamination	**6.3 Mass Decontamination**
Perform mass decontamination for ambulatory and nonambulatory victims at a hazardous materials/WMD incident, given a hazardous materials/WMD incident that requires mass decontamination; an assignment in an IAP; scope of the problem; policies and procedures; approved tools, equipment, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, so that under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, a mass decontamination method is selected, set up, implemented, evaluated, and terminated; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; personnel, tools, and equipment are decontaminated; and mass decontamination operations are reported and documented.	**6.3.3.1** Given scenarios involving hazardous materials/WMD incidents requiring mass decontamination, the operations level responder assigned to perform mass decontamination shall select a mass decontamination process that will minimize the hazard and spread of contamination based on AHJ policies and procedures by completing the following requirements:
6.3 (A) Requisite Knowledge	
Types of PPE and the hazards for which they are used	
Importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures	**6.3.3.1** (1) Describe the importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures when performing assigned tasks.
Mass decontamination methods and advantages and limitations	**6.3.3.1** (2) Identify the advantages and limitations of mass decontamination methods.
Policies and procedures for performing mass decontamination	

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Approved tools, equipment, and PPE for performing mass decontamination	6.3.3.1 (4) Identify the tools, equipment, and PPE required to set up and implement mass decontamination operations
Crowd management techniques	6.3.3.1 (5) Describe crowd control techniques that can be used at incidents where mass decontamination is required
AHJ's mass decontamination team positions, roles, and responsibilities	6.3.3.1 (6) Describe the AHJ's mass decontamination unit/team positions, and describe the roles and responsibilities
Requirements for reporting and documenting for mass decontamination operations	6.3.6.1 Given a scenario involving a hazardous materials/WMD incident involving mass decontamination operations/activities and AHJ policies and procedures, the operations level responder assigned to perform mass decontamination shall report and document the mass decontamination operations/activities as required by the AHJ by completing the following: (1) Identify the reports and supporting documentation required by AHJ pertaining to mass decontamination operations/activities
6.2(B) Requisite Skills	
Selecting PPE	
Using PPE	
Selecting a mass decontamination method to minimize the hazard	6.3.3.1 (3) Identify sources of information for determining the correct mass decontamination methods, and identify how to access those resources in a hazardous materials/WMD incident
Setting up and implementing mass decontamination operations in a safe location	6.3.4.1 Given the selected mass decontamination process and tools, equipment, and PPE provided by the AHJ, the operations level responder assigned to perform mass decontamination shall demonstrate the ability to set up and implement mass decontamination operations for ambulatory and nonambulatory victims consistent with AHJ policies and procedures following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards.
Evaluating the effectiveness of the mass decontamination method	6.3.5.1 Given examples of contaminated items that have undergone the required decontamination, the operations level responder assigned to mass decontamination operations shall identify procedures for determining whether the items have been fully decontaminated according to the standard operating procedures of the AHJ or the incident action plan.
Completing required reports and supporting documentation for mass decontamination operations	6.3.6.1 Given a scenario involving a hazardous materials/WMD incident involving mass decontamination operations/activities and AHJ policies and procedures, the operations level responder assigned to perform mass decontamination shall report and document the mass decontamination operations/activities as required by the AHJ by completing the following: (1) Identify the reports and supporting documentation required by AHJ pertaining to mass decontamination operations/activities

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6.4 Technical Decontamination	**6.4 Technical Decontamination**
Perform technical decontamination in support of entry operations and for ambulatory and nonambulatory victims at a hazardous materials/WMD incident, given a hazardous materials/WMD/ incident that requires technical decontamination; an assignment in an IAP; scope of the problem; policies and procedures for technical decontamination approved tools, equipment, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, so that under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, a technical decontamination method is selected, set up, implemented, evaluated, and terminated; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; personnel, tools, and equipment are decontaminated; and technical decontamination operations are reported and documented.	**6.4.3.1** Given a hazardous materials/WMD incident that requires technical decontamination; an assignment in an IAP; the scope of the problem; policies and procedures; approved tools, equipment, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, the operations level responder assigned to perform technical decontamination shall select a technical decontamination process to minimize the hazard and spread of contamination in support of entry operations and for ambulatory and nonambulatory victims
6.4 (A) Requisite Knowledge	
Types of PPE and the hazards for which they are used	
Importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures	**6.4.3.1** (1) Describe the importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures when performing assigned tasks
Technical decontamination methods and their advantages and limitations	**6.4.3.1** (2) Describe the advantages and limitations of each of the following technical decontamination methods: (a) Absorption (b) Adsorption (c) Chemical degradation (d) Dilution (e) Disinfection (f) Evaporation (g) Isolation and disposal (h) Neutralization (i) Solidification (j) Sterilization (k) Vacuuming (l) Washing
Policies and procedures for performing technical decontamination	**6.4.3.1** (4) Identify the tools, equipment, and PPE for performing, setup, and implement the selected technical decontamination operations
Approved tools, equipment, and PPE for performing technical decontamination	
AHJ's technical decontamination team positions, roles, and responsibilities	

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Requirements for reporting and documenting technical decontamination operations	**6.4.6.1** Reporting and Documenting the Technical Decontamination Operations. Given a scenario involving a hazardous materials/WMD incident involving technical decontamination operations/activities and AHJ policies and procedures, the operations level responder assigned to perform technical decontamination operations shall report and document the technical decontamination operations/activities as required by the AHJ by completing the following: (1) Identify the reports and technical documentation required by the AHJ pertaining to technical decontamination operations/activities
	6.4.3.1 (5) Identify the procedures, tools, equipment, and safety precautions for processing evidence collected during technical decontamination operations at hazardous materials/WMD incidents
	6.4.3.1 (6) Identify procedures, equipment, and safety precautions for handling tools, equipment, weapons, criminal suspects, and law enforcement/search canines brought to the decontamination corridor at hazardous materials/WMD incidents
6.4 (B) Requisite Skills	
Selecting and using PPE	
Selecting a technical decontamination method to minimize the hazard	**6.4.3.1** (3) Identify sources of information on the technical decontamination operations and methods available, and identify how to access those sources in a hazardous materials/WMD incident
Setting up and implementing technical decontamination operations in a safe area	**6.4.4.1** Given the selected technical decontamination operations and methods and the tools, equipment, and PPE provided by the AHJ, the operations level responder assigned to perform technical decontamination shall set up and implement technical decontamination operations and methods in support or entry operations and for ambulatory and nonambulatory victims following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards.
Evaluating the effectiveness of the technical decontamination method	**6.4.5.1** Given examples of contaminated victims, personnel, tools, equipment, and PPE that have undergone the selected technical decontamination operations and methods, the operations level responder assigned to perform technical decontamination operations evaluate the effectiveness of the technical decontamination process consistent with AHJ policies and procedures or the incident action plan (IAP) by completing the following:. (1) Describe the procedures for evaluating effectiveness of the technical decontamination process by visual observations, monitoring device, ultraviolet light, wipe sampling, and chemical analysis

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Completing required reports and supporting documentation for technical decontamination operations	**6.4.6.1** Reporting and Documenting the Technical Decontamination Operations. Given a scenario involving a hazardous materials/WMD incident involving technical decontamination operations/activities and AHJ policies and procedures, the operations level responder assigned to perform technical decontamination operations shall report and document the technical decontamination operations/activities as required by the AHJ by completing the following: (1) Identify the reports and technical documentation required by the AHJ pertaining to technical decontamination operations/activities
6.5 Evidence Preservation and Public Safety Sampling	**6.5 Evidence Preservation and Sampling**
Perform evidence preservation and public safety sampling at a hazardous materials/WMD incident, given a hazardous materials/WMD incident involving potential violations of criminal statutes or governmental regulations including suspicious letters and packages, illicit laboratories, a release/attack with a WMD agent, and environmental crimes; an assignment in an IAP; scope of the problem; policies and procedures; approved tools, equipment, and PPE; and access to a hazardous materials technician, an allied professional including law enforcement personnel or others with similar authority, an emergency response plan, or standard operating procedures so that under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, hazardous materials/WMD incidents with a potential violation of criminal statutes or governmental regulations are identified; notify agency/agencies having investigative jurisdiction and hazardous explosive device responsibility for the type of incident are notified; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; evidence is identified and preserved; public safety samples are collected, packaged, and the outside packaging is decontaminated; emergency responders, tools, and equipment are decontaminated; and evidence preservation and public safety sampling operations are reported and documented.	**6.5.1.2.2** Given a hazardous materials/WMD incident involving potential violations of criminal statutes or governmental regulations including those involving suspicious letters and packages, illicit laboratories, a release/attack with a WMD agent, and environmental crimes; an assignment in an IAP; the scope of the problem; policies and procedures; and approved tools, equipment, and PPE, the operations level responder assigned to perform evidence preservation and public safety sampling
6.5 (A) Requisite Knowledge	
Types of PPE and the hazards for which they are used	**6.5.1.2.2** (1) Analyze a hazardous materials/WMD incident to determine the complexity of the problem and potential outcomes by completing the following tasks: (a) Determine if the incident is potentially criminal in nature, and identify the law enforcement agency having investigative jurisdiction (b) Identify unique aspects of criminal hazardous materials/WMD incidents (2) Plan a response for an incident where there is potential criminal intent involving hazardous materials/WMD within the capabilities and competencies of available personnel, PPE, and response equipment by completing the following tasks: (a) Determine the response options to conduct public safety sampling and evidence preservation operations

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	(b) Describe how the options are within the legal authorities, capabilities, and competencies of available personnel, PPE, and response equipment (3) Implement the planned response to a hazardous materials/WMD incident involving potential violations of criminal statutes or governmental regulations by completing the following tasks under the guidance of law enforcement: (a) Preserve forensic evidence (b) Take samples (c) Seize evidence (4) Report and document evidence preservation and public safety sampling operations
Importance of working under the guidance of a hazardous materials technician, an allied professional including law enforcement personnel or others with similar authority, an emergency response plan, or standard operating procedures	**6.5.3.1 Identifying Unique Aspects of Criminal Hazardous Materials/WMD Incidents.** The operations level responder assigned to evidence preservation and public safety sampling shall describe the unique aspects associated with illicit laboratories, hazardous materials/WMD incidents, and environmental crimes
unique aspects of a suspicious letter, a suspicious package or device, an illicit laboratory, a release/attack with a WMD agent, or an environmental crime	**6.5.2.1 Determining If the Incident Is Potentially Criminal in Nature and Identifying the Law Enforcement Agency That Has Investigative Jurisdiction.** Given examples of hazardous materials/WMD incidents involving potential criminal intent, the operations level responder assigned to evidence preservation and public safety sampling shall describe the potential criminal violation and identify the law enforcement agency having investigative jurisdiction by completing the following requirements: (1) Given examples of the following hazardous materials/WMD incidents, the operations level responder shall describe products that might be encountered in the incident associated with each situation: (a) Hazardous materials/WMD suspicious letter (b) Hazardous materials/WMD suspicious package (c) Hazardous materials/WMD illicit laboratory (d) Release/attack with a WMD agent (e) Environmental crimes
potential violations of criminal statutes or governmental regulations	**6.5.3.1**(1) (d) Describe the procedure to notify the agency with investigative authority
agencies having response authority to collect evidence and public safety samples	**6.5.3.1**(1) (a) Describe the procedure for securing the scene and characterizing and preserving evidence at the scene
agencies having investigative law enforcement authority to collect evidence or public safety samples	**6.5.3.1**(1) (c) Describe the procedure to determine whether the operations level responders are within their legal authority to perform evidence preservation and public safety sampling tasks **6.5.2.1** (2) Given examples of the following hazardous materials/WMD incidents, the operations level responder shall identify the agency(s) with investigative authority and the incident response considerations associated with each situation: (a) Hazardous materials/WMD suspicious letter (b) Hazardous materials/WMD suspicious package (c) Hazardous materials/WMD illicit laboratory (d) Release/attack with a WMD agent (e) Environmental crimes

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notification procedures for agencies having investigative law enforcement authority and hazardous explosive device responsibility	**6.5.3.1**(1) (b) Describe the procedure to document personnel and scene operations associated with the incident
chain-of-custody procedures	**6.5.3.1**(1) (o) Describe chain-of-custody procedures
securing, characterization, and preservation of the scene and potential forensic evidence	**6.5.3.1**(1) (f) Identify potential sample/evidence
approved documentation procedures	**6.5.3.1**(1) (i) Describe documentation procedures
types of evidence	**6.5.3.1** (2) (a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident **6.5.3.1** (3) (a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident **6.5.3.1** (5) (a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident **6.5.3.1** (6) (a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident
use and limitations of equipment to conduct field screening of samples to screen for corrosivity, flammability, oxidizers, radioactivity, volatile organic compounds (VOC), and fluorides for admission into the Laboratory Response Network or other forensic laboratory system	**6.5.3.1**(1) (g) Identify the applicable public safety sampling equipment **6.5.3.1** (2) (d) Describe the field screening protocols for collected public safety samples and evidence **6.5.3.1** (3) (d) Describe the field screening protocols for collected public safety samples and evidence **6.5.3.1** (4) (c) Describe the field screening protocols for collected public safety samples and evidence
	6.5.3.1 (2) (b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, and public safety sample and evidence packaging and transport containers **6.5.3.1** (3) (b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, and public safety sample and evidence packaging and transport containers **6.5.3.1** (5) (b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, and public safety sample and evidence packaging and transport containers **6.5.3.1** (5) (d) Describe the field screening protocols for collected public safety samples and evidence **6.5.3.1** (4) (a) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, and public safety sample and evidence packaging and transport containers **6.5.3.1** (6) (b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, and public safety sample and evidence packaging and transport containers **6.5.3.1** (7) Given examples of different types of potential criminal hazardous materials/WMD incidents, the operations level responder shall identify and describe the application, use, and limitations of the various types of field screening tools that can be utilized for screening the following: (a) Corrosivity (b) Flammability (c) Oxidation (d) Radioactivity (e) Volatile organic compounds (VOC) **6.5.3.1** (8) Describe the potential adverse impact of using destructive field screening techniques

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use of collection kits	**6.5.3.1**(1) (e) Describe the procedure to notify the hazardous devices technician **6.5.3.1**(1) (j) Describe evidentiary sampling techniques
collection and packaging of public safety samples	**6.5.3.1**(1) (k) Describe field screening protocols for collected public safety samples and evidence **6.5.3.1**(1) (l) Describe evidence labeling and packaging procedures **6.5.3.1** (2) (c) Describe the sampling options associated with the collection of liquid and solid public safety samples and evidence **6.5.3.1** (3) (c) Describe the sampling options associated with the collection of liquid and solid public safety samples and evidence **6.5.3.1** (4) (b) Describe the sampling options associated with the collection of liquid and solid public safety samples and evidence **6.5.3.1** (5) (c) Describe the sampling options associated with liquid and solid public safety sample and evidence collection
	6.5.3.1 (6) (c) Describe the sampling options associated with the collection of liquid and solid public safety samples and evidence **6.5.3.1** (6) (d) Describe the field screening protocols for collected public safety samples and evidence
decontamination of outside packaging	
prevention of secondary contamination	**6.5.3.1**(1) (m) Describe evidence decontamination procedures **6.5.3.1**(1) (h) Describe the procedures to protect public safety samples and evidence from secondary contamination
protection and transportation requirements for sample packaging	**6.5.3.1**(1) (n) Describe evidence packaging procedures for evidence transportation **6.5.3.1** (9) Describe the procedures for maintaining the evidentiary integrity of any item removed from the crime scene **6.5.4.2** The operations level responder assigned to evidence preservation and public safety sampling shall describe AHJ policies and procedures for the technical decontamination process.
requirements for reporting and documenting evidence preservation and public safety sampling operations	**6.5.6.1 Reporting and Documenting Evidence Preservation and Public Safety Sampling Operations.** Given a scenario involving a hazardous materials/WMD incident involving evidence preservation and public safety sampling operations and AHJ policies and procedures, the operations level responder assigned to perform evidence preservation and public safety sampling shall report and document the evidence preservation and public safety sampling operations as required by the AHJ by completing the following: (1) Identify the reports and supporting documentation required by the AHJ pertaining to evidence preservation and public safety sampling operations.

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6.5 (B) Requisite Skills	
Identifying incidents with a potential violation of criminal statutes or governmental regulations	**6.5.4.1 Implementing the Planned Response.** Given the incident action plan for a criminal incident involving hazardous materials/WMD, the operations level responder assigned to evidence preservation and public safety sampling shall implement selected response actions consistent with the emergency response plan or standard operating procedures (1) Demonstrate how to secure the scene and characterize and preserve evidence at the scene (2) Document personnel and scene operations associated with the incident
identifying the agency having investigative jurisdiction over an incident that is potentially criminal in nature or a violation of government regulations	
operating field screening and sampling equipment to screen for corrosivity, flammability, oxidizers, radioactivity, volatile organic compounds (VOC), and fluorides	**6.5.4.1** (5) Notify the hazardous devices technician **6.5.4.1** (8) Demonstrate correct techniques to collect public safety samples utilizing the equipment provided
securing, characterizing, and preserving the scene	
identifying and protecting potential evidence until it can be collected by an agency with investigative authority	**6.5.4.1** (6) Identify potential public safety samples and evidence to be collected
following chain-of-custody procedures	
characterizing hazards	
performing protocols for field screening samples for admission into the Laboratory Response Network or other forensic laboratory system	
protecting evidence from secondary contamination	**6.5.4.1** (7) Demonstrate procedures to protect samples and evidence from secondary contamination
determining agency having response authority to collect public safety samples	**6.5.4.1** (4) Describe the procedure to notify the agency with investigative authority
determining agency having investigative law enforcement authority to collect evidence and public safety samples	**6.5.4.1** (3) Determine whether responders are within their legal authority to perform evidence collection and public safety sampling tasks
collecting, packaging, and labeling public safety samples	**6.5.4.1** (10) Demonstrate public safety sampling protocols **6.5.4.1** (11) Demonstrate field screening protocols for public safety samples and evidence collected **6.5.4.1** (12) Demonstrate evidence/sample labeling and packaging procedures
decontaminating outside sample packaging	**6.5.4.1** (13) Demonstrate evidence/sample decontamination procedures
preparing samples for protection and transportation to a laboratory	**6.5.4.1** (14) Demonstrate evidence/sample packaging procedures for evidence transportation **6.5.4.1** (15) Describe chain of custody procedures for evidence/sample preservation
completing required reports and supporting documentation for evidence preservation and public safety sampling operations	**6.5.4.1** (9) Demonstrate documentation procedures

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6.6 Product Control	**6.6 Product Control**
Perform product control with a limited risk of personal exposure at a hazardous materials/WMD incident, given a hazardous materials/WMD incident with release of product; an assignment in an IAP; scope of the problem; policies and procedures; approved tools, equipment, control agents, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, so that under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; a product control method is selected and implemented; the product is controlled; victims, personnel, tools, and equipment are decontaminated; and product control operations are reported and documented.	**6.6.3.1** Given examples of hazardous materials/WMD incidents, the operations level responder assigned to perform product control with limited risk of personal exposure shall select techniques to confine or contain releases of hazardous materials/WMD and to control flammable liquid and flammable gas releases within the capabilities and competencies of available personnel, tools and equipment, PPE, and control agents and equipment in accordance with the AHJ's policies and procedures
6.6 (A) Requisite Knowledge	
Types of PPE and the hazards for which they are used	
importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures	**6.6.3.1** (1) Explain the importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures
definitions of control, confinement, containment, and extinguishment	**6.6.3.1** (2) Explain the difference between control, confinement, containment, and extinguishment
policies and procedures	
product control methods for controlling a release with limited risk of personal exposure	**6.6.3.1** (3) Describe the product control techniques available to the operations level responder **6.6.3.1** (4) Describe the application, necessary tools, equipment, control agents, and safety precautions associated with each of the following control techniques: (a) Absorption (b) Adsorption (c) Damming (d) Diking (e) Dilution (f) Diversion (g) Remote valve shutoff (h) Retention (i) Vapor dispersion (j) Vapor suppression
safety precautions associated with each product control method	**6.6.3.1** (8) Describe the safety precaution associated with each product control technique
location and operation of remote/emergency shutoff devices on cargo tanks and intermodal tanks in transportation and containers at facilities which contain flammable liquids and flammable gases	**6.6.3.1** (7) Identify the location and describe the operation of remote control/emergency shutoff devices to contain flammable liquid and flammable gas releases on cargo tanks on MC/DOT-306/406, MC/DOT-307/407, and MC-331 cargo tanks, intermodal containers, and containers at fixed facilities

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characteristics and applicability of approved product control agents	**6.6.3.1** (6) Identify the characteristics and applicability of the following Class B foams if supplied by the AHJ: (a) Aqueous film-forming foam (AFFF) (b) Alcohol-resistant concentrates (c) Fluoroprotein (d) High-expansion foam
use of approved tools and equipment	**6.6.3.1** (5) Identify and describe the use of tools and equipment provided by the AHJ for product control, including Class B foam application equipment, diking equipment, damming equipment, approved absorbent materials and products, shovels and other hand tools, piping, heavy equipment (such as backhoes), floats, and spill booms and control agents, including Class B foam and dispersal agents
requirements for reporting and documenting product control operations	**6.6.6.1** Reporting and Documenting Product Control Operations. Given a scenario involving a hazardous materials/WMD incident involving product control, the operations level responder assigned to perform product control shall document the product control operations as required by the AHJ by completing the following requirement: (1) Identify the reports and supporting documentation required by the AHJ pertaining to product control operations
6.6 (B) Requisite Skills	
Selecting and using PPE	
selecting and performing product control techniques to confine/contain the release with limited risk of personal exposure	**6.6.3.1** Selecting Product Control Techniques. Given examples of hazardous materials/WMD incidents, the operations level responder assigned to perform product control with limited risk of personal exposure shall select techniques to confine or contain releases of hazardous materials/WMD and to control flammable liquid and flammable gas releases within the capabilities and competencies of available personnel, tools and equipment, PPE, and control agents and equipment in accordance with the AHJ's policies and procedures
using approved control agents and equipment on a release involving hazardous materials/WMD	**6.6.4.2** Given the required tools and equipment provided by the AHJ, perform product control techniques following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards with the following: (1) Using the equipment provided by the AHJ, control flammable liquid and flammable gas releases using techniques, including hose handling, nozzle patterns, and attack operations, found in NFPA 1001. (2) Using the Class B foams or agents and equipment provided by the AHJ, control the spill or fire involving flammable liquids by application of the foam(s) or agent(s).
using remote control valves and emergency shutoff devices	**6.6.4.1** (1) Using the tools and equipment provided by the AHJ, perform the following product control techniques following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards: (a) Operate remote control/emergency shutoff devices to reduce or stop the flow of hazardous material from MC-306/DOT-406, MC-407/DOT-407, and MC-331 cargo tanks, intermodal containers, and containers at fixed facilities containing flammable liquids or gases

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performing product control techniques	**6.6.4.1** Performing Product Control Techniques. Given the selected product control technique and the tools and equipment, PPE, and control agents and equipment provided by the AHJ, at a hazardous materials/WMD incident, the operations level responder assigned to perform product control shall implement the product control technique to confine/contain the release with limited risk of personal exposure
completing required reports and supporting documentation for product control operations	**6.6.6.1** Reporting and Documenting Product Control Operations. Given a scenario involving a hazardous materials/WMD incident involving product control, the operations level responder assigned to perform product control shall document the product control operations as required by the AHJ by completing the following requirement: (1) Identify the reports and supporting documentation required by the AHJ pertaining to product control operations
6.7 Detection, Monitoring, and Sampling	**6.7 Detection, Monitoring, and Sampling**
Perform detection, monitoring, and sampling at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment in an IAP; scope of the problem; policies and procedures; approved resources; detection, monitoring, and sampling equipment; PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, so that under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, detection, monitoring, and sampling methods are selected; approved equipment is selected for detection, monitoring, or sampling of solid, liquid, or gaseous hazardous materials/WMD present; detection, monitoring, and sampling activities are implemented as needed ; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; exposures and personnel are protected detection, monitoring, and sampling operations are implemented as needed ; results of detection, monitoring, and sampling are read, interpreted, recorded, and communicated; if contaminated, personnel and their equipment are decontaminated; detection, monitoring, and sampling equipment is maintained; and all required reports and documentation pertaining to detection, monitoring, and sampling operations are completed reported and documented.	**6.7.3.1** Selecting Detection, Monitoring, and Sampling Equipment. Given the a hazardous materials/WMD incident and the detection, monitoring, and sampling equipment provided by the AHJ, the operations level responder assigned to perform detection, monitoring, and sampling hazardous materials/WMD at the incident
6.7 (A) Requisite Knowledge	
Types of PPE and the hazards for which they are used	
capabilities and limitations of approved PPE	
importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures	**6.7.3.1** (1) Describe the importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures
approved detection, monitoring, and sampling equipment	**6.7.3.1** (2) Describe detection, monitoring, and sampling methods and equipment available
policies and procedures for detection, monitoring, and sampling	

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process for selection of detection, monitoring, and sampling equipment for an assigned task	**6.7.3.1** (3) Describe the considerations for selecting detection, monitoring, and sampling equipment for an assigned task within the capabilities and competencies of available personnel and approved detection, monitoring, sampling equipment, and PPE
operation of approved detection, monitoring, and sampling equipment	**6.7.4.1** (2) Operate the equipment to detect, monitor, and sample the hazardous materials/WMD present following safety procedures, avoiding or minimizing hazards, and protecting exposures and personnel
capabilities, limitations, and AHJ monitoring procedures, including action levels and field testing	**6.7.3.1** (4) Given the detection, monitoring, and sampling equipment provided by the AHJ, describe the following for each piece of equipment: (a) Application, capabilities, and limitations
how to read and interpret results	**6.7.3.1** (4)(c) Procedures for reading, interpreting,
methods for decontaminating detection, monitoring, and sampling equipment according to manufacturers' recommendations or AHJ policies and procedures	**6.7.3.1** (4)(d) Procedures for decontaminating detection, monitoring, and sampling equipment according to manufacturer's recommendations or AHJ policies and procedures
maintenance procedures for detection, monitoring, and sampling equipment according to manufacturers' recommendations or AHJ policies and procedures	**6.7.3.1** (4)(e) Procedures for maintaining detection, monitoring, and sampling equipment according to manufacturers' specifications or AHJ policies and procedures
requirements for reporting and documenting detection, monitoring, and sampling operations	**6.7.3.1** (4)(c) Procedures for reading, interpreting, documenting, and communicating results of detection, monitoring, and sampling operations
6.7 (B) Requisite Skills	
Selecting and using PPE	
field testing and operating approved detection, monitoring, and sampling equipment	**6.7.4.1** (1) Field test the detection, monitoring, and sampling equipment to be used according to the manufacturers' specification and AHJ policies and procedures, including the following: (a) Functional (i.e., bump) test (b) Calibration (c) Other required tests
reading, interpreting, and documenting the readings from detection, monitoring, and sampling equipment	**6.7.4.1** (3) Read, interpret, and document readings from the detection, monitoring, and sampling equipment
communicating results of detection, monitoring, and sampling	**6.7.4.1** (4) Communicate results of detection, monitoring, and sampling operations
decontaminating detection, monitoring, and sampling equipment	**6.7.4.1** (5) Decontaminate the detection, monitoring, and sampling equipment
maintaining detection, monitoring, and sampling equipment according to manufacturers' specifications or AHJ policies and procedures	**6.7.4.1** (6) Maintain detection, monitoring, and sampling equipment according to the manufacturers' specifications or AHJ policies and procedures
completing required reports and supporting documentation for detection, monitoring, and sampling operations	**6.7.6.1** Reporting and Documenting Detection, Monitoring, and Sampling Operations. Given a scenario involving a hazardous materials/WMD incident involving detection, monitoring, and sampling operations and AHJ policies and procedures, the operations level responder assigned to perform detection, monitoring, and sampling shall report and document the detection, monitoring, and sampling operations as required by the AHJ by completing the following: (1) Identify the reports and supporting documentation required by the AHJ pertaining to detection, monitoring, and sampling operations

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6.8 Victim Rescue and Recovery	**6.8 Victim Rescue and Recovery**
Perform rescue and recovery operations at a hazardous materials/WMD incident, given a hazardous materials/WMD incident involving exposed and/or contaminated victims; an assignment in an IAP; scope of the problem; policies and procedures; approved tools, equipment including special rescue equipment, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, so that under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures,	**6.8.3.1** Selecting Rescue and Recovery Options. Given a hazardous materials/WMD incident involving exposed and/or contaminated victims; an assignment in an IAP; the scope of the problem; policies and procedures; approved tools, equipment, including special rescue equipment, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, the operations level responder assigned to victim rescue and recover victims shall select the victim rescue and recovery option(s) for the assignment
the feasibility of conducting a rescue or a recovery operation is determined; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; rescue or recovery options are selected within the capabilities of available personnel, approved tools, equipment, special rescue equipment, and PPE; victims are rescued or recovered, triaged, and transferred to the decontamination group, casualty collection point, area of safe refuge, or medical care in accordance with the IAP; personnel, victims, and equipment used are decontaminated; and victim rescue and recovery operations are reported and documented.	
6.8 (A) Requisite Knowledge	
Types of PPE and the hazards for which they are used	
capabilities and limitations of approved PPE	
importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures	**6.8.3.1** (1) Describe the importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures
the difference between victim rescue and victim recovery	**6.8.3.1** (2) Choose whether the task is victim rescue, victim recovery, or both (a) Describe the difference between victim rescue and victim recovery operations
victim triage methods	
considerations for determining the feasibility of rescue or recovery operations	**6.8.3.1** (2)(b) Describe considerations for determining the feasibility of conducting rescue or recovery operations in each of the following situations: (i) Line-of-sight with ambulatory victims (ii) Line-of-sight with nonambulatory victims (iii) Non-line-of-sight with ambulatory victims (iv) Non-line-of-sight with nonambulatory victims (v) Victim rescue operations versus victim recovery operations
policies and procedures for implementing rescue and recovery	
safety issues	
capabilities and limitations of approved PPE	

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procedures, specialized rescue equipment required, and incident response considerations for rescue and recovery in the following situations: (1) line-of-sight with ambulatory victims	**6.8.3.1** (3) Select the rescue and recovery options are within the capabilities of available personnel and personal protective equipment, approved tools, equipment, special rescue equipment, and PPE for the situation at hand (a) Describe both rescue and recovery options for each of the following situations: (i) Line-of-sight with ambulatory victims
procedures, specialized rescue equipment required, and incident response considerations for rescue and recovery in the following situations: (2) line-of-sight with nonambulatory victims	**6.8.3.1** (3)(ii) Line-of-sight with nonambulatory victims
procedures, specialized rescue equipment required, and incident response considerations for rescue and recovery in the following situations: (3) non-line-of- sight with ambulatory victims	**6.8.3.1** (3)(iii) Non-line-of-sight with ambulatory victims
procedures, specialized rescue equipment required, and incident response considerations for rescue and recovery in the following situations: (4) non-line-of-sight with nonambulatory victims	**6.8.3.1** (3)(iv) Non-line-of-sight with nonambulatory victims
procedures, specialized rescue equipment required, and incident response considerations for rescue and recovery in the following situations: (5) victim rescue operations versus victim recovery operations	**6.8.3.1** (2)(a) Choose whether the task is victim rescue, victim recovery, or both
AHJ's rescue team positions, roles, and responsibilities	**6.8.4.1** (1) Identify the different victim and recovery team positions, roles, and responsibilities
procedures for reporting and documenting victim rescue and recovery operations are completed	**6.8.6.1** Reporting and Documenting Victim Rescue and Recovery Operations. Given a scenario involving a hazardous materials/WMD incident involving victim rescue and recovery operations and AHJ policies and procedures, the operations level responder assigned to perform victim rescue and recovery shall report and document the victim rescue and recovery operations as required by the AHJ by completing the following: (1) Identify the reports and supporting documentation required by the AHJ pertaining to victim rescue and recovery operations
6.8 (B) Requisite Skills	
Identifying both rescue and recovery situations	**6.8.4.1** (1) Identify the different victim and recovery team positions and describe their main functions, roles, and responsibilities
triaging victims	**6.8.4.1** (5) Triage and transfer victims to the decontamination group, casualty collection point, or area of safe refuge or emergency medical care in accordance with the IAP
selecting proper rescue or recovery options	**6.8.3.1** (3) Select the rescue and recovery options are within the capabilities of available personnel and personal protective equipment, approved tools, equipment, special rescue equipment, and PPE for the situation at hand

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using available specialized rescue equipment	**6.8.4.1** (2) Select and use specialized rescue equipment and procedures provided by the AHJ to support victim rescue and recovery
selecting and using PPE for the victim and the rescuer	**6.8.3.1** (6) Identify the PPE protection options required to protect victims during rescue and recovery operations **6.8.4.1** (4) Select required PPE for victims and rescuers
searching for, rescuing, and recovering victims	**6.8.4.1** (3) Search for, rescue, and recover victims following safety procedures, avoiding or minimizing hazards, and protecting exposures and personnel
	6.8.4.1 (6) Follow the AHJ's procedures for the decontamination of rescue/recovery personnel and their equipment
completing required reports and supporting documentation for victim rescue and recovery	**6.8.6.1** Reporting and Documenting Victim Rescue and Recovery Operations. Given a scenario involving a hazardous materials/WMD incident involving victim rescue and recovery operations and AHJ policies and procedures, the operations level responder assigned to perform victim rescue and recovery shall report and document the victim rescue and recovery operations as required by the AHJ by completing the following: (1) Identify the reports and supporting documentation required by the AHJ pertaining to victim rescue and recovery operations
6.9 Response to Illicit Laboratories	**6.9 Response to Illicit Laboratories**
Perform response operations at an illicit laboratory at a hazardous materials/WMD incident, given a hazardous materials/WMD incident involving an illicit laboratory; an assignment in an IAP; scope of the problem; policies and procedures; approved tools, equipment, and PPE; and access to a hazardous materials technician, an allied professional including law enforcement personnel or others with similar authority, an emergency response plan, or standard operating procedures, so that under the guidance of a hazardous materials technician including law enforcement personnel or others with similar authority, an allied professional, an emergency response plan, or standard operating procedures, the scene is secured; the type of laboratory is identified; potential hazards are identified; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; control procedures are implemented; evidence is identified and preserved; personnel, victims, tools, and equipment are decontaminated; and illicit laboratory operations are reported and documented.	
6.9 (A) Requisite Knowledge	
Types of PPE and the hazards for which they are used	
importance of working under the guidance of a hazardous materials technician, an allied professional including law enforcement personnel or others with similar authority, an emergency response plan, or standard operating procedures	**6.9.3.4.2** (2) Factors to be evaluated in selection of the proper PPE for each type of tactical operation

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types of illicit laboratories and how to identify them	**6.9.2.1** Determining If a Hazardous Materials/WMD Incident Is an Illicit Laboratory Operation. Given examples of hazardous materials/WMD incidents involving illicit laboratory operations, the operations level responder assigned to respond to illicit laboratory incidents shall identify the potential drugs/WMD being manufactured by completing the following related requirements: (1) Given examples of illicit drug manufacturing methods, describe the operational considerations, hazards, and products involved in the illicit process
operational considerations at illicit laboratories	**6.9.2.1** (2) Given examples of illicit chemical WMD methods, describe the operational considerations, hazards, and products involved in the illicit process (3) Given examples of illicit biological WMD methods, describe the operational considerations, hazards, and products involved in the illicit process
hazards and products at illicit laboratories	**6.9.2.1** (1) Given examples of illicit drug manufacturing methods, describe the operational considerations, hazards, and products involved in the illicit process
potential booby traps often found at illicit laboratories	**6.9.2.1** (4) Given examples of illicit laboratory operations, describe the booby traps that have been encountered by response personnel
law enforcement agencies with investigative authority and responsibilities at illicit laboratories	**6.9.2.1** (5) Given examples of illicit laboratory operations, describe the agencies that have investigative authority and operational responsibility to support the response **6.9.3.3** Identifying the Agency That Has Investigative Jurisdiction. The operations level responder assigned to respond to illicit laboratory incidents shall identify the agency having investigative jurisdiction by completing the following: (1) Given scenarios involving illicit drug manufacturing or illicit WMD manufacturing, identify the agency(s) with investigative authority for the following situations: (a) Illicit drug manufacturing (b) Illicit WMD manufacturing (c) Environmental crimes resulting from illicit laboratory operations (d) Improvised explosive devices, improvised WMD dispersal devices, and improvised explosives laboratories
crime scene coordination with agencies having investigative jurisdiction	**6.9.3.2.2** (5) Coordinated crime scene operation with the agency having investigative authority
securing and preserving evidence	**6.9.3.2.2** (4) Mitigation of immediate hazards while preserving evidence
procedures for conducting a joint hazardous materials/hazardous devices assessment operation	**6.9.3.2.2** (2) Joint hazardous materials and hazardous devices technician site reconnaissance and hazard identification **6.9.4.1.1** (5) Describe procedures for conducting joint hazardous materials/hazardous devices assessment operations
procedures for determining atmospheric hazards through detection, monitoring, and sampling	**6.9.3.4.2** (4) Factors to be evaluated in the selection of detection devices
procedures to mitigate immediate hazards	

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safety procedures and tactics	**6.9.3.4.2** Given scenarios involving illicit drug manufacturing or illicit WMD manufacturing, describe the following: (1) Hazards, safety procedures, and tactical guidelines for this type of emergency
factors to be considered in the selection of decontamination, development of a remediation plan, and decontaminating tactical law enforcement personnel, weapons, and law enforcement canines	**6.9.3.4.2** (3) Factors to be considered in selection of appropriate decontamination procedures **6.9.3.4.2** (5) Factors to be considered in the development of a remediation plan
procedures for decontaminating potential suspects	**6.9.3.4.2** (3) Factors to be considered in selection of appropriate decontamination procedures
procedures for going through technical decontamination while wearing PPE	
procedures for reporting and documenting illicit laboratory operations are completed	**6.9.3.2.2** (6) Documenting personnel and scene operations associated with the incident **6.9.6.1** Reporting and Documenting Illicit Laboratory Response Operations. Given a scenario involving a hazardous materials/WMD incident involving illicit laboratory response operations and AHJ policies and procedures, the operations level responder assigned to perform illicit laboratory response shall report and document the illicit laboratory response operations as required by the AHJ by completing the following: (1) Identify the reports and supporting documentation required by the AHJ pertaining to illicit laboratory response operations
6.9 (B) Requisite Skills	
implementing scene control procedures	**6.9.3.2.2** Given an incident involving illicit drug manufacturing or illicit WMD manufacturing, the operations level responder assigned to illicit laboratory incidents shall describe the following tasks: (1) Securing and preserving the scene **6.9.4.1.1** Given a simulated illicit drug/WMD laboratory incident, the operations level responder assigned to respond to illicit laboratory incidents shall be able to perform the following tasks: (1) Describe safe and effective methods for law enforcement to secure the scene
selecting and using PPE	**6.9.3.4.2** (2) Factors to be evaluated in selection of the proper PPE for each type of tactical operation
selecting detection, monitoring, and sampling equipment	**6.9.3.2.2** (3) Determining atmospheric hazards through air monitoring and detection
securing an illicit laboratory	**6.9.3.2.2** Given an incident involving illicit drug manufacturing or illicit WMD manufacturing, the operations level responder assigned to illicit laboratory incidents shall describe the following tasks: (1) Securing and preserving the scene
identifying and isolating hazards	
identifying safety hazards	**6.9.4.1.1** (4) Describe methods to identify and avoid hazards found at illicit laboratories such as booby traps and releases of hazardous materials

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conducting a joint hazardous materials/hazardous devices assessment operation	**6.9.3.2.2** (2) Joint hazardous materials and hazardous devices technician site reconnaissance and hazard identification
decontaminating potential suspects, tactical law enforcement personnel, weapons, and law enforcement canines	**6.9.3.4.2** (3) Factors to be considered in selection of appropriate decontamination procedures **6.9.4.1.1** (2) Demonstrate decontamination procedures for tactical law enforcement personnel to include weapons and law enforcement K-9s securing an illicit laboratory **6.9.4.1.1** (3) Demonstrate decontamination procedures for potential suspects
completing required reports and supporting documentation for illicit laboratory response operations	**6.9.6.1** Reporting and Documenting Illicit Laboratory Response Operations. Given a scenario involving a hazardous materials/WMD incident involving illicit laboratory response operations and AHJ policies and procedures, the operations level responder assigned to perform illicit laboratory response shall report and document the illicit laboratory response operations as required by the AHJ by completing the following: (1) Identify the reports and supporting documentation required by the AHJ pertaining to illicit laboratory response operations
	6.9.3.1 Determining the Response Options. Given an analysis of hazardous materials/WMD incidents involving illicit laboratories, the operations level responder assigned to respond to illicit laboratory incidents shall identify possible response options.
No JPRs for this section.	**6.10 Disablement/Disruption of Improvised Explosive Devices (IEDs), Improvised WMD Dispersal Devices, and Operations at Improvised Explosives Laboratories.**
	6.10.1 General. **6.10.1.1 Introduction.** **6.10.1.1.1** The operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall be that person, competent at the operations level, who is assigned to interrupt the functioning of an IED or an improvised WMD dispersal device or conduct operations at improvised explosives laboratories. **6.10.1.1.2** The operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall possess current certification as a Hazardous Device Technician from the FBI Hazardous Devices School, Department of Defense, or equivalent certifying agency as determined by the AHJ and be functioning as a member of a bomb squad or recognized military unit.

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	6.10.1.1.3 The operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all mission-specific competencies for PPE *(see Section 6.2)*, mission-specific competencies for response to illicit laboratories *(see Section 6.9)*, and all competencies in this section. **6.10.1.1.4** The operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall operate under the guidance of an allied professional or standard operating procedures. **6.10.1.1.5** The operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall receive the additional training necessary to meet the specific needs of the jurisdiction and/or agency. **6.10.1.2 Goal.** **6.10.1.2.1** The goal of the competencies in this section shall be to provide the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories with the knowledge and skills to perform the tasks in 6.10.1.2.2 and 6.10.1.2.3 in a safe and effective manner. **6.10.1.2.2** When responding to hazardous materials/WMD incidents involving a potential IED or improvised WMD dispersal device, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall be able to perform the following tasks: (1) Analyze a hazardous materials/WMD incident involving an improvised WMD dispersal device to determine the complexity of the problem and potential outcomes by completing the following tasks: (a) Determine if an IED or WMD dispersal device is present (b) Categorize the device by its delivery method (2) Plan a response for a hazardous materials/WMD incident where there is a potential improvised WMD dispersal device within the capabilities and competencies of available personnel, PPE and response equipment by completing the following tasks: (a) Determine if response options can be employed to conduct a disablement/disruption of the device (b) Describe the actions to be taken and the resources to be requested if the incident exceeds the available capabilities

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	(3) Implement the planned response to a hazardous materials/WMD incident involving an IED or WMD dispersal device by completing the following tasks under the guidance of the senior hazardous devices technician (HDT) present: (a) Employ disablement/disruption techniques in accordance with the FBI Hazardous Devices School "logic tree," the current edition of the National Bomb Squad Commanders Advisory Board's (NBSCAB) "A Model for Bomb Squad Standard Operating Procedures," established protocol of military units, or the AHJ (4) Report and document potential IED or improvised WMD dispersal device operations **6.10.1.2.3** When responding to hazardous materials/WMD incidents involving potential improvised explosives laboratories, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall be able to perform the following tasks: (1) Analyze a hazardous materials/WMD incident involving a potential improvised explosives laboratory to determine the complexity of the problem and potential outcomes and whether the incident has the potential for being an improvised explosives laboratory operation (2) Plan a response to a hazardous materials/WMD incident involving a potential improvised explosives laboratory in compliance with mitigation techniques and evidence recovery within the capabilities and competencies of available personnel, PPE, and control equipment, after notifying the responsible investigative agencies of the problem (3) Implement the planned response to a hazardous materials/WMD incident involving a potential improvised explosives laboratory utilizing applicable standard operating procedures and/or technical advice from qualified allied professionals (4) Report and document potential improvised explosives laboratories operations **6.10.2 Competencies — Analyzing the Incident.** **6.10.2.1 Determining If the Incident Involves the Potential Presence of an Improvised WMD Dispersal Device.** Given examples of hazardous materials/WMD incidents involving an IED or improvised WMD dispersal device, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall identify and/or categorize the hazard by completing the following: (1) Given examples of the following hazardous materials/WMD incidents involving an IED or improvised WMD dispersal device, describe products that might be encountered in the incident associated with each situation: (a) Letter/package-based improvised dispersal device (b) Briefcase/backpack-based improvised dispersal device (c) Transportation-borne WMD dispersal device (d) Fixed location hazards where an IED has been placed to cause the deliberate release of a material

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	6.10.2.2 Determining If the Hazardous Materials/WMD Incident Involves an Improvised Explosives Laboratory Operation. Given examples of hazardous materials/WMD incidents involving improvised explosives laboratories, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall identify the potential explosives/WMD being manufactured by completing the following related requirements: (1) Given examples of improvised explosives manufacturing methods, describe the operational considerations, hazards, and products involved in the process (2) Given examples of improvised explosives laboratory operations, describe the booby traps that have been encountered by response personnel (3) Given examples of improvised explosives laboratory operations, describe the agencies that have investigative authority and operational responsibility to support the response **6.10.3 Competencies — Planning the Response.** **6.10.3.1 Identifying Unique Aspects of Improvised WMD Dispersal Device Related Hazardous Materials/WMD Incidents.** When responding to hazardous materials/WMD incidents, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratory incidents shall be capable of identifying the unique aspects associated with such incidents by completing the following requirements: (1) Given an incident involving a non-vehicle-based WMD dispersal device, shall be able to perform the following tasks: (a) Describe the hazards, safety procedures, and tactical guidelines for this type of incident (b) Describe the factors to be evaluated in selecting the PPE (c) Describe the procedure for identifying and obtaining the appropriate emergency response elements to support disablement/disruption operations (2) Given an incident involving a vehicle-borne WMD dispersal device, shall be able to perform the following tasks: (a) Describe the hazards, safety procedures, and tactical guidelines for this type of incident (b) Describe the factors to be evaluated in selecting the PPE (c) Describe the procedure for identifying and obtaining the appropriate emergency response elements to support disablement/disruption operations (3) Given examples of different types of incidents involving an improvised WMD dispersal device, shall identify and describe the application use and limitations of various types of field screening tools that can be utilized for determining the presence of the following materials: (a) Gamma and neutron radiation (b) Explosive materials [commercial and homemade explosives (HME)]

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	6.10.3.2 Identifying Unique Aspects of Improvised Explosives Laboratory-Related Hazardous Materials/WMD Incidents. When responding to conduct mitigation procedures on energetic materials at an improvised explosives laboratory, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall be capable of identifying the unique aspects associated with such incidents by completing the following requirements: (1) Given a scenario involving an improvised explosives laboratory and detection devices provided by the AHJ, complete the following: (a) Describe the hazards, safety procedures, and tactical guidelines for this type of incident (b) Describe the factors to be evaluated in selecting the PPE (c) Describe the application, use, and limitations of various types of field screening tools that can be utilized for determining the presence of the following materials: i. Radioactive materials that emit alpha, beta, gamma, or neutron radiation, including radionuclide identification of gamma emitting radioactive materials ii. Explosive materials (commercial and HME) (d) Demonstrate the field test and operation of each detection device and interpret the readings based on local procedures (e) Describe local procedures for decontamination of themselves and their detection devices upon completion of the material detection mission (f) Describe the procedure for identifying and obtaining the appropriate emergency response elements to support disablement/disruption or mitigation operations **6.10.3.3 Identifying Potential Response Options.** **6.10.3.3.1** Given scenarios of an incident involving a potential IED or improvised WMD materials dispersal device, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall identify possible response options. **6.10.3.3.2** Given scenarios of an incident involving a potential improvised explosives laboratories, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall identify possible response options. **6.10.3.4 Selecting Personal Protective Equipment.** Given the PPE provided by the AHJ, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at an incident at improvised explosives laboratories shall select the PPE required to support such operations at hazardous materials/ WMD incidents based on the *National Guidelines for Bomb Technicians* adopted by the National Bomb Squad Commanders Advisory Board (NBSCAB) *(see Section 6.2)*.

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	6.10.4 Competencies — Implementing the Planned Response. **6.10.4.1** Given scenarios of an incident involving a potential IED or improvised WMD dispersal device, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at an improvised explosives laboratory shall be able to complete the following tasks: (1) Using detection and monitoring devices provided by the AHJ, demonstrate the field test and operation of each device and interpret the readings based on local or agency procedures (2) Perform diagnostics based on procedures instructed by a nationally accredited hazardous devices school or program (3) Perform disablement/disruption techniques in accordance with the FBI Hazardous Devices School "logic tree," the NBSCAB "A Model for Bomb Squad Standard Operating Procedures," established protocol for military units, or established protocol of the AHJ (4) Assist in planning the air monitoring and sampling operations within the capabilities and competencies of available personnel, PPE, and response equipment and, in accordance with the AHJ, describe the air monitoring and sampling options available (5) Given the air monitoring and sampling equipment provided by the AHJ, shall complete the following: (a) Select the detection or monitoring equipment suitable for detecting or monitoring of the IED or improvised WMD dispersal device (b) Describe the operation, capabilities, limitations, local monitoring procedures, field-testing, and maintenance procedures associated with each device provided by the AHJ (c) Describe local procedures for decontamination of the detection and monitoring devices upon completion of the mission **6.10.4.2** Given a simulated improvised explosives laboratory incident, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations shall be able to perform the following tasks: (1) Describe the safe and effective methods for law enforcement to secure the scene (2) Demonstrate methods to identify and avoid safety hazards at improvised explosives laboratories such as booby traps, releases of hazardous materials, and initiating components (3) Using detection and monitoring devices provided by the AHJ, demonstrate the field test and operation of each device and interpret the readings based on local or agency procedures (4) Describe the methods that could be utilized to mitigate the hazards identified

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	6.10.4.3 The operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall demonstrate the ability to wear an appropriate combination of chemical protective clothing, respiratory protection, and ballistic protection for the hazards identified in 6.10.2.1 and 6.10.2.2. **6.10.4.4** The operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall describe the local procedures for the technical decontamination process. **6.10.5 Competencies — Evaluating Progress. (Reserved)** **6.10.6 Competencies — Terminating the Incident. (Reserved)**
No JPRs for this section.	**6.11 Diving in Contaminated Water Environment.**
	6.11.1 General. **6.11.1.1 Introduction.** **6.11.1.1.1** The operations level responder assigned to perform diving in contaminated water environments shall be that person, competent at the operations level, who is assigned to perform either dive or dive surface support operations in water suspected to be contaminated with hazardous materials during emergency response operations, defined as "no notice" dive operations for the purposes of immediate protection of lives or property. **6.11.1.1.2** The operations level responder assigned to perform contaminated water diving during emergency response operations shall possess current certification per the policies of the AHJ to perform diving operations, to include the use of self-contained underwater breathing apparatus (SCUBA) (which could include rebreather diving apparatus), and/or surface supplied diving apparatus. **6.11.1.1.3** The operations level responder assigned to perform contaminated water surface support operations during emergency response shall be certified per the policies of the AHJ to perform all surface support operations tasks assigned by the AHJ such as dive tender, air console operator, dive supervisor, or other related task. **6.11.1.1.4** The operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all mission-specific competencies for personal protective equipment *(see Section 6.2)*, and all competencies in this section.

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	6.11.1.1.5 The operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall operate under the guidance of a hazardous materials technician, allied professional, or standard operating procedures. **6.11.1.1.6** The operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall receive the additional training necessary to meet the specific needs of the jurisdiction and/or agency. **6.11.1.2 Goal.** **6.11.1.2.1** The goal of the competencies in this section shall be to provide the operations level responder assigned to perform contaminated water diving or dive surface support operations with the knowledge and skills to perform the tasks in 6.11.1.2.2 in a safe and effective manner. **6.11.1.2.2** When responding to emergency incidents involving water potentially contaminated with hazardous materials, the operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall be able to perform the following tasks: (1) Analyze an emergency incident involving water potentially contaminated with hazardous materials to determine the complexity of the problem and potential outcomes by completing the following tasks: (a) Determine if hazardous materials are present (b) Categorize the hazards to the dive responder by performance of a hazard risk assessment (2) Plan a response for an emergency incident where there is a potential to dive in water contaminated with hazardous materials within the capabilities and competencies of available personnel, PPE, and control equipment by completing the following tasks: (a) Determine if response options can be employed effectively to conduct a safe diving operation (b) Describe the actions to be taken and the resources to be requested if the incident exceeds the available capabilities (3) Implement the planned response to a contaminated water diving operation by completing the following tasks under the guidance of a hazardous materials technician, allied professional, or standard operating procedures: (a) Employ diving operations in accordance with the policies of the AHJ (4) Evaluate the response to a contaminated water diving operation by completing the following tasks: (a) Determine the effectiveness of protective equipment and efficiency of decontamination (5) Terminate the response to a contaminated water diving operation by completing the following tasks: (a) Document the incident and determine the levels of contamination on diving equipment

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	6.11.2 Competencies — Analyzing the Incident. **6.11.2.1 Performing a Pre-Dive Assessment of the Dive Location.** Given a dive location, the operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall perform a risk assessment to determine the presence of hazards to divers and dive surface support personnel by completing the following: (1) Given examples of potential hazards at planned dive locations, describe the hazards that might be associated with each situation: (a) Hazards associated with dive locations documented in available reference materials such as, but not limited to, Emergency Planning and Community Right-to-Know Act (EPCRA) Tier II reporting, Combined Sewer Overflow reports, state environmental reports, fish advisories, and identified Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, aka Superfund) reporting (b) Historical releases of hazardous materials near or upstream from the dive location (c) Knowledge of hazardous materials containers or vessels near or upstream from the dive location **6.11.2.2 Determining If the Incident Involves Potential Contamination of the Water.** Given examples of hazardous materials/WMD incidents involving the potential contamination of water, the operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall identify and/or categorize the hazard by completing the following: (1) Given examples of the following hazardous materials/WMD incidents involving potentially contaminated water, describe the hazards that might be encountered from the incident associated with each situation: (a) Chemicals floating on the surface of the water (b) Chemicals stratified in the water column or infiltrated in bottom sediment (c) Pathogenic biological materials in the water (d) Radiological particulates or radioactive sources in the water (e) Hazmat containers floating on the surface of the water (f) Hazmat containers below the surface of the water **6.11.2.3 Determining the Risk from Hazards at the Dive Location.** Given examples of hazardous materials/WMD at the dive location, the operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall identify the potential risk to divers and dive surface support personnel by completing the following requirements: (1) Given examples of hazardous materials/WMD identified at the dive location, describe the hazards to divers and dive surface support personnel and the operational considerations associated with each hazard:

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	(a) Flammable or combustible materials (b) Flammable solid/dangerous when wet materials (c) Organic peroxides and oxidizers (d) Poisons and toxins (e) Radioactive materials (f) Pathogenic biologic materials (g) Corrosive materials (2) Given examples of hazardous materials/WMD containers identified at the dive location, describe the secondary hazards, including mechanical hazards, to divers and dive surface support personnel and the operational considerations associated with each hazard: (a) Drums, cargo tanks, or other low-pressure containers floating on the surface (b) Drums, cargo tanks, or other low-pressure containers resting on the bottom (c) Compressed gas cylinders, containers, cargo tanks, or other pressure vessels floating on the surface (d) Compressed gas cylinders, containers, cargo tanks, or other pressure vessels resting on the bottom **6.11.3 Competencies — Planning the Response.** **6.11.3.1 Identifying Unique Aspects of Dive Related Hazardous Materials/WMD Incidents.** When responding to hazardous materials/WMD incidents, the operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall be capable of identifying the unique aspects associated with such incidents by completing the following requirements: (1) Given an incident involving contaminated water diving emergency response operations, perform the following: (a) Describe the safety procedures and guidelines required by the AHJ for this type of incident (b) Describe the factors to be evaluated in selecting the personal protective equipment for surface support personnel (c) Describe the factors to be evaluated in selecting dive suit types (d) Describe the factors to be evaluated in selecting dive suit materials (e) Describe the factors to be evaluated in selecting diver breathing air supply systems (f) Describe the factors to be evaluated in selecting the detection and monitoring used by surface support personnel (g) Describe the factors to be evaluated in selecting decontamination procedures and solutions (h) Describe the factors to be evaluated by medical personnel in support of contaminated dive operations (i) Describe the procedures for evaluating the diver's readiness to dive as required by the AHJ (j) Describe techniques for contamination avoidance, including buoyancy techniques when applicable

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	(k) Describe the factors to be evaluated in selecting water quality sampling equipment in support of the operation, as required by the AHJ (l) Describe the factors to be evaluated in selecting sediment sampling equipment in support of the operation, as required by the AHJ (2) Given an incident involving a contaminated water diving emergency response operation, perform the following support functions: (a) Describe the application, use, and limitations of various types of detection and monitoring equipment utilized by the AHJ to include: (i) Combustible gas indicators (ii) Oxygen monitors (iii) Toxic gas detectors (iv) pH indicators (v) Radiation monitors (vi) Volatile organic compound (VOC) detectors (b) Describe the field test and operation of each detection device provided by the AHJ, and interpret the readings based on local procedures (c) Describe AHJ procedures for decontamination of personnel and equipment upon completion of dive operations (d) Describe the AHJ procedure for identifying and obtaining the appropriate emergency response elements to support dive and dive surface support operations **6.11.3.2 Identifying Potential Response Options.** **6.11.3.2.1** Given scenarios involving a potential contaminated water dive emergency response operation, the operations level responder assigned to contaminated water diving or dive surface support operations shall identify possible response options. **6.11.3.2.2** Given PPE provided by the AHJ, the operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall select the PPE required to perform operations during contaminated water diving and dive surface support operations. **6.11.4 Competencies — Implementing the Planned Response.** **6.11.4.1** Given scenarios involving a contaminated water dive operation, the operations level responder assigned to contaminated water diving or dive surface support operations during emergency response shall be able to complete the following tasks: (1) Using the detection and monitoring devices provided by the AHJ for use during surface operations, demonstrate the field test and operation of each device and interpret the readings based on AHJ procedures (2) Demonstrate the establishment of the technical decontamination corridor in anticipation of diver egress from contaminated water in accordance with AHJ procedures (3) Demonstrate the ability to collect dive site water quality samples for analysis post-dive, to assist with the evaluation of dive equipment contamination as required by the AHJ

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	6.11.4.2 Given scenarios involving a contaminated water dive operation, the operations level responder certified by the AHJ to perform contaminated water diving during emergency response shall be able to complete the following tasks: (1) Demonstrate the ability to use diving dry suits provided by the AHJ (2) Demonstrate the ability to use full facemask regulators provided by the AHJ (3) Demonstrate the ability to use diving helmets provided by the AHJ (4) Demonstrate the ability to relay pertinent hazard identification information from submerged containers or vessels as possible, given visibility conditions **6.11.4.3** The operations level responder assigned to perform contaminated water surface support operations during emergency response shall demonstrate the ability to wear an appropriate combination of chemical protective clothing, respiratory protection, and personal flotation devices for the hazards identified in 6.11.2.2 and 6.11.2.3. **6.11.4.4** The operations level responder assigned to perform contaminated water surface support operations during emergency response shall demonstrate the AHJ procedures for technical decontamination. **6.11.5 Competencies — Evaluating Progress.** **6.11.5.1** Given scenarios involving a contaminated water dive operation, the operations level responder assigned to contaminated water diving or dive surface support operations during emergency response shall be able to complete the following tasks: (1) Evaluate the effectiveness of diver protective clothing (2) Evaluate the effectiveness of the technical decontamination process **6.11.6 Competencies — Terminating the Incident.** **6.11.6.1** Given scenarios involving a contaminated water dive operation, the operations level responder assigned to contaminated water diving or dive surface support operations during emergency response shall be able to complete the following tasks: (1) Describe the AHJ procedures for returning potentially contaminated dive equipment to service (2) Describe the AHJ procedures for evaluating water and sediment quality samples post-dive for potential contaminants, exposure analysis, and evaluation of dive equipment for contamination (3) Describe the AHJ procedures for evaluating sediment samples for contamination (4) Describe the AHJ procedures for documenting dive site activities

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No JPRs for this section.	**6.12 Evidence Collection.**
	6.12.1 General. **6.12.1.1 Introduction.** **6.12.1.1.1** The operations level responder assigned to perform evidence collection at hazardous materials/WMD incidents shall be that person, competent at the operations level, who is assigned by the AHJ to collect evidence at hazardous materials/WMD incidents involving potential violations of criminal statutes or governmental regulations. **6.12.1.1.2** The operations level responder assigned to perform evidence collection at hazardous materials/WMD incidents shall possess the authority to collect evidence, as delegated by the AHJ, in accordance with governmental regulations. **6.12.1.1.3** The operations level responder assigned to perform evidence collection at hazardous materials/WMD incidents shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all mission-specific competencies for PPE *(see Section 6.2)*, and all competencies in this section. **6.12.1.1.4** The operations level responder assigned to perform evidence collection at hazardous materials/WMD incidents shall operate under the guidance of a hazardous materials technician, an allied professional, or standard operating procedures. **6.12.1.1.5** The operations level responder assigned to perform evidence collection at hazardous materials/WMD incidents shall receive the additional training necessary to meet specific needs of the jurisdiction. **6.12.1.2 Goal.** **6.12.1.2.1** The goal of the competencies in this section shall be to provide the operations level responder assigned to perform evidence collection at hazardous materials/WMD incidents with the knowledge and skills to perform the following tasks in a safe and effective manner: (1) Determine if the incident has a potential for being criminal in nature, and identify the agency that has investigative jurisdiction (2) Identify unique aspects of criminal hazardous materials/WMD incidents (3) Determine the response options to conduct evidence collection operations within the capabilities and competencies of available personnel, PPE, and response equipment (4) Describe how the response options are within the legal authorities, capabilities, and competencies of available personnel, PPE, and response equipment (5) Implement the planned response to a hazardous materials/WMD incident involving potential violations of criminal statutes or governmental regulations by completing the following tasks under the guidance of law enforcement:

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	(a) Secure the scene (b) Preserve evidence (c) Take public safety samples as needed for responder safety (d) Collect evidence (6) Report and document evidence collection operations. **6.12.2 Competencies — Analyzing the Incident.** **6.12.2.1 Determining If the Incident Is Criminal in Nature.** Given examples of the following hazardous materials/WMD incidents, the operations level responder shall describe clues for the presence of hazards that might be encountered in the incident associated with each of the following situations: (1) Hazardous materials/WMD suspicious letter (2) Hazardous materials/WMD suspicious package (3) Hazardous materials/WMD illicit laboratory (4) Release/attack with a WMD agent (5) Environmental crimes **6.12.2.2 Identifying the Agency That Has Investigative Jurisdiction.** Given examples of hazardous materials/WMD incidents involving potential criminal intent, the operations level responder assigned to collect evidence shall describe the potential criminal violation and identify the agency having investigative jurisdiction and the incident response considerations associated with each of the following situations: (1) Hazardous materials/WMD suspicious letter (2) Hazardous materials/WMD suspicious package (3) Hazardous materials/WMD illicit laboratory (4) Release/attack with a WMD agent (5) Environmental crimes **6.12.3 Competencies — Planning the Response.** **6.12.3.1 Identifying Unique Aspects of Criminal Hazardous Materials/WMD Incidents.** The operations level responder assigned to collect evidence shall describe the unique aspects associated with illicit laboratories, hazardous materials/WMD incidents, and environmental crimes by completing the following requirements: (1) Given an incident involving illicit laboratories, a hazardous materials/WMD incident, or an environmental crime, the operations level responder shall perform the following tasks: (a) Describe the procedure for securing the scene (b) Describe the procedure for characterizing and preserving evidence at the scene (c) Describe the procedure for documenting personnel and scene operations associated with the incident (d) Describe the procedure for determining whether the operations level responders are within their legal authority to perform evidence collection tasks (e) Describe the procedure for notifying the agency with investigative authority (f) Describe the procedure for notifying hazardous device technician (g) Identify the need to collect public safety samples for the protection of responders (h) Identify potential evidentiary samples

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	(i) Identify applicable equipment for collecting evidence (j) Describe the procedures to protect evidence from secondary contamination (k) Describe the AHJ documentation procedures for collection of evidence (l) Describe evidentiary sampling techniques (m) Describe field screening protocols for evidence to be collected (n) Describe evidence labeling and packaging procedures (o) Describe evidence decontamination procedures (p) Describe packaging procedures for evidence transportation (q) Describe evidence chain-of-custody procedures (2) Given an example of an illicit laboratory, the operations level responder assigned to collect evidence shall be able to perform the following tasks: (a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident (b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, evidence packaging, and evidence transport containers (c) Describe the sampling options associated with liquid sample and solid sample evidence collection (d) Describe the field screening protocols for collected evidence (3) Given an example of an environmental crime, the operations level responder assigned to collect evidence shall be able to perform the following tasks: (a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident (b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, evidence packaging, and evidence transport containers (c) Describe the sampling options associated with the collection of liquid sample and solid sample evidence (d) Describe the field screening protocols for collected evidence (4) Given an example of a hazardous materials/WMD suspicious letter, the operations level responder assigned to collect evidence shall be able to perform the following tasks: (a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident (b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, evidence packaging, and evidence transport containers (c) Describe the sampling options associated with the collection of liquid sample and solid sample evidence (d) Describe the field screening protocols for collected evidence (5) Given an example of a hazardous materials/WMD suspicious package, the operations level responder assigned to collect evidence shall be able to perform the following tasks:

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	(a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident (b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, evidence packaging, and evidence transport containers (c) Describe the sampling options associated with liquid sample and solid sample evidence (d) Describe the field screening protocols for collected evidence (6) Given an example of a release/attack involving a hazardous material/WMD agent, the operations level responder assigned to collect evidence shall be able to perform the following tasks: (a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident (b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, evidence packaging, and evidence transport containers (c) Describe the sampling options associated with the collection of liquid sample and solid sample evidence (d) Describe the field screening protocols for collected evidence (7) Given examples of different types of potential criminal hazardous materials/WMD incidents, the operations level responder shall identify and describe the application, use, and limitations of the various types field screening tools that can be utilized for screening evidence for the following prior to collection: (a) Corrosivity (b) Flammability (c) Oxidizers (d) Radioactivity (e) Volatile organic compounds (VOC) (f) Fluorides (8) Describe the potential adverse impact of using destructive field screening techniques on evidence prior to collection (9) Describe the procedures for maintaining the evidentiary integrity of any item removed from the scene **6.12.3.2 Selecting Personal Protective Equipment (PPE).** Given the PPE provided by the AHJ, the operations level responder assigned to evidence collection shall select the PPE required to support evidence collection at hazardous materials/WMD incidents based on local procedures *(see Section 6.2)*. **6.12.4 Competencies — Implementing the Planned Response.** **6.12.4.1 Implementing the Planned Response.** Given the incident action plan for a criminal incident involving hazardous materials/WMD, the operations level responder assigned to collect evidence shall implement selected response actions consistent with the emergency response plan or standard operating procedures by completing the following requirements:

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	(1) Demonstrate how to secure the scene and characterize and preserve evidence at the scene (2) Demonstrate documentation of personnel and scene operations associated with the incident (3) Determine whether responders are within their legal authority to perform evidence collection tasks (4) Describe the procedure to notify the agency with investigative authority (5) Describe the procedure to notify hazardous device technician (6) Identify potential evidence to be collected (7) Demonstrate procedures to protect evidence from secondary contamination (8) Demonstrate field screening protocols for evidence prior to collection (9) Demonstrate AHJ approved techniques to collect evidence utilizing the equipment provided (10) Demonstrate evidence documentation procedures (11) Demonstrate evidence labeling and packaging procedures (12) Demonstrate evidence decontamination procedures (13) Demonstrate packaging procedures for evidence transportation (14) Describe chain-of-custody procedures for evidence **6.12.4.2** The operations level responder assigned to evidence collection shall describe local procedures for the technical decontamination process. **6.12.5 Competencies — Evaluation Progress. (Reserved)** **6.12.6 Competencies — Terminating the Incident.** **6.12.6.1 Reporting and Documenting Evidence Collection Operations.** Given a scenario involving a hazardous materials/WMD incident involving evidence collection operations and AHJ policies and procedures, the operations level responder assigned to perform evidence collection shall report and document the evidence collection operations as required by the AHJ by completing the following: (1) Identify the reports and supporting documentation required by the AHJ pertaining to evidence collection operations

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7.2.1*	**7.2 Analyzing the Incident.**
Classify hazardous materials/WMD and verify the presence and concentrations of hazardous materials through detection, monitoring, and sampling at a hazardous materials/WMD incident, given a hazardous materials/WMD incident with released identified and unidentified hazardous materials; an assignment in an incident action plan (IAP); policies and procedures; approved resources; detection and monitoring equipment; and personal protective equipment (PPE), so that PPE is selected and used; hazardous materials/WMD are classified by their basic hazard categories; the presence of hazardous materials is verified; the concentrations of hazardous materials in the atmosphere are determined; signs of exposure in victims and responders are recognized and identified; samples of solids, liquids, and gases are collected; results of detection and monitoring equipment are read, interpreted, recorded, and communicated; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; personnel using the detection, monitoring, and sampling equipment, as well as the equipment, are decontaminated; detection, monitoring, and sampling equipment is maintained according to manufacturers' recommendations; and detection, monitoring, and sampling operations are reported and documented.	**7.2.1.2* Detection, Monitoring, and Sampling.** Given a hazardous materials/WMD incident with released identified and unidentified hazardous materials, an assignment in an IAP, policies and procedures, and approved resources, detection and monitoring equipment, and PPE, the hazardous materials technician shall, through detection, monitoring, and sampling, classify hazardous materials/WMD by the basic categories; verify the presence of hazardous material; determine the concentration of hazardous materials in the atmosphere; collect samples of solids, liquids, and gases; and read, interpret, record, and communicate the results of detection and monitoring equipment by completing the following tasks: (1) Select equipment for detection, monitoring, and sampling solids, liquids, and gases suitable for the hazardous materials/WMD present at the incident within the capabilities and competencies of available personnel, approved resources including detection, monitoring, and sampling equipment, and PPE in accordance with the AHJ's policies and procedures. (a) Identify the basic hazard categories and their definitions— for example, biological, corrosivity, energy (explosivity, radioactivity, reactivity), flammability, oxygen concentration, thermal (heat and cold), and toxicity. (b) Describe monitoring technologies. (c) Describe the types of detection and monitoring equipment including colorimetric (e.g., tubes, chips, papers, strips, reagents), electrochemical cells (e.g., toxic gas sensors), flammable gas/LEL, noncontact thermal detection device, oxygen concentration, photoionization detector (PID), biological detection (e.g., immunoassays, protein tests), and radiation detection and monitoring including the following: (i) Application, capabilities, and limitations (ii) Application of ionization potential (ip) when using a PID (iii) Procedures operating the equipment, including field testing, safety precautions, and action levels (d) Describe the process for classifying basic hazard categories of identified solid and liquid materials and unidentified contaminants in the atmosphere. (e) Describe the following processes for radioactive materials: (i) Determine radiation dose rates from radioactive material labels. (ii) Determine background, rate, and dose. (iii) Determine if a radioactive materials container is leaking/breached by comparing meter readings to the Transportation Index (TI).

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	(f) Describe the process for monitoring lighter-than-air gases and vapors, heavier-than-air gases and vapors in a confined area, and heavier-than-air gases and vapors in an unconfined area. (g) Describe the methods for collecting samples of solids, liquids, and gases. (h) Describe the procedures for reading, interpreting, recording, and communicating test results of detection and monitoring equipment. (i) Describe the field maintenance and testing procedures for detection and monitoring equipment. (j) Describe the procedures for decontaminating detection, monitoring, and sampling equipment according to manufacturer's recommendations or AHJ policies and procedures. (k) Describe the procedures for maintaining detection, monitoring, and sampling equipment according to manufacturers' specifications or local policies and procedures. (2) Using the selected detection and monitoring equipment [colorimetric (e.g., tubes, chips, papers, strips, reagents), electrochemical cells (e.g., toxic gas sensors), flammable gas/LEL, noncontact thermal detection device, oxygen concentration, photoionization detector (PID), biological detection (if provided by the AHJ), radiation detection monitoring devices (e.g., a contamination measuring instrument or instruments able to measure alpha, beta, and gamma radiation, pancake Geiger-Mueller), exposure rate instrument (e.g., instruments able to measure a range of exposure rate), dosimetry devices (e.g., personnel radiation monitors/devices), perform the following detection, monitoring, and sampling tasks following safety procedures, avoiding or minimizing hazards, and protecting exposures and personnel: (a) Field test the detection, monitoring, and sampling equipment to be used according the manufacturers' specification and local policies and procedures including the following: (i) Functional (i.e., bump) test (ii) Calibration (iii) Other required tests (b) Classify hazardous materials by basic hazard categories. (c) Verify the presence of hazardous materials. (d) Determine the concentration of hazardous materials in the atmosphere. (e) Collect samples of solids, liquids, and gases. (f) Monitor, read, interpret, record, and communicate readings from the equipment. (g) Decontaminate detection, monitoring, and sampling equipment. (h) Report and document detection, monitoring, and sampling activities.

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7.2.1 (A)* Requisite Knowledge	
Basic hazard categories, including biological, corrosivity, energy (explosivity, radioactivity, reactivity), flammability, oxygen concentration, thermal (heat and cold), and toxicity and their definitions; policies and procedures; detection, monitoring, and sampling technologies; analysis process for classifying basic hazard categories of identified solid, liquid, and gaseous materials and unidentified contaminants in the atmosphere; types of detection, monitoring, and sampling equipment [colorimetrics (e.g., tubes, chips, papers, strips, reagents); electrochemical cells (e.g., toxic gas sensors), flammable gas/LEL, noncontact thermal detection device, oxygen concentration, photoionization detector (PID), biological detection, and radiation detection and monitoring]; process for determining radiation dose rates from radioactive material labels; determining background, dose rate; determining if a radioactive materials container is leaking/breached by comparing meter readings to Transportation Index (TI); process for monitoring lighter-than-air gases and vapors, heavier-than-air gases and vapors in a confined area, and heavier-than-air gases and vapors in an unconfined area; capabilities and limiting factors of detection, monitoring and sampling equipment; detection, monitoring, and sampling equipment required to classify the basic hazard categories; recognition and identification of signs of exposure in victims and responders; methods for collecting samples of solids, liquids, and gases; reading, interpreting, recording, and communicating test results of detection and monitoring, and sampling equipment; and field maintenance and testing procedures for approved detection, monitoring, and sampling equipment.	
7.2.1 (B)* Requisite Skills	
Selecting and using PPE; determining radiation dose rates from radioactive material labels; using each of the following types of detection, monitoring, and sampling equipment [colorimetrics (e.g., tubes, chips, papers, strips, reagents); electrochemical cells (e.g., toxic gas sensors), flammable gas/LEL, noncontact thermal detection device, oxygen concentration, photoionization detector (PID), and radiation detection and monitoring devices] to either classify hazardous materials by basic hazard categories, verify the presence of hazardous materials or determine the concentration of hazardous materials; collect samples of gases, liquids, and solids; monitoring, reading, interpreting, recording, and communicating readings from detection, monitoring, and sampling equipment according to the manufacturers' specifications and recommendations; and completing required reports and supporting documentation for detection, monitoring, and sampling operations.	
7.2.2* Hazard and Response Information Collection and Interpretation.	**7.2.2 Collecting and Interpreting Hazard and Response Information.**

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Collect and interpret hazard and response information at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, approved reference sources, and approved tools and equipment, so that hazard and response information is collected, interpreted, and communicated.	Given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, access to approved reference sources (technical resources, computer databases, and results of monitoring equipment), and approved tools and equipment access to approved resources (technical resources, computer databases, and results of monitoring equipment), and approved tools and equipment, the hazardous materials technician shall collect, interpret, and communicate hazard and response information not available from the current edition of the ERG or an SDS and shall meet the requirements of 7.2.2.1 through 7.2.2.5. **7.2.2.1*** Identify and explain the types, advantages, and limitations of hazard and response information available from each of the following resources: (1) Hazardous materials databases (2) Monitoring equipment (3) Reference manuals (4) Technical information centers (i.e., CHEMTREC/CANUTEC/SETIQ and governmental authorities) (5) Technical information specialists **7.2.2.2** Describe the following hazard and response terms including chemical and physical properties, radiation, exposure; the significance in the risk analysis process; and application of hazard and response: (1) Air reactivity (2) Autorefrigeration (3) Boiling point (4) Catalyst (5) Chemical change (6) Chemical interactions (7) Compound, mixture (8) Concentration (9) Corrosive (acids and bases/alkaline) (10) Critical temperature (11) Cryogenic liquid heat transfer processes (conduction, convection, radiation, and direct contact) (12) Liquid heat transfer processes; conduction, convection, radiation, and direct contact (e.g., with cryogenic) (13) Decomposition temperature (14) Dose (15) Dose response (16) Endothermic (17) Evaporization rate (18) Exothermic (19) Expansion ratio (20) Half-life (21) Inhibitor (22) Maximum safe storage temperature (MSST) (23) Melting point and freezing point (24) Miscibility (25) Odor and odor threshold (26) Organic and inorganic (27) pH

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	(28) Physical change (29) Radioactivity (30) Reactivity (31) Relative density (32) Self-accelerating decomposition temperature (SADT) (33) Solubility (34) Solution and slurry (35) Strength (36) Sublimation (37) Temperature of product (38) Volatility (39) Viscosity **7.2.2.3** Identify the signs and symptoms, and target organ effects of exposure to hazardous materials/WMD. **7.2.2.4*** Identify hazardous and response information to be communicated. **7.2.2.5** Collect and interpret hazardous and response information.
7.2.2 (A) Requisite Knowledge	
Types, advantages, and limitations of hazard and response information available from approved reference sources; significance and application of hazard and response terms, including chemical and physical properties, radiation terms, exposure terms (air reactivity, autorefrigeration, boiling point, catalyst, chemical change, chemical interactions, compound and mixture, concentration, corrosive (acids, bases, alkaline), critical temperature and pressure, cryogenic liquid heat transfer processes (conduction, convection, radiation, and direct contact), dose, dose response, endothermic, evaporization, exothermic, expansion ratio, half-life, inhibitor, maximum safe storage temperature (MSST), melting point and freezing point, miscibility, odor, odor threshold, organic and inorganic, pH, physical change, radioactivity, reactivity, relative density, self-accelerating decomposition temperature (SADT), solubility, solution and slurry, strength, sublimation, temperature of product, and volatility, as well as a higher level of understanding of operations level terms: boiling point, fire point, flammable range (LFL and UFL) and explosive range (LEL and UEL), flash point, ignition (autoignition) temperature, persistence, physical state (solid, liquid, gas), polymerization, specific gravity, toxic products of combustion, vapor density, and vapor pressure); principles of heat transfer associated with cryogenic liquid spills; signs and symptoms and target organ effects of exposure to hazardous materials/WMD; methods for determining the pressure and amount of lading in bulk containers and facility containers; and hazard and response information to be communicated.	
7.2.2 (B)* Requisite Skills	
Collecting and interpreting hazard and response information; identifying signs and symptoms of exposure to hazardous materials/WMD, including target organ effects of exposure to hazardous materials/WMD; and determining radiation exposure rates from labels attached to radioactive materials containers.	

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7.2.3* Assessing Container Condition.	
Assess the condition of a container and its closures at a hazardous materials/WMD incident, given an incident involving hazardous materials/WMD; an assignment in an IAP; policies and procedures; the scope of the incident; identity of material(s) involved and their hazards, including results of detection, monitoring, and sampling; a container with required markings; and approved resources and PPE, so that PPE is selected and used; the container and its closures are inspected; the type of damage to the container and closures is identified; the type of stress on the container is identified; the level of risk associated with container and closure damage and stress is identified; safety procedures are followed; hazards are avoided or minimized; personnel, tools, and equipment are decontaminated; and a description of the condition of the container and its closures is communicated.	**7.2.1.1 Identifying Containers and Contents.** **7.2.1.1.1** Given examples of various containers for hazardous materials/WMD, the hazardous materials technician shall identify each container by name and specification and identify the typical contents by name and hazard class. **7.2.1.1.2** Given examples of the following railroad cars, the hazardous materials technician shall identify the container by name and specification and identify the typical contents by name and hazard class: (1) Cryogenic liquid tank cars (2) Nonpressure tank cars (3) Pneumatically unloaded hopper cars (4) Pressure tank cars **7.2.1.1.3** Given examples of the following intermodal tanks, the hazardous materials technician shall identify the container by name and specification and identify the typical contents by name and hazard class: (1) Nonpressure intermodal tanks (2) Pressure intermodal tank (3) Specialized intermodal tanks (4) Cryogenic intermodal tanks (5) Tube modules **7.2.1.1.4** Given examples of the following cargo tanks, the hazardous materials technician shall identify the container by name and specification and identify the typical contents by name and hazard class: (1) Compressed gas tube trailers (2) Corrosive liquid tanks (3) Cryogenic liquid tanks (4) Dry bulk cargo tanks (5) High-pressure tanks (6) Low-pressure chemical tanks (7) Nonpressure liquid tanks **7.2.1.1.5** Given examples of the following facility storage tanks, the hazardous materials technician shall identify the container by name and identify the typical contents by name and hazard class: (1) Cryogenic liquid tank (2) Nonpressure tank (3) Pressure tank **7.2.1.1.6** Given examples of the following nonbulk packaging, the hazardous materials technician shall identify the package by name and identify the typical contents by name and hazard class: (1) Bags (2) Carboys (3) Cylinders (4) Drums

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	7.2.1.1.7 Given examples of the following radioactive materials packages, the hazardous materials technician shall identify the container/package by name and identify the typical contents by name: (1) Excepted (2) Industrial (3) Type A (4) Type B (5) Type C **7.2.1.1.8** Given examples of the following packaging, the hazardous materials technician shall identify the package by name and identify the typical contents by name and hazard class: (1) Intermediate bulk container (IBC) (2) Ton container **7.2.1.1.9** Given examples of three facility and three transportation containers, the hazardous materials technician shall identify the approximate capacity of each container. **7.2.1.1.10** Using the markings on the container, the hazardous materials technician shall identify the capacity (by weight or volume) of the following examples of transportation vehicles: (1) Cargo tanks (2) Tank cars (3) Tank containers **7.2.1.1.11** Using the markings on the container and other available resources, the hazardous materials technician shall identify the capacity (by weight or volume) of each of the following facility containers: (1) Cryogenic liquid tank (2) Nonpressure tank (general service or low-pressure tank) (3) Pressure tank **7.2.3*** **Describing the Condition of the Container Involved in the Incident.** Given an incident involving hazardous materials/WMD; an assignment in an IAP; policies and procedures; identity of material(s) involved and the hazards including results of detection, monitoring, and sampling; a container with required markings; and approved resources, the hazardous materials technician shall identify the container and its closures, identify the damage to the container and its closures, identify the stress(es) on the container, describe the level of risk associated with the damage and stress(es), and communicate this information by completing the related requirements of 7.2.3.1 through 7.2.3.3. **7.2.3.1** Identify the basic design and construction features, including closures for bulk, intermediate bulk, and nonbulk containers; facilities containers; radioactive materials containers; and piping and pipelines.

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	7.2.3.2 Identify the typical types of damage for bulk, intermediate bulk, and nonbulk containers; facilities containers; radioactive materials containers; and piping and pipelines and the levels of risk associated with the damage. (1) Describe types of stress(es) (2) Identify methods for determining the pressure and quantity of lading remaining in containers and indicators of an increase in container pressure **7.2.3.3** Assess the condition of the container and its contents following safety procedures, avoiding and minimizing hazards, and protecting exposures and personnel. (1) Identify the type of damage to the container and its closures and level of risk associated with the damage (2) Identify the stress(es) on the container (3) Communicate the results of the assessment
7.2.3 (A)* Requisite Knowledge	
Process for assessing container condition; basic design and construction features, including closures for bulk, intermediate bulk, and nonbulk containers, facility containers, radioactive materials containers, and piping and pipelines; types of damage and their level of risk; types of stress; specification markings; and methods for determining the pressure and quantity of lading remaining in containers and indicators of an increase in container pressure.	
7.2.3 (B) Requisite Skills	
Assessing the condition of the container and its closures, identifying the type of damage and level of risk associated with the damage, identifying stress(es) on the container, and communicating the condition of the container and its closures and the level of risk associated with that condition.	
7.2.4* Predicting Behavior.	**7.2.4 Predicting Likely Behavior of Materials and Their Containers Where Multiple Materials Are Involved.**
Predict the behavior of the hazardous materials/WMD involved in a hazardous materials/WMD incident, given an incident involving multiple hazardous materials/WMD; an assignment in an IAP; policies and procedures; physical and chemical properties of the materials involved; results of detection, monitoring, and sampling; condition of the container (damage and stress); surrounding conditions; and approved reference sources, so that the behavior of each hazardous materials/WMD container and its contents is identified, the reactivity issues and hazards of the combined materials are identified, and a description of the likely behavior of the hazards is communicated.	Given an incident involving multiple hazardous materials/WMD; an assignment in an IAP; policies and procedures; physical and chemical properties of the materials involved; results of detection, monitoring, and sampling; condition of the container [damage and stress(es)]; surrounding conditions; and approved reference sources, the hazardous materials technician shall identify the likely behavior of the hazardous material/WMD involved, identify the reactivity issues and hazards of the combined materials, and communicate a description of the likely behavior by meeting the following requirements: (1) Identify resources that indicate the reactivity issues of mixing various hazardous materials/WMD (2) Identify the impact of the following fire and safety features on the behavior of the products during an incident at a bulk liquid facility and explain the significance in the analysis process: (1) Fire protection systems (2) Monitoring and detection systems

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	(3) Pressure relief and vacuum relief protection (4) Product spillage and control (impoundment and diking) (5) Tank spacing (6) Transfer operations (3) Identify the impact of the following fire and safety features on the behavior of the products during an incident at a bulk gas facility and explain the significance in the analysis process: (1) Fire protection systems (2) Monitoring and detection systems (3) Pressure relief protection (4) Transfer operations
7.2.4 (A)* Requisite Knowledge	
Process for predicting behavior, resources that indicate the reactivity issues of mixing various hazardous materials/WMD, impact of fire and safety features on the behavior of products at facilities, heat transfer processes that occur as a result of a cryogenic liquid spill, and methods for communicating the results of predicting behavior.	
7.2.4 (B)* Requisite Skills	
Using the process to predict likely behavior of materials and their containers when multiple materials are involved, identifying reactivity issues associated with mixing various hazardous materials, and communicating the predicted behavior.	
7.2.5* Estimating Outcomes.	**7.2.5 Estimating the Likely Sixe of an Endangered Area.**
Estimate the potential outcomes at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, the likely behavior of the container and its contents, and approved resources and equipment, so that the concentrations of materials within the endangered area are measured or predicted; physical, health, and safety hazards within the endangered area are identified; areas of potential harm in the endangered area are identified; potential outcomes within the endangered area are identified; and potential outcomes are communicated.	Given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, the likely behavior of the container and its contents, and approved resources and equipment, the hazardous materials technician shall use approved resources and equipment; measure and predict concentrations of materials within the endangered area; identify the physical, health, and safety hazards within the endangered area; identify the areas of potential harm in the endangered area; estimate the potential outcomes within the endangered area; and communicate the potential outcomes by completing the following requirements: **7.2.5.1** Identify resources for dispersion pattern prediction and modeling, including computers, monitoring equipment, or specialists in the field. **7.2.5.2** Identify the methods for measuring and predicting concentrations of materials within the endangered area to determine public protective response options and the areas to be protected. **7.2.5.3** Identify the methods for identifying the physical, safety, and health hazards within the endangered area. **7.2.5.4** Describe the following health hazard terms and exposure values, and explain the significance in the analysis process: (1) Counts per minute (cpm) and kilocounts per minute (kcpm) (2) Immediately dangerous to life and health (IDLH) value

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	(3) Incapacitating concentration 50 percent (4) Incubation period (5) Infectious dose (6) Lethal concentrations (LC_{50}) (7) Lethal dose (LD_{50}) (8) Parts per billion (ppb) (9) Parts per million (ppm) (10) Permissible exposure limit (PEL) (11) Radiation absorbed dose (rad) (12) Roentgen equivalent man (rem), millirem (mrem), microrem (µrem) (13) Sievert, millsievert (mSv), microsivert (µSv) (14) Threshold limit value ceiling (TLV-C) (15) Threshold limit value short-term exposure limit (TLV-STEL) (16) Threshold limit value time-weighted average (TLV-TWA) **7.2.5.5** Identify methods for determining the areas of potential harm within the endangered area. **7.2.5.6*** Identify methods for determining the outcomes within an endangered area. **7.2.5.7** Given a hazardous materials/WMD release and the corresponding instrument monitoring readings, the hazardous materials technician shall determine the applicable public protective response options and the areas to be protected.
7.2.5 (A) Requisite Knowledge	
Methods for determining concentrations of materials within the endangered area; methods for identifying physical, health, and safety hazards within the endangered area; health hazard terms and exposure values, including Acute Exposure Guideline Levels for airborne chemicals (AEGLs), counts per minute, kilocounts per minute, immediately dangerous to life and health, incapacitating concentration (IC_{50}), incubation period, infectious dose (ID), lethal concentrations (LD_{50}), lethal dose (LD), parts per billion, parts per million, permissible exposure limit (PEL), radiation absorbed dose (rad), gray (Gy), roentgen equivalent man (rem), millirem (mrem), microrem (µrem), sievert (Sv), millisievert (mSv), microsievert (µSv), curie (Ci), becquerel (Bq), threshold limit value ceiling, threshold limit value short-term exposure limit, threshold limit value time weighted average, and their significance in the analysis process; methods for identifying areas of potential harm within the endangered area; methods for identifying potential outcomes in the areas of potential harm within the endangered area; and procedures for communicating potential outcomes.	
7.2.5 (B) Requisite Skills	
Using approved resources and equipment; determining concentrations of materials within the endangered area; identifying the physical, health, and safety hazards within the endangered area; identifying the areas of potential harm in the endangered area; estimating the potential outcomes in the endangered area; and communicating the potential outcomes.	

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7.3.1 Response Objectives and Options.	**7.3 Response Planning**
Develop and recommend to the incident commander or hazardous materials officer response objectives and action options at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis, including incident-related information, life safety risks, environmental risks, and property risks; available resources; and policies and procedures, so that response objectives are identified for the incident and action options are identified for each response objective.	**7.3.1 Identifying Response Objectives and Options.** **7.3.1.1** Given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis including incident-related information, life safety risks, environmental risks, and property risks; available resources; and policies and procedures, the hazardous materials technician shall develop and recommend to the incident commander (IC) or hazardous materials officer response objectives and options by completing the following requirements: (1) Describe the considerations for identifying response objectives (defensive, offensive, and nonintervention) (2) Describe the considerations for identifying the possible response options to accomplish a given response objective
7.3.1 (A) Requisite Knowledge	
Steps for developing response objectives and steps for identifying action options for each response objective.	
7.3.1 (B) Requisite Skills	
Developing response objectives for a hazardous materials incident and identifying action options for each response objective.	
7.3.2* Personal Protective Equipment (PPE) Selection.	**7.3.2 Selecting Personal Protective Equipment (PPE)**
Select the PPE ensemble required for a given response option at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, results of the incident analysis, response objectives and options for the incident, approved references, and policies and procedures, so that required PPE is identified for each response option.	**7.3.2 Selecting Personal Protective Equipment (PPE).** Given a hazardous materials/WMD incident, results of the incident analysis, response objectives and options for the incident, approved references, and policies and procedures, the hazardous materials technician shall select the PPE required for the specified response option(s) by completing the following requirements: **7.3.2.1** Identify types of PPE available for response based on NFPA standards and classifications levels, the OSHA/EPA levels of PPE (A, B, C, D) and the advantages of using certified PPE. **7.3.2.2** Describe the types of PPE available for the following hazards: (1) Thermal (2) Radiological (3) Asphyxiating (4) Chemical (5) Etiological (6) Mechanical **7.3.2.3** Identify the factors to be considered in selecting PPE for the following specified action options: (1) In selecting chemical-protective clothing (CPC) (2) Significance of degradation, penetration, and permeation on the selection of protective clothing (3) Indications of material degradation of protective clothing (4) Different designs of liquid splash-protective ensembles and vapor-protective ensembles and their advantages and disadvantages

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	(5) Types, advantages, and disadvantages of cooling measures used for personnel who are wearing PPE **7.3.2.4** Identify the effects of physiological and psychological stresses on users of PPE. **7.3.2.5** Identify the process for inspecting, testing, and maintenance of PPE.
7.3.2 (A)* Requisite Knowledge	
Identify the PPE available for response based on NFPA PPE standards and certification levels; levels of PPE (A, B, C, and D); advantages of using certified PPE; types of PPE available for various hazards, including thermal, radiological, asphyxiation, chemical, etiological, and mechanical (TRACEM); factors to be considered in selecting respiratory protection; factors to be considered in selecting chemical-protective clothing (CPC); significance of degradation, penetration, and permeation on the selection of protective clothing; indications of material degradation of protective clothing; advantages and limitations of the different designs of liquid splash–protective ensembles and vapor-protective ensembles; types, advantages, and limitations of cooling measures for cooling personnel wearing PPE; information provided on chemical compatibility charts; and effects of physiological and psychological stresses on users of PPE.	
7.2.3 (B)* Requisite Skills	
Selecting PPE ensemble for a specified response option based on all hazards identified and determining the effectiveness of protective clothing based on its uses and limitations.	
7.3.3 Decontamination Method Selection.	**7.3.3 Selecting Decontamination Procedures.**
Select the decontamination method for a given response option at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, results of the incident analysis, response objectives and options for the incident, available resources, and policies and procedures, so that a decontamination method to minimize the hazards for each response option is identified and the equipment required to implement the decontamination method is identified.	Given a hazardous materials/WMD incident, results of the incident analysis, response objectives and options for the incident, available resources, and policies and procedures, the hazardous materials technician shall select the decontamination procedure for a given response action, the equipment required to implement that procedure by completing the following requirements: (1) Describe the application, advantages, and limitations of each of the following decontamination methods: (a) Absorption (b) Adsorption (c) Chemical degradation (d) Dilution (e) Disinfection (f) Evaporation (g) Isolation and disposal (h) Neutralization (i) Solidification (j) Sterilization (k) Vacuuming (l) Washing

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	(2) Identify reference sources for determining applicable decontamination methods, and identify how to access those resources in a hazardous materials/WMD incident (3) Identify equipment required to implement each of the decontamination methods
7.3.3 (A)* Requisite Knowledge	
Decontamination methods including absorption, adsorption, chemical degradation, dilution, disinfecting, evaporation, isolation and dispersal, neutralization, solidification, sterilization, vacuuming, and washing; advantages and limitations of decontamination methods; reference sources for determining applicable decontamination operations and methods; methods for accessing these resources; and equipment required to implement specified decontamination operations and methods.	
7.3.3 (B) Requisite Skills	
Selecting decontamination procedures (operations and methods) and identifying the equipment required to implement decontamination procedure (operations and methods).	
7.3.4* Action Plan Development.	**7.3.4 Developing a Plan of Action.**
Develop a plan of action for a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, results of the incident analysis, response objectives and options for the given incident, available resources, and policies and procedures, so that the tasks and resources required to meet the response objectives are identified, specified response objectives and response options are addressed, plan is consistent with the emergency response plan and policies and procedures, and plan is within the capability of available personnel, PPE, and control equipment.	Given a hazardous materials/WMD incident, an assignment in an IAP, results of the incident analysis, response objectives and options for the given incident, available resources, and policies and procedures, the hazardous materials technician shall prepare an action including site safety and a control plan, safety briefing materials, and pre-entry activities; identify atmospheric and physical safety hazards when incident involved a confined space; and preserve evidence and take public safety samples at the incident consistent with the AHJ policies and procedures and within the capability of available personnel, PPE, and response equipment for that incident by completing the following requirements: (1) Identify the components of an IAP and subplans (2) Identify the components of a safety briefing (3) Identify pre-entry activities to be performed (4) Identify the components of a site safety and control plan (5) Identify safety considerations to be included **7.3.4.1** Describe the difference between control, confinement, containment, and extinguishment. **7.3.4.2** Describe the purpose of, procedures for, required tools and equipment for, and safety precautions for following techniques for hazardous materials/WMD (product) control: (1) Absorption (2) Adsorption (3) Blanketing (4) Damming (5) Diking (6) Dilution (7) Dispersion (8) Diversion (9) Neutralization

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	(10) Overpacking (11) Patching (12) Plugging (13) Pressure isolation and reduction (isolation of valves, pumps, or energy sources) (14) Retention (15) Remote valve shutoff (16) Sealing closures (17) Vapor dispersion (18) Vapor suppression **7.3.4.3** Describe the atmospheric physical safety hazards associated with hazardous materials/WMD incidents involving confined spaces. **7.3.4.4** Identify the procedures, equipment, and safety precautions for preserving and collecting legal evidence at hazardous materials/WMD incidents.
7.3.4 (A)* Requisite Knowledge	
Components of an IAP and subplans; definitions of control, confinement, containment, and extinguishment; purpose of, procedures for, required tools and equipment for, and safety precautions for various techniques for hazardous materials/WMD (product) control; components of a safety briefing; atmospheric and physical safety hazards associated with hazardous materials/WMD in confined spaces; pre-entry tasks to be performed; and procedures, equipment, and safety precautions for preserving and collecting legal evidence.	
7.3.4 (B) Requisite Skills	
Preparing an action plan, identifying site safety and control components, identifying points for a safety briefing, identifying pre-entry tasks, identifying atmospheric and physical safety hazards when incident involves a confined space, and preserving and collecting legal evidence.	
7.4.1 Performing Assigned IMS/ICS Duties.	**7.4.1* Performing Incident Command Duties.**
Perform assigned hazardous materials branch or group functions within the incident command system (ICS) at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; policies and procedures, including an emergency response plan and standard operating procedures; the IAP; and approved resources, so that the assigned functions within the hazardous materials branch or group are completed.	Given the emergency response plan or standard operating procedures and a scenario involving a hazardous materials/WMD incident, the hazardous materials technician shall demonstrate the duties of an assigned function in the hazardous materials group within the incident command system and shall identify the role of the hazardous materials technician during hazardous materials/WMD incidents. (1) Identify the various positions in the hazardous materials group within the incident command system (ICS) and describe the main functions (2) Identify the role of the hazardous materials technician during hazardous materials/WMD incidents
7.4.1 (A)* Requisite Knowledge	

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Organizational structure of the hazardous materials branch or group; duties and responsibilities of hazardous materials branch or group functions; resources available to complete assigned functions; reporting structure; and procedures for communicating with the hazardous materials branch or group supervisor, ICS operations section chief, or IC.	
7.4.1 (B) Requisite Skills	
Performing the duties and responsibilities of an assigned function in the hazardous materials branch or group organization; and communicating observations to hazardous materials branch director/group supervisor, ICS operations section chief, or IC.	
7.4.2* Personal Protective Equipment Use.	**7.4.2 Using Personal Protective Equipment (PPE).**
Don, work in, and doff PPE at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, results of the incident analysis, response objectives and options for the incident, and PPE ensembles as identified in the IAP, so that PPE is selected, inspected, donned, worked in, decontaminated, and doffed; safety procedures are followed; hazards are avoided or minimized; equipment is maintained and stored properly; and the use of PPE is reported and documented.	Given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, results of the incident analysis, response objectives and options for the incident, and PPE ensembles as identified in the IAP, the hazardous materials technician shall inspect, don, work in, go through decontamination while wearing, and doff PPE provided by the AHJ, and shall complete the following requirements: (1) Describe safety for personnel wearing PPE, including buddy systems, backup systems, accountability systems, safety briefings, and evacuation/escape procedures (2) Inspect, don, work in, and doff PPE provided by the AHJ (3) Go through the process of being decontaminated (emergency and technical) while wearing PPE (4) Maintain and store PPE following instructions provided by the manufacturer
7.4.2 (A)* Requisite Knowledge	
Types of PPE and the hazards for which they are used; capabilities, advantages, limitations, selection, and use of PPE; components of an IAP; safety procedures for personnel working in PPE; additional safety concerns of working in the hot zone; procedures for decontamination, maintenance, inspection, and storage of PPE; procedures for being decontaminated while wearing PPE; procedures for maintenance, testing, inspection, and storage of PPE according to manufacturers' specifications and recommendations; importance of personnel exposure records, steps in keeping an activity log and exposure records, requirements for reporting and documenting the use of PPE, and requirements for filing documents and maintaining records.	
7.4.2 (B) Requisite Skills	
Inspecting, donning, working in, going through technical decontamination while wearing PPE; and completing required reports and supporting documents for the use of PPE.	
7.4.3.1* Product Control	**7.4.3 Performing Product Control Techniques.**

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Perform product control techniques at a hazardous materials/WMD incident, given a hazardous materials/WMD incident with release of product, an assignment in an IAP, results of the incident analysis, policies and procedures for product control, response objectives and options for the incident, and approved tools, equipment, control agents, and PPE, so that an approved product control technique is selected and implemented; the product is controlled; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; personnel, victims, tools, and equipment used are decontaminated; tools and equipment are inspected and maintained; and product control operations are reported and documented.	Given the selected product control technique and the tools and equipment, PPE, and control agents and equipment provided by the AHJ at a hazardous materials/WMD incident, the hazardous materials technician shall confine/contain the release from bulk or nonbulk pressure containers/closures, nonbulk liquid containers/closures, and bulk liquid containers/closures, following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards, by completing the following requirements: **7.4.3.1 Product Control.** Given a hazardous materials/WMD incident with release of product; an assignment in an IAP; results of the incident analysis; policies and procedures for product control; response objectives and options for the incident; and approved tools, equipment, control agents, and PPE; the hazardous materials technician shall perform the control techniques by completing the following requirements *[following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards]*: (1) Identify and implement product control techniques to confine released hazardous materials/WMD including: (a) Absorption (b) Adsorption (c) Damming (d) Diking (e) Dilution (f) Diversion (g) Retention (h) Vapor dispersion (i) Vapor suppression (2) Identify the application and purpose of, advantages and limitations of, procedures for, required tools and equipment for, and safety precautions for each of the control techniques for confining released materials (3) Identify the procedures for controlling releases from the packaging/flammable liquid and flammable gas releases using techniques, including hose handling, nozzle, patterns, and attack operations (4) Identify the characteristics, applicability, and use of Class B foams or agents, the required equipment for application of the foam or agent to control the spill or fire by application of the foam(s) or agent(s)
7.4.3.1 (A)* Requisite Knowledge	
Types of PPE and the hazards for which they are used; policies and procedures for product control; product control techniques (absorption, adsorption, blanketing, damming, diking, dilution, dispersion, diversion, neutralization, overpacking, patching, plugging, pressure isolation and reduction, retention, remote valve shutoff, vapor dispersion, and vapor suppression); purpose of, procedures for, required tools and equipment for, and safety precautions for hazardous materials/WMD control techniques; location and operation of remote emergency shutoff devices; characteristics, applicability, and use of approved product control agents; use of approved tools and equipment; and procedures for inspection and maintenance of tools and equipment.	

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7.4.3.1 (B)* Requisite Skills	
Selecting and using PPE, selecting and using approved control agents and equipment on a release involving hazardous materials/WMD, using container control valves and remote emergency shutoff devices, performing product control techniques, inspecting and maintaining tools and equipment; and completing required and supporting documentation for product control operations.	
7.4.3.2* Controlling Container Leaks.	**7.4.3.2 Controlling Leaks from Containers.**
Control leaks from containers and their closures at a hazardous materials/WMD incident, given three scenarios, including (1) a leak from a bulk or nonbulk pressure container or its closures, (2) a leak from a nonbulk liquid container or its closures, and (3) a leak from a bulk liquid container or its closures; an assignment in an IAP; results of the incident analysis; policies and procedures for controlling leaks from containers and/or their closures; and approved tools, equipment, and PPE, so that an approved product control technique is selected and used; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; hazard monitoring is completed; leaks are controlled (confined or contained); emergency responders, tools, and equipment used are decontaminated; tools and equipment are inspected and maintained; and product control operations are reported and documented.	**7.4.3.2.1** Given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; three scenarios including a leak from a bulk or nonbulk pressure container or its closures, a leak from a nonbulk liquid container or its closures, and a leak from a bulk liquid container or its closures; policies and procedures for controlling leaks from containers and/or their closures; and approved tools, equipment, and PPE; the hazardous materials technician shall control leaks from the containers and their closures, monitoring for hazards as necessary, by completing the following requirements *[following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards]*: (1) Identify the product control techniques to contain leaking hazardous materials/WMD including: (a) Patching (b) Plugging (c) Repositioning the container (d) Sealing closures (e) Remote valve shutoff (2) Identify types of containers, the closures, and ways the containers and closures develop leaks (3) Operate remote control/emergency shutoff devices to reduce or stop the flow of hazardous material from MC-306/DOT-406, MC-407/DOT-407, and MC-331 cargo tanks and intermodal tanks containing flammable liquids or gases or fixed facility containers (4) Given the fittings on a pressure container and using tools and equipment provided by the AHJ, contain the leaks by the following methods: (a) Close valves that are open (b) Replace or tighten loose plugs (c) Replace missing plugs **7.4.3.2.2** Given a 55 gal (208 L) drum and applicable tools and materials, contain the following types of leaks: (1) Bung leak (2) Chime leak (3) Forklift puncture (4) Nail puncture
7.4.3.2 (A)* Requisite Knowledge	

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Types of PPE and the hazards for which they are used, policies and procedures for product control; types of containers and their closures; ways in which containers and their closures develop leaks, hazards of and safety precautions for controlling; container/closure leaks; methods for controlling container or closure leaks on nonbulk, intermediate bulk, radioactive, facility containers, and pipe and pipelines; location and operation of remote emergency shutoff devices on cargo tanks and at facilities; characteristics, applicability, and use of approved product control agents; approved tools and equipment used to control container/closure leaks; and procedures for inspection and maintenance of tools and equipment.	
7.4.3.2 (B)* Requisite Skills	
Selecting and using PPE, selecting and using approved control agents and equipment; controlling leaks on containers and their closures (patching, plugging, sealing closures, remote valve shutoff, closing valves, repositioning container; replacing missing plugs, and tightening loose fittings); decontaminating tools and equipment; inspecting and maintaining tools and equipment; and requirements for reporting and documenting product control operations.	
7.4.3.3* Overpacking Nonbulk and Radioactive Materials Containers.	**7.4.3.3 Overpacking Nonbulk and Radioactive Materials Containers.**
Overpack damaged or leaking nonbulk and radioactive materials containers at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; a loaded damaged or leaking container; a suitable overpack container; policies and procedures; and approved tools, equipment, and PPE, so that an approved overpack technique is selected; the damaged or leaking container is placed into a suitable overpack and the overpack is closed, marked, and labeled; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; emergency responders, tools, and equipment are decontaminated; tools and equipment are inspected and maintained; and product control operations are reported and documented.	**7.4.3.3.1** Given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; a loaded damaged or leaking container; a suitable overpack container; policies and procedures; and approved tools, equipment, and PPE; the hazardous materials technician shall place the damaged or leaking nonbulk or radioactive materials container is placed into a suitable overpack and the overpack is closed, marked, and labeled by completing the following requirements: *[following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards]*: (1) Identify ways nonbulk and radioactive materials containers are damaged (2) Identify hazards associated with overpacking damaged or leaking nonbulk and radioactive materials containers (3) Identify methods for overpacking damaged or leaking nonbulk and radioactive materials containers including tools and equipment required (4) Identify markings and labels required for overpack containers (5) Identify methods for decontaminating tools and equipment used for overpacking damaged or leaking nonbulk and radioactive materials containers (6) Identify equipment and maintenance procedures **7.4.3.3.2** Given a 55 gal (208 L) drum and an overpack drum, demonstrate the ability to place the 55 gal (208 L) drum into the overpack drum using the following methods: (1) Rolling slide-in (2) Slide-in (3) Slip-over

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7.4.3.3 (A) Requisite Knowledge	
Types of PPE and the hazards for which they are used; policies and procedures for overpacking damaged or leaking nonbulk and radioactive materials containers; ways in which nonbulk and radioactive materials containers are damaged; hazards associated with overpacking damaged or leaking nonbulk and radioactive materials containers; methods to overpack damaged or leaking nonbulk and radioactive materials containers; marking and labeling overpack containers; the tools and equipment used to overpack damaged or leaking nonbulk and radioactive materials containers; and equipment and maintenance procedures.	
7.4.3.3 (B) Requisite Skills	
Selecting and using PPE; placing a damaged or leaking nonbulk materials container into the overpack container; placing a damaged or leaking radioactive materials container into an overpack container; following safety procedures and minimizing and avoiding hazards; decontaminating tools and equipment; inspecting and maintaining tools and equipment; and completing requirements for reporting and documenting product control operations.	
7.4.3.4 Liquid Product Transfer.	**7.4.3.4 Liquid Product Transfer.**
Transfer liquids from leaking nonpressure containers at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; a leaking nonpressure container and a recovery container; policies and procedures for transferring liquids from leaking nonpressure containers; and approved tools, equipment, and PPE, so that an approved product transfer method is selected and used; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; hazard monitoring is completed; the containers are bonded and grounded; product is transferred to the recovery container; emergency responders, tools, and equipment used are decontaminated; tools and equipment are inspected and maintained; and product control operations are reported and documented.	**7.4.3.4.1** Given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; a leaking nonpressure container and a recovery container; policies and procedures for transferring liquids from leaking nonpressure containers; and approved tools, equipment, and PPE; the hazardous materials technician shall monitor for hazards, ground and bond the containers, transfer the liquid product from the leaking container to the recovery container, suppress vapors as necessary, decontaminate tools and equipment, and inspect and maintain tools and equipment by completing performing the following requirements: *[following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards]*: (1) Select a compatible recovery container (2) Monitor for hazards (3) Transfer liquid product (4) Grounding and bonding the containers (5) Perform vapor suppression (6) Select the required tools and equipment and their proper use for transferring liquid product (7) Decontaminate tools and equipment (8) Inspect and maintain tools and equipment for transferring liquid product (9) 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 and AHJ policies and procedures (10) Identify three considerations for assessing a leak or spill inside a confined space without entering the area

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	7.4.3.4.2 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. **7.4.3.4.3** Identify three considerations for assessing a leak or spill inside a confined space without entering the area.
7.4.3.4 (A) Requisite Knowledge	
Types of PPE and the hazards for which they are used; policies and procedures for liquid product transfer; identifying a compatible recovery container; requirements for hazard monitoring; methods for transferring liquid product; grounding and bonding methods; methods for vapor suppression; use of approved tools and equipment; procedures for inspection and maintenance of tools and equipment; and requirements for reporting and documenting product control operations.	
7.4.3.4 (B) Requisite Skills	
Selecting and using PPE; identifying a compatible recovery container and transfer equipment; monitoring for hazards; grounding and bonding containers; transferring liquid product from a leaking container to a recovery container; suppressing vapors; decontaminating tools and equipment; inspecting and maintaining tools and equipment; and completing reports and supporting documentation for product control operations.	
7.4.4.1 Mass Decontamination.	**7.4.4 Decontamination**
Perform mass decontamination for ambulatory and nonambulatory victims at a hazardous materials/WMD incident, given a hazardous materials/WMD incident requiring mass decontamination; an assignment in an IAP; results of the incident analysis; policies and procedures; and approved PPE, tools, and equipment, so that PPE is selected and used; a mass decontamination procedure is selected, set up, implemented, evaluated, and terminated; victims are decontaminated; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; personnel, tools, and equipment are decontaminated; and mass decontamination operations are reported and documented.	**7.4.4* Performing Decontamination Operations Identified in the Incident Action Plan.** Given a hazardous materials/WMD incident requiring decontamination; an assignment in an IAP; results of the incident analysis; policies and procedures; and approved PPE, tools, and equipment; the hazardous materials technician shall implement, evaluate the effectiveness of, and terminate the following decontamination operations as assigned: (1) Technical decontamination operations in support of entry operations (2) Technical decontamination operations involving ambulatory and nonambulatory victims
	(3) Mass decontamination operations involving ambulatory and nonambulatory victims **7.5.2 Evaluating the Effectiveness of the Decontamination Process.** Given an incident action plan for a scenario involving a hazardous materials/WMD incident, the hazardous materials technician shall evaluate the effectiveness of any decontamination procedures identified in the incident action plan.

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7.4.4.1 (A)* Requisite Knowledge	
Types of PPE and the hazards for which they are used; advantages and limitations of operations and methods of mass decontamination; policies and procedures; approved tools, equipment, and PPE; procedures for performing mass decontamination; safety precautions; crowd management techniques; AHJ mass decontamination unit duties within the command structure; and required reports and supporting documentation for mass decontamination operations.	
7.4.4.1 (B)* Requisite Skills	
Selecting and using suitable PPE, selecting a mass decontamination procedure to minimize the hazard, setting up and implementing mass decontamination operations for ambulatory and nonambulatory victims, evaluating the effectiveness of the mass decontamination process, and completing reporting and documentation requirements.	
7.4.4.2 Technical Decontamination.	
Establish and implement technical decontamination in support of entry operations and for ambulatory and nonambulatory victims at a hazardous materials/WMD incident, given a hazardous materials/WMD incident requiring technical decontamination; an assignment in an IAP; results of the incident analysis; policies and procedures; and approved PPE, tools, and equipment, so that approved PPE is selected and used; a technical decontamination procedure is selected, set up, implemented, evaluated, and terminated; victims are decontaminated; safety procedures are followed; hazards are avoided or minimized; if contaminated, personnel, tools, and equipment are decontaminated; and all reports and documentation of technical decontamination operations are completed.	**7.4.4* Performing Decontamination Operations Identified in the Incident Action Plan.** Given a hazardous materials/WMD incident requiring decontamination; an assignment in an IAP; results of the incident analysis; policies and procedures; and approved PPE, tools, and equipment; the hazardous materials technician shall implement, evaluate the effectiveness of, and terminate the following decontamination operations as assigned: (1) Technical decontamination operations in support of entry operations (2) Technical decontamination operations involving ambulatory and nonambulatory victims (3) Mass decontamination operations involving ambulatory and nonambulatory victims **7.5.2 Evaluating the Effectiveness of the Decontamination Process.** Given an incident action plan for a scenario involving a hazardous materials/WMD incident, the hazardous materials technician shall evaluate the effectiveness of any decontamination procedures identified in the incident action plan.
7.4.4.2 (A)* Requisite Knowledge	
Types of PPE and the hazards for which they are used; advantages and limitations of operations and methods of technical decontamination; policies and procedures; approved tools, equipment, and PPE; procedures for performing technical decontamination; safety precautions; crowd management techniques; technical decontamination unit duties within the command structure; and approved forms for reporting and documenting technical decontamination.	

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7.4.4.2 (B)* Requisite Skills	
Selecting and using PPE, selecting a technical decontamination procedure to minimize the hazard, setting up and implementing technical decontamination operations, evaluating the effectiveness of the technical decontamination procedure, and completing required reports and supporting documentation for technical decontamination operations.	
7.5 Evaluating and Reporting Progress.	**7.5 Evaluating the Incident.**
Evaluate and report the progress of assigned tasks at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, current incident conditions, response options and actions taken, and approved communication equipment, so that the actual behavior of material and container is compared to that predicted, the effectiveness of response options and actions in accomplishing response objectives is determined, modifications to the response options and actions are made, and the results are communicated.	**7.5.1 Evaluating the Effectiveness of the Control Functions.** Given a hazardous materials/WMD incident, an assignment in an IAP, current incident conditions, response options and actions taken, and approved communication equipment, the hazardous materials technician shall compare the actual behavior of the material and container to that predicted, determine the effectiveness of response options and actions in accomplishing response objectives, make modifications to the response options and actions as necessary, and communicate the results by completing the following requirements: (1) Identify procedures for evaluating whether the response options and actions are effective in accomplishing the response objectives (2) Identify resources for identifying improving, static, or deteriorating conditions (3) Identify approved communication procedures and communication equipment (4) Identify the process for modifying response options and actions
7.5.1 (A) Requisite Knowledge	
Procedures for evaluating whether the response options and actions are effective in accomplishing the response objectives; resources for identifying improving, static, or deteriorating conditions; approved communication procedures and communication equipment; and the process for modifying response options and action.	
7.5.1 (B) Requisite Skills	
Comparing predicted behavior of the material and its container to the actual behavior, determining effectiveness of response options and actions, communicating the status of response options and actions, and modifying the response options and actions based on the incident status review.	
7.6 Terminating the Incident.	**7.6 Terminating the Incident**
Terminate a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, operational observations of response operations (incident information), and approved forms for documentation and reporting, so that assistance in scheduled incident debriefings and critiques is provided, and incident operations are reported and documented.	**7.6.1 Assisting in the Debriefing and Critiques.** Given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, operational observations of activities (incident information), and approved forms for documentation and reporting, the hazardous materials technician shall communicate operational observations (incident information) at debriefings and critiques and complete, forward, and file required reports, records, and supporting documents by completing the following requirements:

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	(1) Describe the purpose, regulatory issues, elements, and procedures for conducting debriefings and critiques (2) Describe documentation and reporting requirements according to the AHJ (3) Identify approved forms and procedures for completing required reports, records, and supporting documentation (4) Describe the importance of and procedures for filing documents and maintaining records
7.6.1 (A) Requisite Knowledge	
Purpose, regulatory issues, elements, and procedures for conducting debriefings and critiques; documentation and reporting requirements; approved forms and procedures for completing required reports, records, and supporting documentation; and importance of and requirements for reporting and documenting incident operations, including filing and maintenance requirements.	
7.6.1 (B) Requisite Skills	
Communicating operational observations (incident information) at debriefings and critiques; and completing, forwarding, and filing required reports, records, and supporting documentation.	

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8.2.1 Analyze the Incident.	**8.2 Competencies – Analyzing the Incident.**
Analyze a hazardous materials/weapons of mass destruction (WMD) incident, given a hazardous material/WMD incident; incident information; policies and procedures; available resources; approved references; and access to a hazardous materials technician, an allied professional, an emergency plan, or standard operating procedures, so that the hazards are assessed and risks are evaluated.	**8.2.1 Collecting and Interpreting Hazard and Response Information.** **8.2.1.1** Given access to printed and technical resources, computer databases, and detection and monitoring equipment, the incident commander shall ensure the collection and interpretation of hazard and response information not available from the current edition of the ERG or an SDS. **8.2.1.2** Given access to printed and technical resources, computer databases, and monitoring equipment, 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) Hazardous materials databases (2) Detection and monitoring equipment (3) Reference manuals (4) Technical information centers (5) Technical information specialists **8.2.2 Estimating Potential Outcomes.** Given scenarios involving hazardous materials/WMD incidents, 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 complete the following tasks:

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	(1) Identify the steps for estimating the outcomes within an endangered area of a hazardous materials/WMD incident (2) Describe the following toxicological terms and exposure values, and explain their significance in the analysis process: (a) Counts per minute (cpm) and kilocounts per minute (kcpm) (b) Immediately dangerous to life and health (IDLH) value (c) Infectious dose (d) Lethal concentrations (LC_{50}) (e) Lethal dose (LD_{50}) (f) Parts per billion (ppb) (g) Parts per million (ppm) (h) Permissible exposure limit (PEL) (i) Radiation absorbed dose (rad) (j) Roentgen equivalent man (rem), millirem (mrem), microrem (μrem) (k) Threshold limit value ceiling (TLV-C) (l) Threshold limit value short-term exposure limit (TLV-STEL) (m) Threshold limit value time-weighted average (TLV-TWA) (n) Other toxicological terms or exposure values as determined by the AHJ (3)*Identify two methods for predicting the areas of potential harm within the endangered area of a hazardous materials/WMD incident (4) Identify the methods available to the organization for obtaining local weather conditions and predictions for short-term future weather changes (5) 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) Dose response (c) Local and systemic effects (d) Routes of exposure (e) Synergistic effects (6)*Describe the health risks associated with the following: (a) Biological agents and biological toxins (b) Blood agents (c) Choking agents (d) Irritants (riot control agents) (e) Nerve agents (f) Radiological materials (g) Vesicants (blister agents)
8.2.1 (A) Requisite Knowledge	
Advantages and limitations of hazardous materials databases, detection and monitoring equipment, reference manuals, technical information centers, and technical information specialists; methods available to obtain local weather conditions and predictions; resources to predict behavior and estimate outcomes.	

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8.2.1 (B) Requisite Skills	
Assessing hazards and evaluating risks; written and verbal communication.	
8.3.1 Plan the Response.	**8.3 Competencies – Planning the Response**
Plan the response to a hazardous materials/WMD incident, given an hazardous materials/WMD incident, the results of the incident analysis, and available resources, so that the response objectives are identified, potential response options are identified, level of personal protective equipment (PPE) is approved, decontamination process is approved, response options are selected based on available resources, and an IAP is developed.	**8.3.1 Identifying Response Objectives.** Given an analysis of a hazardous materials/WMD incident, the incident commander shall be able to describe the steps for determining response objectives (defensive, offensive, and nonintervention). **8.3.2** Identifying the Potential Response Plan. Given scenarios involving hazardous materials/WMD, the incident commander shall identify the possible response options (defensive, offensive, and nonintervention) by response objective for each problem and shall complete the following tasks: (1) Identify the possible response options to accomplish a given response objective. (2) Identify the purpose of each of the following techniques for hazardous materials control: (a) Absorption (b) Adsorption (c) Blanketing/covering (e) Contamination isolation (f) Damming (g) Diking (h) Dilution (i) Dispersion (j) Diversion (k) Fire suppression (l) Neutralization (m) Overpacking (n) Patching (o) Plugging (p) Pressure isolation and reduction (flaring; venting; vent and burn; isolation of valves, pumps, or energy sources) (q) Retention (r) Solidification (s) Transfer (t) Vapor control (dispersion, suppression) **8.3.3** Approving the Level of PPE. Given scenarios involving hazardous materials/WMD with known and unknown hazardous materials/WMD, the incident commander shall approve the PPE for the response options specified in the IAP in each situation and shall complete the following tasks: (1) Identify the four levels of chemical protection (EPA/OSHA) and describe the equipment required for each level and 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

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	(3) Describe three safety considerations for personnel working in vapor-protective, liquid splash–protective, and high temperature–protective clothing (4) Identify the physiological and psychological stresses that can affect users of PPE **8.3.4** Developing an Incident Action Plan (IAP) Given scenarios involving hazardous materials/WMD incidents, the incident commander shall develop an IAP, including site safety and control plan, consistent with the emergency response plan or standard operating procedures and within the capability of the available personnel, PPE, and response equipment, and shall complete the tasks in 8.3.4.1 through 8.3.4.5.5. **8.3.4.1** The incident commander shall identify the steps for developing an IAP. **8.3.4.2** The incident commander shall identify the factors to be evaluated in selecting public protective actions, including evacuation and sheltering-in-place. **8.3.4.3** Given the emergency response plan or standard operating procedures, the incident commander shall identify the entity that 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 protective action (evacuation or shelter in-place) (9) Provide fire suppression services (10) Provide on-scene medical triage, treatment, and transport (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 operations-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 incident scene security (22) Provide incident or crime scene investigation (23) Provide evidence collection and sampling **8.3.4.4** The incident commander shall identify the process for determining the effectiveness of a response option based on the potential outcomes.

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	8.3.4.5 The incident commander shall identify the safe operating practices and procedures that are required to be followed at a hazardous materials/WMD incident.
	8.3.4.5.1 The incident commander shall identify the importance of pre-incident planning relating to safety during responses to specific sites. **8.3.4.5.2** The incident commander shall identify the procedures for presenting a safety briefing prior to allowing personnel to work on a hazardous materials/WMD incident. **8.3.4.5.3*** The incident commander shall identify at least three safety precautions associated with search and rescue missions at hazardous materials/WMD incidents. **8.3.4.5.4** 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) Disinfection (6) Evaporation (7) Isolation and disposal (8) Neutralization (9) Solidification (10) Sterilization (11) Vacuuming (12) Washing **8.3.4.5.5*** The incident commander shall identify the atmospheric and physical safety hazards associated with hazardous materials/WMD incidents involving confined spaces.
Approving the personal protective equipment for response options, developing a plan of action, and ability to use verbal and written communication.	
8.3.1 (A)* Requisite Knowledge	
Response objectives, purpose of hazardous materials control techniques, approving the level of PPE, steps for developing an IAP, factors to be evaluated in public protective actions, making tactical assignments, and safe operating practices and procedures.	
8.3.1 (B) Requisite Skills	
8.4.1 Implementing the Incident Action Plan (IAP).	**8.4 Competencies – Implementing the Planned Response**

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Implement the planned response in a hazardous materials/WMD incident, given a hazardous materials/WMD incident and resources and equipment available, so that IMS/ICS is implemented, resources are directed, a focal point for information transfer is established, and actions are taken to meet the response objectives of the IAP.	**8.4.1 Implementing an Incident Command System.** Given a copy of the emergency response plan and annexes related to hazardous materials/WMD, the incident commander shall identify the requirements of the plan, including the procedures for notification and utilization of nonlocal resources (governmental personnel), by completing the following requirements: (1) Identify the role of the command element during a hazardous materials/WMD incident (2) Describe the concept of unified command and its application and use at a hazardous materials/WMD incident (3) Identify the duties and responsibilities of the following hazardous materials branch/group functions within the incident command system: (a) Decontamination (b) Entry (backup) (c) Hazardous materials branch director or group supervisor (d) Hazardous materials safety (e) Information and research (4) Identify the steps for implementing the emergency response plans required under Title III Emergency Planning and Community Right-to-Know Act (EPCRA) of the Superfund Amendments and Reauthorization Act (SARA) Section 303, or other state and emergency response planning legislation (5) Given the emergency response planning documents, identify the elements of each of the documents. (6) Identify the elements of the incident management system/incident command system (IMS/ICS) necessary to coordinate response activities at hazardous materials/WMD incidents (7) Identify the primary government agencies and identify the scope of the regulatory authority (including the regulations) pertaining to the production, transportation, storage, and use of hazardous materials and the disposal of hazardous wastes (8) Identify the governmental agencies and resources that can offer assistance during a hazardous materials/WMD incident and identify their role and the type of assistance or resources that might be available **8.4.2* Directing Resources (Private and Governmental).** Given a scenario involving a hazardous materials/WMD 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. **8.4.3 Providing a Focal Point for Information Transfer to the Media and Elected Officials.** Given a scenario involving a hazardous materials/WMD incident, the incident commander shall identify information to be provided to the media and governmental officials and shall complete the following tasks: (1) Identify the local policy for providing information to the media (2) Identify the responsibilities of the public information officer and the liaison officer at a hazardous materials/WMD incident (3) Describe the concept of a joint information center (JIC) and its application and use at a hazardous materials/WMD incident

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8.4.1 (A)* Requisite Knowledge	
Role of the command element, concept of unified command and its application and use, duties and responsibilities of hazardous materials branch/group functions, transfer of command, implementing IMS/ICS, directing resources, and establishing a focal point for information transfer.	
8.4.1 (B) Requisite Skills	
Implementing IMS/ICS including unified command as necessary, assigning and directing resources, and establishing information transfer focal point.	
8.5.1 Evaluate Progress and Adjust IAP.	**8.5 Competencies — Evaluating Progress**
Evaluate the progress and adjust the IAP as needed at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, actions taken, and changing incident conditions, so that actual behavior of material and container is compared to that predicted, effectiveness of action options and actions is determined, and modifications to the IAP are made as needed until the scene is determined to be stabilized and hazards are controlled.	**8.5.1 Evaluating Progress of the Incident Action Plan (IAP).** Given scenarios involving hazardous materials/WMD incidents, the incident commander shall evaluate the progress of the IAP to determine whether the efforts are accomplishing the response objectives and shall complete the following tasks: (1) Identify the procedures for evaluating whether the response 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) Control, containment, or confinement operations (b) Decontamination process (c) Established control zones (d) Personnel being used (e) PPE (4) Make modifications to the IAP as necessary **8.5.2* Transferring Command and Control During the Response Phase and the Post-Response Phase.** Given a scenario involving a hazardous materials/WMD incident, the emergency response plan, and standard operating procedures, the incident commander shall be able to identify the steps to take to transfer command and control of the incident.
8.5.1 (A) Requisite Knowledge	
Determination of safe versus unsafe, procedures for evaluating whether the action options are effective in accomplishing the objectives, steps for comparing actual behavior of the material and the container to that predicted, and procedures for making modifications to the IAP.	
8.5.1 (B) Requisite Skills	
Comparing predicted behavior of the material and its container to the actual behavior, determining effectiveness of action options and actions, and modifying the IAP when needed.	

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Chapter 8 Incident Commander	
NFPA 1072	**NFPA 472**
8.6.1 Termination.	**8.6 Competencies — Terminating Response Operations.**
Terminate response operations at a hazardous materials/WMD incident, given a hazardous materials/WMD incident that has been determined to be stabilized with hazards controlled, operational observations, and approved forms for documentation and reporting, so that command is transferred, debriefings are held, post-incident analysis is completed, a critique is conducted, and overall incident response operations are reported and documented.	**8.6.1 Terminating Response Operations.** Given a scenario involving a hazardous materials/WMD incident in which the IAP objectives have been achieved, the hazardous materials incident commander shall describe the steps taken to terminate the incident consistent with the emergency response plan and/or standard operating procedures and shall complete the following tasks: (1) Identify the steps required for terminating the hazardous materials/WMD incident (2) Identify the procedures for transferring command to the AHJ having responsibility for post-emergency response operations (PERO) **8.6.2 Conducting a Debriefing.** Given scenarios involving a hazardous materials/WMD incident, the incident commander shall conduct a debriefing of the incident and shall complete the following tasks: (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/WMD incident **8.6.3 Conducting a Post-Incident Critique.** Given details of a scenario involving a multiagency hazardous materials/WMD incident, the incident commander shall conduct a critique of the incident and shall complete the following tasks: (1) Describe the 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/WMD 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 **8.6.4 Reporting and Documenting the Hazardous Materials/WMD Incident.** Given a scenario involving a hazardous materials/WMD incident, the incident commander shall demonstrate the ability to report and document the incident consistent with governmental requirements and shall complete the following tasks: (1) Identify the reporting requirements of the governmental agencies (2) Identify the requirements for compiling incident reports, filing documents, and maintaining records as defined in the emergency response plan and/or standard operating procedures (3) Identify the steps in keeping an activity log and exposure records for hazardous materials/WMD incidents (4) Identify the procedures required for legal documentation and chain of custody and continuity described in the standard operating procedures or the emergency response plan

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Chapter 8 Incident Commander	
NFPA 1072	**NFPA 472**
8.6.1 (A)* Requisite Knowledge	
Transition from safe and nonsafe; regulatory issues; elements and procedures for conducting a debriefing, a post-incident analysis, and a critique; and requirements for reporting and documenting overall incident response operations.	
8.6.1 (B) Requisite Skills	
Transferring command; participating in a debriefing, post-incident analysis, and critiques; and completing required reports and supporting documentation for overall incident response operations.	

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PART I

NFPA® 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents,* 2018 Edition, with Commentary

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Part I of this handbook presents the full text of NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, and explanatory commentary to guide the reader through the standard. NFPA 472 identifies the levels of competence required of responders to incidents involving hazardous materials and weapons of mass destruction for awareness level personnel, operations level responders, mission-specific competencies, hazardous materials technicians, specialty designation competencies for technicians, incident commanders, hazardous materials officers, hazardous materials safety officers, and specialist employees. The 2018 edition of NFPA 472 is designed to address traditional hazardous materials response issues and the emerging issues presented by terrorism and the criminal use of hazardous materials.

An asterisk (*) following a standard paragraph number indicates that advisory annex material pertaining to that paragraph appears in Annex A. Paragraphs that begin with the letter A are extracted from Annex A of the standard. Although printed in black ink, this nonmandatory material is purely explanatory in nature. For ease of use, this handbook places Annex A material immediately after the standard paragraph to which it refers.

In addition to standard text and annexes, Part I includes explanatory commentary that provides the history and other background information for specific paragraphs in the standard. To readily identify commentary material, commentary text, illustration captions, and tables are shown in blue tint. Art in the standard is labeled as "figures," and the art in the commentary is labeled as "exhibits" to help the reader distinguish between the two.

The Technical Committee on Hazardous Materials Response Personnel has completed work on NFPA 1072, *Standard on Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications,* 2017 edition, which identifies job performance requirements for awareness, operations, operations mission-specific, technician, and incident commander levels. To best recognize the work of the technical committee and to make the correlation between the documents easy for stakeholders and users to reference, a matrix is included at the beginning of this book to link and associate the related material of NFPA 1072 and NFPA 472.

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REVISION SYMBOLS IDENTIFYING CHANGES FROM THE PREVIOUS EDITION

Text revisions are shaded. A Δ before a section number indicates that words within that section were deleted and a Δ to the left of a table or figure number indicates a revision to an existing table or figure. When a chapter was heavily revised, the entire chapter is marked throughout with the Δ symbol. Where one or more sections were deleted, a • is placed between the remaining sections. Chapters, annexes, sections, figures, and tables that are new are indicated with an ***N***.

Note that these indicators are a guide. Rearrangement of sections may not be captured in the markup, but users can view complete revision details in the First and Second Draft Reports located in the archived revision information section of each code at www.nfpa.org/docinfo. Any subsequent changes from the NFPA Technical Meeting, Tentative Interim Amendments, and Errata are also located there.

Shaded text = Revisions   Δ = Text deletions and figure/table revisions   • = Section deletions   ***N*** = New material

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1 Administration

Chapter 1 provides the administrative text and requirements for the 2018 edition of NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*. This chapter covers the scope, purpose, and application of the standard.

NFPA 472 applies to personnel whose normal duties may require them to be first on the scene. Responders include those from fire service, emergency medical service, law enforcement, and other public sector agencies as well as responders from private industry, including industrial fire brigades and workers engaged in both transportation and fixed hazardous materials handling and disposal operations.

For organizations that must comply with either the Occupational Health and Safety Administration (OSHA) or the Environmental Protection Agency (EPA) hazardous materials emergency response regulations [1], Commentary Table I.1.1 compares these federal regulations to the specific competency levels outlined in NFPA 472.

COMMENTARY TABLE I.1.1 *NFPA and OSHA Comparison*

NFPA 472, 2018 Edition	*OSHA 1910.120*
Chapter 4, Awareness Level Personnel	1910.120(q)(6)(i), First Responder Awareness Level
Chapter 5, Operations Level Responders	1910.120(q)(6)(ii), First Responder
Chapter 6, Mission-Specific Competencies	No OSHA equivalent
Chapter 7, Hazardous Materials Technicians	1910.120(q)(6)(iii), Hazardous
Chapter 8, Incident Commanders	1910.120(q)(6)(v), On Scene Incident
Chapter 9, Specialist Employees	1910.120(q)(5), Specialist Employee
Chapter 10, Hazardous Materials Officers	No OSHA equivalent
Chapter 11, Hazardous Materials Safety Officers	No OSHA equivalent
Chapter 12, Technicians with a Tank Car Specialty	No OSHA equivalent
Chapter 13, Technicians with a Cargo Tank Specialty	No OSHA equivalent
Chapter 14, Technicians with an Intermodal Tank Specialty	No OSHA equivalent
Chapter 15, Technicians with a Marine Tank and Non-Tank Vessel Specialty	No OSHA equivalent
Chapter 16, Technicians with a Flammable Liquids Bulk Storage Specialty	No OSHA equivalent
Chapter 17, Technicians with a Flammable Gases Bulk Storage Specialty	No OSHA equivalent
Chapter 18, Technicians with a Radioactive Material Specialty	No OSHA equivalent

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Chapter 19, Technicians with an Advanced Monitoring and Detection Specialty	No OSHA equivalent
Chapter 20, Technicians with a Consequence Analysis and Planning Specialty	No OSHA equivalent
Chapter 21, Technicians with an Advanced Chemical Risk Assessment and Analysis Specialty	No OSHA equivalent
Chapter 22, Technicians with an Advanced Product Control Specialty	No OSHA equivalent
Chapter 23, Technicians with a Weapons of Mass Destruction Specialty	No OSHA equivalent
Chapter 24, Technicians with an Advanced Decontamination Specialty	No OSHA equivalent

1.1 Scope.

1.1.1* This standard shall identify the minimum levels of competence required by responders to emergencies involving hazardous materials/weapons of mass destruction (WMD).

The key to achieving the level of competence required in 1.1.1 is training and evaluation. NFPA 472 is a performance-based standard, and therefore training hour requirements are not given. Instead, NFPA 472 deals with the objectives and abilities that a responder must attain to be considered competent. The performance-based approach was chosen by committee members because hazardous materials emergency response is a constantly changing field of knowledge, skills, and control methods, based on continually developing technology, chemicals, and needs.

Competencies can identify skills, knowledge, and abilities expected for the specific hazardous materials responder levels. NFPA 472 can be used for designing training and evaluation programs, certifying responders, measuring and critiquing on-the-job performance, defining hiring practices, and setting organizational policies, procedures, and goals.

Competencies for the technician with a specialty designation have been included since the 1997 edition of NFPA 472:

- Tank cars (Chapter 12)
- Cargo tanks (Chapter 13)
- Intermodal tanks (Chapter 14)
- Marine tank vessels (Chapter 15)

With each successive edition, additional areas of specialty designation competencies were added. In NFPA 472, 2013 edition, the following specialties included:

- Technicians with a Flammable Liquids Bulk Storage Specialty (Chapter 16)
- Technicians with a Flammable Gases Bulk Storage Specialty (Chapter 17)
- Technicians with a Radioactive Material Specialty (Chapter 18)

With significant discussion during the development of the 2018 edition, the technical committee raised concerns to the base level competencies for the technician. Technology and increased risk-based response approaches have important concerns. The technical committee revised technician competencies for Chapter 7 and developed specialty competencies in the following areas for the 2018 edition of NFPA 472:

- Technicians with an Advanced Monitoring and Detection Specialty (Chapter 19)
- Technicians with a Consequence Analysis and Planning Specialty (Chapter 20)

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- Technicians with an Advanced Chemical Risk Assessment and Analysis Specialty (Chapter 21)
- Technicians with an Advanced Product Control Specialty (Chapter 22)
- Technicians with a Weapons of Mass Destruction Specialty (Chapter 23)
- Technicians with an Advanced Decontamination Specialty (Chapter 24)

The inclusion of these specialty levels does not limit the technician level in the performance of the tasks that have always been assigned at that level. Instead, the technical committee has added specific language to explain that the capabilities and operations performed at the technician level can still be performed by technicians in hazardous materials incidents, no matter the incident involvement.

Since the 1997 edition, NFPA 472 has also included two other levels of competencies:

- Hazardous Materials Officer (Chapter 10)
- Hazardous Materials Safety Officer (Chapter 11)

The hazardous materials officer could be the "officer in charge" of the hazardous materials team, the hazardous materials group supervisor, or the hazardous materials technical specialist. The hazardous materials officer can be a part of the entry team or can closely supervise the operation from the warm zone. At some larger and more complex incidents, more than one hazardous materials officer could be needed for each team working at the incident.

A response team can be composed of members at several levels. For example, a team might have personnel at the operations level and at the technician level, or it might be made up of personnel at specialist employee A and B levels. The levels of competencies in NFPA 472 apply to individuals rather than to response teams.

A.1.1.1 Outside the United States, hazardous materials might be called dangerous goods *(see Annex E)*. Weapons of mass destruction (WMD) are known by many different abbreviations and acronyms, including CBRNE (chemical, biological, radiological, nuclear, explosive), B-NICE (biological, nuclear, incendiary, chemical, explosive), COBRA (chemical, ordinance, biological, radiological agents), and NBC (nuclear, biological, chemical).

1.1.2 This standard shall apply to any individual or member of any organization who responds to hazardous materials/WMD incidents.

1.1.3 This standard shall cover the competencies for awareness level personnel, operations level responders, hazardous materials technicians, incident commanders, hazardous materials officers, hazardous materials safety officers, and other specialist employees.

1.2 Purpose.

1.2.1 The purpose of this standard shall be to specify minimum competencies required for those who respond to hazardous materials/WMD incidents and necessary for a risk-based response to these incidents.

1.2.2 The competencies contained herein shall help reduce the numbers of accidents, injuries, and illnesses during response to hazardous materials/WMD incidents and shall help prevent exposure to hazardous materials/WMD, thus reducing the possibility of fatalities, illness, and disabilities to emergency response personnel.

Hazardous materials are an integral part of the industrial society in which we live, and incidents involving such materials are inevitable. Many responders might experience a complex hazardous materials incident only once in their careers. However, those dedicated to providing emergency services must be prepared to manage such incidents effectively and safely. Those involved in manufacturing, using, storing, and transporting hazardous materials should also be trained to safely undertake initial

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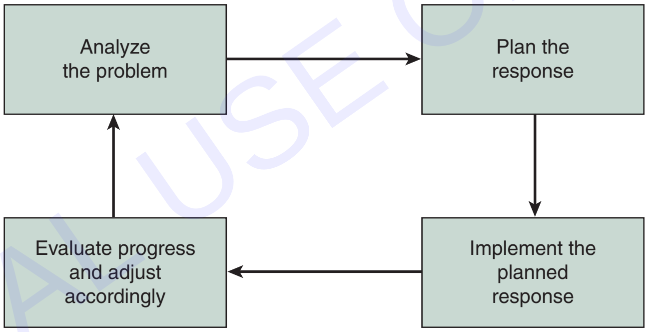
protective actions when an unplanned release occurs and to assist emergency responders who are called on to minimize and control the hazard.

Protecting the responders and ensuring their safety at the scene of an incident is one of the principal purposes specified in 1.2.2 of NFPA 472. Adhering to the provisions of NFPA 472 at each level of competency should provide a high degree of safety, despite the hazards encountered. The successful mitigation of a hazardous materials incident depends on proper organization and planning. The technical committee has used a standard system to organize the approach and mitigation of a hazardous materials incident, and that system is represented in Exhibit I.1.1.

Each duty involves a series of tasks and steps that must be considered and resolved by decisions and actions. These duties, when supported by the response community, are the framework for an appropriate, risk-based response to hazardous materials incidents. Reasoned decisions based on this risk-based approach minimize harm resulting from a hazardous materials incident while reducing the risk to the responders.

EXHIBIT 1.1.1

This diagram shows the duties of initial response personnel that are associated with emergencies involving hazardous materials.



N **1.2.3** This document is also intended to further clarify competencies with the associated job performance requirements (JPRs) established in NFPA 1072.

It was the intention of the technical committee to develop the professional qualifications for hazardous materials and weapons of mass destruction from the information developed over the years from NFPA 472. Chapters for awareness, operations, operations mission-specific, technician, and incident commander (Chapters 4–8) correlate to the job performance requirements (JPRs) found in NFPA 1072.

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

NFPA 472 is not intended to be the sole description of ultimate performance regarding hazardous materials incident response, which is stated in Section 1.3. The authority having jurisdiction (AHJ) should not take the contents of the standard as sufficient for all possible incidents. Rather, the included competencies resulted from a consensus process. Therefore, an appropriate action for the AHJ would be to consider the standard and decide to add to the competencies as needed to address local conditions or specific situations.

Reference Cited in Commentary

1. Title 29, Code of Federal Regulations, Part 1910.120, "Hazardous Waste Operations and Emergency Response."

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2 Referenced Publications

This chapter lists the publications that are referenced within the mandatory chapters of NFPA 472. These mandatory referenced publications are needed for effective use of and compliance with NFPA 472. The requirements contained within these references constitute part of the requirements of NFPA 472. Annex H of NFPA 472 lists nonmandatory publications that are referenced within the nonmandatory annexes of NFPA 472.

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, Quincy, MA 02169-7471.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam,* 2016 edition.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, 2017 edition.

NFPA 1001, *Standard for Fire Fighter Professional Qualifications*, 2013 edition.

NFPA 1072, *Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications*, 2017 edition.

2.3 Other Publications.

N **2.3.1 ASTM Publications.** ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM A240/A240M-07, *Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.* November 1, 2015.

2.3.2 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Emergency Planning and Community Right-to-Know Act, Public Law 99–499, 1986.

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Emergency Response Guidebook, Pipeline and Hazardous Materials Administration, U.S. Department of Transportation, 2016 edition.

FBI Bomb Data Center, Special Technicians Bulletin 2010-1, "A Model for Bomb Squad Standard Operating Procedures," Washington, DC, July 22, 2011.

National Bomb Squad Commanders Advisory Board (NBSCAB), *National Guidelines for Bomb Technicians*.

Superfund Amendments and Reauthorization Act (SARA), National Guidelines for Bomb Technicians, March 2014, U.S. Department of Justice.

Title 18, U.S. Code, Section 2332a, "Use of Weapons of Mass Destruction."

Title 46, Code of Federal Regulations, Subchapter C, Parts 24–28.

Title 46, Code of Federal Regulations, Subchapter D, Parts 30–39.

Title 46, Code of Federal Regulations, Subchapter I, Parts 90–105.

Title 46, Code of Federal Regulations, Subchapter I-A, Parts 107–109.

Title 46, Code of Federal Regulations, Subchapter H, Parts 70–79.

Title 46, Code of Federal Regulations, Subchapter L, Parts 125–134.

Title 46, Code of Federal Regulations, Subchapter O, Parts 150–154.

Title 46, Code of Federal Regulations, Subchapter T, Parts 175–185.

2.3.3 Other Publications. *Merriam-Webster's Collegiate Dictionary*, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 51, *Standard for the Design and Installation of Oxygen–Fuel Gas Systems for Welding, Cutting, and Allied Processes*, 2018 edition.

NFPA 70®, National Electrical Code®, 2017 edition.

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Definitions

3

The definitions presented in Chapter 3 are either NFPA primary definitions or have been established by the Technical Committee on Hazardous Materials Response Personnel for specific use in NFPA 472. Operations level responder definitions are also located here in Chapter 3 but will mainly apply to the competencies required in Chapters 5 and 6. All the terms defined in Chapter 3 will assist the responder to understand the competencies as they are presented throughout the document. The committee has made every effort to present definitions that are commonly used terms and widely understood by emergency responders. The phrase *hazardous materials/weapons of mass destruction* is truncated to the acronym *HM/WMD* or the term *hazmat/WMD* in various places throughout the commentary of this handbook. See Part V of this handbook for a glossary of all the definitions from Chapter 3 of each of the following codes: NFPA 472, NFPA 473, NFPA 475, and NFPA 1072.

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

The authority having jurisdiction (AHJ) can also seek the expertise of other allied professionals, including a certified safety professional (CSP), certified health physicist (CHP), certified industrial hygienist (CIH), certified hazardous materials (CHM), or similar credentialed or competent individuals. These individuals might also be referred to as a subject matter expert (SME) in a mission-specific area.

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

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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.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

In a document dealing with the very broad concept of hazardous materials response, AHJs include officials at all levels of government, from federal to local authorities.

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.

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.

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.

3.2.4 Shall. Indicates a mandatory requirement.

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

The term *should* is not used in the main body of an NFPA standard, but it can be found in the annexes, which contain explanatory or recommended information.

3.2.6 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

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3.3 General Definitions.

N **3.3.1 Action Options.** Tasks responders perform to meet response objectives at hazardous materials/weapons of mass destruction (WMD) incidents.

Δ **3.3.2* Allied Professional.** That person who possesses the knowledge, skills, and technical competence to provide assistance in the selection, implementation, and evaluation of tasks at a hazardous materials/weapons of mass destruction (WMD) incident.

Allied professionals might also be referred to as SMEs in a mission-specific area.

Δ **A.3.3.2 Allied Professional.** Examples could include certified safety professional (CSP), certified health physicist (CHP), certified industrial hygienist (CIH), radiation safety officer (RSO), or similar credentialed or competent individuals as determined by the authority having jurisdiction (AHJ). An allied professional can also be referred to as a technical specialist or subject matter expert (SME).

3.3.3 Analyze. The process of identifying a hazardous materials/weapons of mass destruction (WMD) problem and determining likely behavior and harm within the training and capabilities of the emergency responder.

3.3.4 Area of Specialization.

Awareness level personnel include truck drivers; train crew members; municipal, industrial, or chemical plant workers; and others whose duties require them to work in facilities where hazmat/WMD are manufactured, transported, stored, used, or could be otherwise released. Awareness level personnel are not expected to take any action that would require a great deal of training and experience. Rather, their actions are basic, defensive, and limited. Awareness level personnel are those likely to witness or discover a hazmat/WMD release during their normal job activities and who would be expected, as part of their responsibilities, to activate the emergency notification system.

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

3.3.4.2 Organization's Area of Specialization. Any chemicals or containers used by the specialist employee's employer.

Δ **3.3.5 Awareness Level Personnel.** Personnel who, in the course of their normal duties, could encounter an emergency involving hazardous materials/weapons of mass destruction (WMD) and who are expected to recognize the presence of the hazardous materials WMD, protect themselves, call for trained personnel, and secure the scene. *(See Annex E.)*

Awareness level personnel include truck drivers; train crew members; municipal, industrial, or chemical plant workers; and others whose duties require them to work in facilities where hazmat/WMD are manufactured, transported, stored, used, or could be otherwise released. Awareness level personnel are not expected to take action that would require a great deal of training and experience. Rather, their actions are basic, defensive, and limited. Awareness level personnel are those likely to witness or discover a hazmat/WMD release during their normal job activities and who would be expected, as part of their responsibilities, to activate the emergency notification system.

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3.3.6 CANUTEC. The Canadian Transport Emergency Centre, operated by Transport Canada, that provides emergency response information and assistance on a 24-hour basis for responders to hazardous materials/weapons of mass destruction (WMD) incidents.

3.3.7 CHEMTREC. 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/weapons of mass destruction (WMD) incidents.

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

Knowledge and skills can be measured, but judgment is not as easily evaluated, and judgment and decision-making skills can vary substantially with circumstances. Nonetheless, training and experience improve a responder's ability to make decisions in emergencies. Various competencies outlined in this performance-based standard focus on the skills necessary rather than the hours of training needed to achieve those skills. Necessary training hours can vary from individual to individual and jurisdiction to jurisdiction, depending on prior individual training and experience and on the requirements of the AHJ. In addition to training, experience and practice through drills, tabletop exercises, and other hands-on practice and training exercises is invaluable.

3.3.9* 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.

The U.S. Occupational Safety and Health Administration (OSHA) has promulgated regulations relating to worker safety in confined spaces, as defined earlier. These regulations introduced a system of working in such spaces that includes hazard recognition and risk assessment; testing, evaluating, and monitoring; and permits for entry, work, and rescue. See www.osha.gov for more information.

A.3.3.9 Confined Space. Additionally, a confined space is further defined as having one or more of the following characteristics:

(1) The area contains or has the potential to contain a hazardous atmosphere, including an oxygen-deficient atmosphere.
(2) The area contains a material with the 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.

•

3.3.10 Container. A receptacle, piping, or pipeline used for storing or transporting material of any kind; synonymous with "packaging" in transportation.

Some regulations and codes define a container by placing size limitations on its capacity, but NFPA 472 does not. A container in this case would be anything designed or intended to hold a hazardous material.

N ***3.3.10.1 Bulk Transportation Containers.*** Containers, including transport vehicles, having a liquid capacity of more than 119 gal (450 L), a solids capacity of more than 882 lb (400 kg), or a compressed gas water capacity of more than 1001 lb (454 kg) that are either placed on or in a transport vehicle, or vessel or are constructed as an integral part of the transport vehicle, including **a.** Cargo tanks including nonpressure tanks — MC-306/DOT-406 or equivalent, low-pressure tanks — MC-307-DOT-407 or equivalent, corrosive liquid tanks — MC-312/DOT-412 or equivalent, high-pressure tanks — MC-331 or equivalent, and cryogenic tanks — MC-338 or equivalent **b.** Portable tanks such as

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intermodal tanks, including nonpressure tanks, pressure tanks, cryogenic tanks, and tube modules **c.** Tank cars including nonpressure tank cars, pressure tanks cars, and cryogenic tank cars **d.** Ton containers.

N ***3.3.10.2 Facility Storage Tanks.*** Atmospheric and low-pressure storage tanks, pressurized storage tanks, and cryogenic storage tanks.

N ***3.3.10.3 Intermediate Bulk Containers (IBCs).*** Pressure, nonpressure, and cryogenic rigid or flexible portable containers, other than cylinders or portable tanks, designed for mechanical lifting.

N ***3.3.10.4 Nonbulk Containers.*** Containers, including bags, boxes, carboys, cylinders, drums, and Dewar flasks for cryogenic liquids, having a liquid capacity of 119 gal (450 L) or less, a solids capacity of 882 lb (400 kg) or less, or a compressed gas water capacity of 1001 lb (454 kg) or less.

N ***3.3.10.5 Pipeline.*** A length of pipe including pumps, valves, flanges, control devices, strainers, and/or similar equipment for conveying fluids. [**70,** 2017]

N ***3.3.10.6 Piping.*** Assemblies of piping components used to convey, distribute, mix, separate, discharge, meter, control, or snub fluid flows. Piping also includes pipe-supporting elements but does not include support structures such as building frames, bents, foundations, or any other equipment excluded from this standard. [**51,** 2013]

N ***3.3.10.7* Radioactive Materials Containers.*** Excepted packaging, industrial packaging, Type A, Type B, and Type C packaging for radioactive materials.

N ***A.3.3.10.7 Radioactive Materials Containers.*** *Excepted packaging* is used to transport materials with extremely low levels of radioactivity that meet only general design requirements for any hazardous material. Excepted packaging ranges from a product's fiberboard box to a sturdy wooden or steel crate, and typical shipments include limited quantities of materials, instruments, and articles such as smoke detectors. Excepted packaging will contain non-life-endangering amounts of radioactive material.

Industrial packaging is used to transport materials that present limited hazard to the public and the environment. Examples of these materials are contaminated equipment and radioactive waste solidified in materials such as concrete. This packaging is grouped into three categories based on the strength of packaging: IP-1, IP-2, and IP-3. Industrial packaging will contain non-life-endangering amounts of radioactive material.

Type A packaging is used to transport radioactive materials with concentrations of radioactivity not exceeding the limits established in 49 CFR 173.431. Typically, Type A packaging has an inner containment vessel made of glass, plastic, or metal and packing material made of polyethylene, rubber, or vermiculite. Examples of materials shipped in Type A packaging include radiopharmaceuticals and low-level radioactive wastes. Type A packaging will contain non-life-endangering amounts of radioactive material.

Type B packaging is used to transport radioactive materials with radioactivity levels higher than those allowed in Type A packaging, such as spent fuel and high-level radioactive waste. Limits on activity contained in a Type B packaging are provided in 49 CFR 173.431. Type B packaging ranges from small drums [55 gal (208 L)] to heavily shielded steel casks that sometimes weigh more than 138 tons (125 metric tonnes). Type B packaging can contain potentially life-endangering amounts of radioactive material.

Type C packaging is used for consignments transported by aircraft of high-activity radioactive materials that have not been certified as "low dispersible radioactive material" (including plutonium). They are designed to withstand severe accident conditions associated with air transport without loss of containment or significant increase in external radiation levels. The Type C packaging performance requirements are significantly more stringent than those for Type B packaging. Type C packaging is not authorized for domestic use but can be authorized for international shipments of high-activity radioactive material consignments. Regulations

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Closer Look

Radioactive Materials Containers

The strength and reliability of radioactive materials packaging are especially important in transportation because of the possibility of devastating incidents and the potential harm that could result from released radioactive material. At least four groups in the United States promulgate rules governing the transport of radioactive material, including the U.S. DOT, U.S. Nuclear Regulatory Commission, U.S. Department of Energy, and U.S. Postal Service. DOT regulations are generally more detailed in 49 CFR 173, Subpart I, "Class 7 Radioactive Materials" [3]. The Canadian Nuclear Safety Commission (CNSC) is the regulatory authority in Canada.

Regulations cannot eliminate accidents in transportation, so their emphasis is on ensuring safety in routine handling situations for minimally hazardous material and ensuring integrity under all circumstances for highly dangerous materials.

These goals of containment and safety focus on the package and its ability in the following three areas:

1. Contain the material (prevent leaks)
2. Prevent unusual occurrences (such as criticality)
3. Reduce external radiation to safe levels through shielding

Excepted packages are for materials with extremely low levels of radioactivity. Due to the very limited hazard of the contents, packaging requirements include ease of handling as well as reasonable strength for transportation. Packaging can range from a fiberboard box to a sturdy wooden or steel crate. Packages are not identified as such by package markings or on shipping papers. Excepted packages are used for transporting limited quantities of radioactive material that would pose very low hazard if released in an accident.

Industrial packages are intended for materials with a low concentration of radioactivity that poses a limited hazard to the public and the environment. The radioactive material can be liquid or can be solidified in such materials as concrete or glass. Industrial packages are not identified as such by package markings or on shipping papers. The following three categories are based on strength:

1. IP-l packages must meet the same design requirements as excepted packaging.
2. IP-2 packages must pass the same tests as Type A for free-drop and stacking.
3. IP-3 packages must pass IP-2 tests and the water spray and penetration tests for Type A shipment of solid contents.

Type A packages are used to transport radioactive material with higher concentrations of radioactivity than those allowed in excepted and industrial packages. They often have an inner containment vessel made of glass, plastic, or metal surrounded by packaging material of polyethylene, rubber, vermiculite, or wood. The packaging might be an absorbent in a fiberboard, wood, or metal outer container. This packaging must be able to withstand heavy rain equivalent to 2 in. (5.1 cm) per hour, free-dropping from 4 ft (1.22 m), stacking (compression equal to the weight of the package for at least 24 hours), vibration [1 hour, strong enough to raise the package 0.063 in. (1.6 cm)], and penetration by a dropped weight [1.25 in. (3.18 cm) in diameter and 13.2 lb (5.99 kg) dropped from 40 in. (1.02 m)].

Type B protects materials with higher radioactivity levels, including spent nuclear fuel, so it is substantially constructed to retain the contents under normal transport conditions and under severe accident conditions. Sizes range from small handheld radiography cameras to small drums [55 gal (208 L)] to heavily shielded steel casks that can weigh more than 100 tons (101.6 kilotons). This packaging must be strong enough to withstand tests for dropping 30 ft (9.1 m) so that the package's weakest point is hit; puncture, dropped 40 in. (1.02 m) onto a 6 in. (15.2 cm) diameter steel rod 8 in. (20.3 cm) high, again hitting the package's weakest point; heat, 1475°F (802°C) for 30 min; crush, for some lightweight packages, a drop of 1,100 lb (499 kg) mass 30 ft (9.1 m) onto the package, and immersion under 50 ft (15.2 m) of water. Packages are identified as Type B by markings on the package and shipping papers. Examples of Type A and Type B packaging are shown below.

Examples of radioactive materials packaging Type A and Type B: Radiopharmaceuticals are commonly transported in Type A packages resembling the ones pictured (left). Type B packages can range from small handheld radiography cameras similar to the one shown (right) to heavily shielded steel casks that weigh well over 100 tons.

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require that both Type B and Type C packaging be marked with a trefoil symbol to ensure that the package can be positively identified as carrying radioactive material. The trefoil symbol must be resistant to the effects of both fire and water so that it is likely to survive a severe accident and serve as a warning to emergency responders.

The performance requirements for Type C packaging include those applicable to Type B packaging with enhancements on some tests that are significantly more stringent than those for Type B packaging. For example, a 200 mph (321.8 km/hr) impact onto an unyielding target is required instead of the 30 ft (9.1 m) drop test required of a Type B packaging; a 60-minute fire test is required instead of the 30-minute test for Type B packaging; and a puncture/tearing test is required. These stringent tests are expected to result in packaging designs that will survive more severe aircraft accidents than Type B packaging designs.

• **3.3.11 Contaminant.** A hazardous material, or the hazardous component of a weapon of mass destruction (WMD), 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.

Containment often involves plugging or patching a container to stop a leak. Committing personnel to this type of operation must be carefully considered and must take into account the level of training they have received. Many, if not most, containment activities can be considered to be "offensive" in nature, involve a higher risk of exposure, and typically require training to the technician or the specialist employee A level (see Exhibit I.3.1).

EXHIBIT I.3.1

A technician or private sector specialist employee with Level A training and appropriate personal protective equipment (PPE) can enter the hot zone for assessment and initial rescue. (Courtesy of endopack/iStock/Thinkstock)

3.3.12 Contamination. The process of transferring a hazardous material, or the hazardous component of a weapon of mass destruction (WMD), from its source to people, animals, the environment, or equipment, that can act as a carrier.

The term *contamination* is one of the most important considerations for emergency responders from a health and safety standpoint. The importance of determining whether personnel or equipment have been contaminated cannot be overemphasized. Because personnel are often unaware that contamination has occurred, procedures must be established ahead of time to ensure proper monitoring and decontamination procedures are in place and followed at each incident scene.

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

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3.3.13 Control. The procedures, techniques, and methods, used in the mitigation of hazardous materials/weapons of mass destruction (WMD) incidents, including containment, extinguishment, and confinement.

The term *control* can be used interchangeably with the word *mitigation*. Every measure taken to control a hazardous materials incident is part of the mitigation process. Limiting the degree of contamination by whatever means available is also part of the control or mitigation process.

N *3.3.13.1* ***Confinement.*** Those procedures taken to keep a material, once released, in a defined or local area.

N *3.3.13.2* ***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).

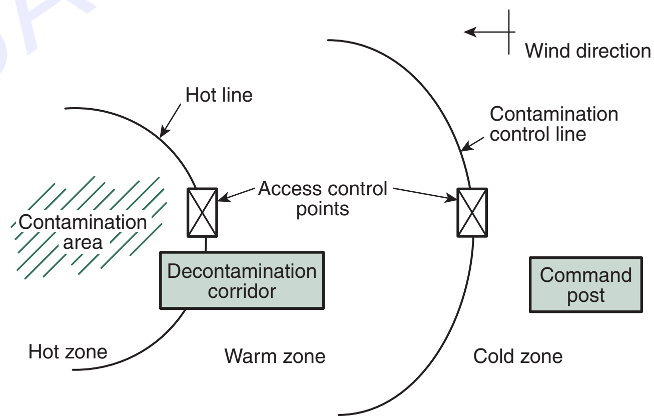
N *3.3.13.3* ***Extinguishment.*** To cause to cease burning.

3.3.14* Control Zones. The areas at hazardous materials/weapons of mass destruction (WMD) incidents within an established/controlled perimeter that are designated based upon safety and the degree of hazard.

The choice of basic terms related to control zones such as *hot*, *warm*, and *cold* is based on the fact that the words are simple and easily understood and that they clearly suggest the nature of the situation one would expect to encounter in any area with such a designation. (See also the definitions of *cold zone, hot zone*, and *warm zone*.) The relationship between these zones at the incident site is shown in Exhibit I.3.2.

EXHIBIT I.3.2

Control zones are shown in relation to the incident site.



A.3.3.14 Control Zones. Law enforcement agencies might utilize different terminology for site control, for example, *inner* and *outer perimeters* as opposed to *hot* or *cold zones*. The operations level responder should be familiar with the terminology and procedures used by the AHJ and coordinate on-scene site control operations with law enforcement.

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.

3.3.14.1 ***Cold Zone.*** The control zone of hazardous materials/weapons of mass destruction (WMD) incidents that contains the incident command post and such other support functions as are deemed necessary to control the incident.

The outer boundary of the cold zone is referred to as the isolation perimeter or the outer perimeter. Only emergency responders or incident support personnel can operate inside this perimeter, and in most instances the public does not have access to the cold zone.

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3.3.14.2 Decontamination Corridor. The area usually located within the warm zone where decontamination is performed.

3.3.14.3 Hot Zone. The control zone immediately surrounding hazardous materials/weapons of mass destruction (WMD) incidents, which extends far enough to prevent adverse effects of hazards to personnel outside the zone and where only personnel who are trained, equipped, and authorized to do the assigned work are permitted to enter.

The hot zone is the area where the hazmat/WMD release has occurred or could take place. The hot zone may also be referred to as the inner perimeter by law enforcement personnel. It is the area where there is a high potential for exposure or contamination to the materials involved, and where personal protective clothing and equipment are required based on the hazards present.

The boundary between the hot zone and warm zone should be indicated by some physical means such as barrier tape, barricades, or some other marks.

3.3.14.4* Warm Zone. The control zone at hazardous materials/weapons of mass destruction (WMD) incidents where personnel and equipment decontamination and hot zone support takes place.

Two functions of the warm zone are to contain the contaminants and prevent a contaminant's spread to the cold zone and beyond (see Exhibit I.3.3). To some extent, the warm zone serves as a buffer between the hot zone and cold zone. The level of contamination in the warm zone should decrease the closer one gets to the cold zone, not only because of the decontamination function, but also because of the increasing space.

The warm zone includes control points for the decontamination corridor. Support activities include staging of backup personnel and equipment, staging of evidence, and personnel and equipment decontamination. Additionally, portions of this area might be used as safe refuge for initial patient evacuation and triage.

EXHIBIT I.3.3

When the entry team is ready to exit the hot zone, they must pass through the warm zone and decontamination area to clean their chemical-protective clothing (CPC) to reduce the possibility of cross-contamination from potentially dangerous material. (Courtesy of Hildebrand and Fish, LLC)

A.3.3.14.4 Warm Zone. The warm zone includes control points for the decontamination corridor, thus helping to reduce the spread of contamination. This support may include staging of backup personnel and equipment, staging of evidence, and personnel and equipment decontamination. Additionally, portions of this area may be used as a safe refuge for initial patient evacuation and triage.

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

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Determining the specific individual and agency in charge of a hazmat/WMD incident can be difficult in the aftermath of a hazmat/WMD incident, depending on its scope and nature. For example, many responders, in an effort to be of assistance after a major incident, will report to the scene and might begin rescue or recovery operations independently of other operations that could be in progress. Command might also be transferred as an incident develops.

3.3.16* Decontamination. The physical and/or chemical process of reducing and preventing the spread and effects of contaminants to people, animals, the environment, or equipment involved at hazardous materials/weapons of mass destruction (WMD) incidents.

Δ **A.3.3.16 Decontamination.** There are three types of decontamination (commonly known as "decon") performed by emergency responders: emergency, mass, and technical.

Gross decontamination is a phase of decontamination where significant reduction of the amount surface contamination takes place as quickly as possible. This is usually accomplished by mechanical removal of the contaminant or initial rinsing from handheld hose lines, emergency showers, or other nearby sources of water.

Gross decontamination is performed on the following:

(1) Team members before their technical decontamination
(2) Emergency responders before leaving the incident scene
(3) Victims during emergency decontamination
(4) Persons requiring mass decontamination
(5) Personal protective equipment used by emergency responders before leaving the scene

Decontamination sometimes performed on victims in a hospital setting is generally referred to as *definitive decontamination* but is not covered in this standard.

Δ ***3.3.16.1* Emergency Decontamination.*** The process of immediately reducing contamination of individuals in potentially life-threatening situations with or without the formal establishment of a decontamination corridor.

Δ ***A.3.3.16.1 Emergency Decontamination.*** This process can be as simple as removal of outer or all garments from the individual to washing down with water from a fire hose or emergency safety shower. The sole purpose is to quickly separate as much of the contaminant as possible from the individual to minimize exposure and injury.

3.3.16.2* Gross Decontamination. A phase of the decontamination process where significant reduction of the amount of surface contamination takes place as soon as possible, most often accomplished by mechanical removal of the contaminant or initial rinsing from handheld hose lines, emergency showers, or other nearby sources of water.

A.3.3.16.2 Gross Decontamination. Victims of a hazardous material release that is potentially life threatening due to continued exposure from contamination are initially put through a gross decontamination, which will significantly reduce the amount of additional exposure. This is usually accomplished by mechanical removal of the contaminant or initial rinsing from handheld hose lines, emergency showers, or other nearby sources of water. Responders operating in a contaminated zone in personal protective equipment (PPE) are put through gross decontamination, which will make it safer for them to remove the PPE without exposure and for members assisting them.

Δ ***3.3.16.3* Mass Decontamination.*** The process of reducing or removing surface contaminants from large numbers of victims in potentially life-threatening situations in the fastest time possible.

Δ ***A.3.3.16.3 Mass Decontamination.*** Mass decontamination is initiated where the number of victims and time constraints do not allow the establishment of an in-depth decontamination process.

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Mass decontamination should be established at once to reduce the harm being done to the victims by the contaminants. Initial operations are most often performed with handheld hose lines or master streams supplied from fire apparatus while a more formal process is being set up. A formal technical decontamination might be necessary if it is determined through detection, observation, or concern that the initial emergency decontamination was not effective [e.g., victims exposed to a radiological dispersal device (RDD) or an aerosolized biologic agent].

3.3.16.4* Technical Decontamination. The planned and systematic process of reducing contamination to a level that is as low as reasonably achievable.

A.3.3.16.4 Technical Decontamination. Technical decontamination is the process subsequent to gross decontamination designed to remove contaminants from responders, their equipment, and victims. It is intended to minimize the spread of contamination and ensure responder safety. Technical decontamination is normally established in support of emergency responder entry operations at a hazardous materials incident, with the scope and level of technical decontamination based on the type and properties of the contaminants involved. In non-life-threatening contamination incidents, technical decontamination can also be used on victims of the initial release. Examples of technical decontamination methods are the following:

(1) Absorption
(2) Adsorption
(3) Chemical degradation
(4) Dilution
(5) Disinfecting
(6) Evaporation
(7) Isolation and disposal
(8) Neutralization
(9) Solidification
(10) Sterilization
(11) Vacuuming
(12) Washing

The specific decontamination procedure to be used at an incident is typically selected by a hazardous materials technician *(see 7.3.3)* and is subject to the approval of the incident commander.

Δ **3.3.17 Degradation.** A chemical action involving the molecular breakdown of a protective clothing material or equipment due to contact with a chemical.

3.3.18* Demonstrate. To show by actual performance.

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

3.3.19 Describe. To explain verbally or in writing using standard terms recognized by the hazardous materials/weapons of mass destruction (WMD) response community.

N **3.3.20 Detection and Monitoring Equipment.** Instruments and devices used to detect, classify, or quantify materials.

Monitoring equipment is very useful for the following reasons:

1. To determine the presence and nature of hazardous material
2. To help determine the PPE that can be used safely
3. To help establish control zones

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4. To identify or classify unknowns
5. To determine the level of contamination or decontamination

3.3.21 Dispersal Device. Any weapon or combination of mechanical, electrical, or pressurized components that is designed, intended, or used to cause death or serious bodily injury through the release, dissemination, or impact of toxic or poisonous chemicals or their precursors, biological agent, toxin or vector, or radioactive material.

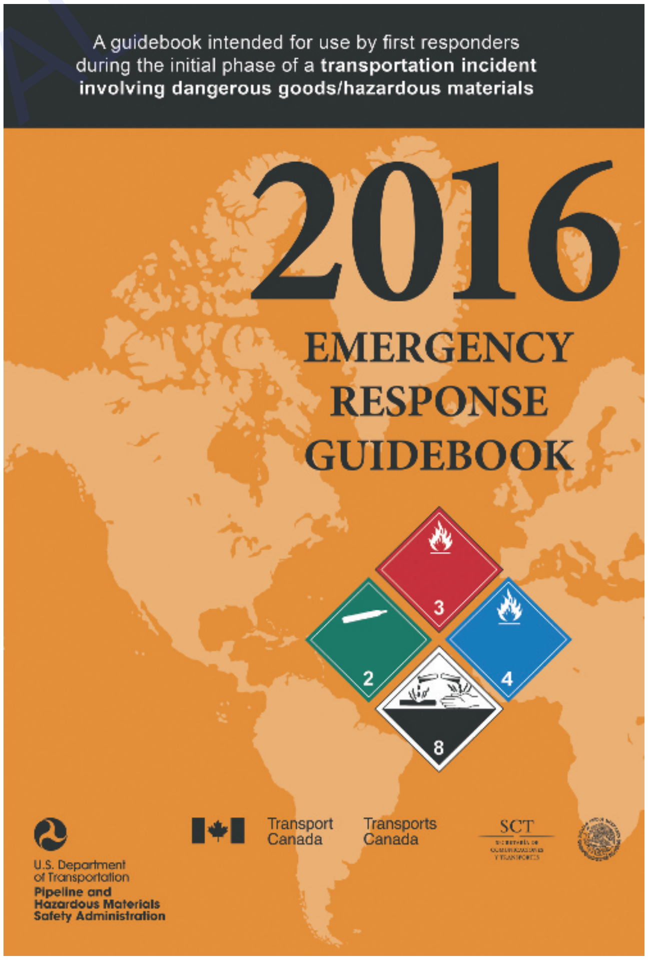
Δ **3.3.22 *Emergency Response Guidebook* (ERG).** The reference book, written in plain language, to guide emergency responders in their actions at the incident scene, specifically the Emergency Response Guidebook from the U.S. Department of Transportation; Transport Canada; and the Secretariat of Transportation and Communications, Mexico.

The *Emergency Response Guidebook* (ERG) [1] was developed by the U.S. DOT, Transport Canada, and the Secretariat of Communications and Transportation of Mexico (SCT) for use by fire fighters, police, and other emergency services personnel. The guidebook's two central purposes are to assist emergency personnel in identifying the specific or generic materials involved in an incident and to protect responders and the public during the initial response to an incident. The ERG is updated to include new products and technology.

The 2016 edition is available online at www.phmsa.dot.gov. See Exhibits I.3.4 and I.3.5.

EXHIBIT I.3.4

The Emergency Response Guidebook was developed by Canadian, Mexican, and U.S. authorities for use during the initial response to an incident.



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3.3.23 Endangered Area. The actual or potential area of exposure associated with the release of a hazardous material/weapon of mass destruction (WMD).

The size of an endangered area is a key element in determining the magnitude of a hazardous materials incident. A hazardous material that poses a threat to a 500 ft² (47 m²) area is much easier to manage than one that affects a square mile. The Table of Initial Isolation and Protective Action Distances in the ERG provides guidance in determining the size of the endangered area based on the contaminants present and the type of container involved.

3.3.24 Evaluate. The process of assessing or judging the effectiveness of a response operation or course of action within the training and capabilities of the emergency responder.

N **3.3.25 Evidence Preservation.** Deliberate and specific actions taken with the intention of protecting potential evidence from contamination, damage, loss, or destruction.

3.3.26 Example. An illustration of a problem serving to show the application of a rule, principle, or method (e.g., past incidents, simulated incidents, parameters, pictures, and diagrams).

3.3.27* Exposure. The process by which people, animals, the environment, property, and equipment are subjected to or come in contact with a hazardous material/weapon of mass destruction (WMD).

ID No.	Guide No.	Name of Material
3290	154	Poisonous solid, corrosive, inorganic, n.o.s.
3290	154	Toxic solid, corrosive, inorganic, n.o.s.
3291	158	(Bio)Medical waste, n.o.s.
3291	158	Clinical waste, unspecified, n.o.s.
3291	158	Medical waste, n.o.s.
3291	158	Regulated medical waste, n.o.s.
3292	138	Batteries, containing Sodium
3292	138	Cells, containing Sodium
3292	138	Sodium, batteries containing
3293	152	Hydrazine, aqueous solution, with not more than 37% Hydrazine
3294	131	Hydrogen cyanide, solution in alcohol, with not more than 45% Hydrogen cyanide
3295	128	Hydrocarbons, liquid, n.o.s.
3296	126	Heptafluoropropane
3296	126	Refrigerant gas R-227
3297	126	Chlorotetrafluoroethane and Ethylene oxide mixture, with not more than 8.8% Ethylene oxide
3297	126	Ethylene oxide and Chlorotetrafluoroethane mixture, with not more than 8.8% Ethylene oxide
3298	126	Ethylene oxide and Pentafluoroethane mixture, with not more than 7.9% Ethylene oxide
3298	126	Pentafluoroethane and Ethylene oxide mixture, with not more than 7.9% Ethylene oxide
3299	126	Ethylene oxide and Tetrafluoroethane mixture, with not more than 5.6% Ethylene oxide
3299	126	Tetrafluoroethane and Ethylene oxide mixture, with not more than 5.6% Ethylene oxide
3300	119P	Carbon dioxide and Ethylene oxide mixture, with more than 87% Ethylene oxide
3300	119P	Ethylene oxide and Carbon dioxide mixture, with more than 87% Ethylene oxide
3301	136	Corrosive liquid, self-heating, n.o.s.
3302	152	2-Dimethylaminoethyl acrylate
3303	124	Compressed gas, poisonous, oxidizing, n.o.s.
3303	124	Compressed gas, poisonous, oxidizing, n.o.s. (Inhalation Hazard Zone A)
3303	124	Compressed gas, poisonous, oxidizing, n.o.s. (Inhalation Hazard Zone B)
3303	124	Compressed gas, poisonous, oxidizing, n.o.s. (Inhalation Hazard Zone C)
3303	124	Compressed gas, poisonous, oxidizing, n.o.s. (Inhalation Hazard Zone D)
3303	124	Compressed gas, toxic, oxidizing, n.o.s.
3303	124	Compressed gas, toxic, oxidizing, n.o.s. (Inhalation Hazard Zone A)
3303	124	Compressed gas, toxic, oxidizing, n.o.s. (Inhalation Hazard Zone B)
3303	124	Compressed gas, toxic, oxidizing, n.o.s. (Inhalation Hazard Zone C)

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EXHIBIT I.3.5

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An exposure is quickly assumed to be an external one, but attention must be paid to the special hazards of internal exposures. For example, an internal radiation exposure from ingesting radioactive material can be more damaging to the body than an external exposure.

A.3.3.27 Exposure. The magnitude of exposure is dependent primarily on 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 can be external, internal, or both.

N **3.3.28 Exposures.** The people, animals, environment, property, and equipment that might become exposed at a hazardous materials/weapons of mass destruction (WMD) incident.

3.3.29* Fissile Material. Material whose atoms are capable of nuclear fission (capable of being split).

A.3.3.29 Fissile Material. Department of Transportation (DOT) regulations define fissile material as plutonium-239, plutonium-242, uranium-233, uranium-235, or any combination of these radionuclides. This material is usually transported with additional shipping controls that limit the quantity of material in any one shipment. Packaging used for fissile material is designed and tested to prevent a fission reaction from occurring during normal transport conditions as well as hypothetical accident conditions.

There is an error in identifying plutonium numerically in A.3.3.29; it should be 241 instead of 242.

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N **3.3.30 Harm.** Adverse effect created by being exposed to a hazard.

N **3.3.31 Hazard.** Capable of causing harm or posing an unreasonable risk to life, health, property, or the environment.

Δ **3.3.32* Hazardous Material.** Matter (solid, liquid, or gas) or energy that when released is capable of creating harm to people, the environment, and property, including weapons of mass destruction (WMD) as defined in 18 U.S. Code, Section 2332a, as well as any other criminal use of hazardous materials, such as illicit labs, environmental crimes, or industrial sabotage.

Δ **A.3.3.32 Hazardous Material.** In United Nations model codes and regulations, hazardous materials are called dangerous goods. See also 3.3.68 and A.3.3.68, Weapon of Mass Destruction (WMD).

3.3.33* Hazardous Materials Branch/Group. The function within an overall incident management system (IMS) that deals with the mitigation and control of the hazardous materials/weapons of mass destruction (WMD) portion of an incident.

A.3.3.33 Hazardous Materials Branch/Group. This function is directed by a hazardous materials officer and deals principally with the technical aspects of the incident.

The hazardous materials branch provides an organizational structure that allows the necessary supervision and control of essential operations at a hazardous materials incident. These operations include the tactical objectives carried out in the hot zone, the control of site access, and decontamination. Depending on the size and scope of the incident, the hazardous materials branch can be referred to as the hazmat group. See NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety* [2], for more information on incident management systems (IMSs).

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Δ **3.3.34* Hazardous Materials Officer.** The person who is responsible for directing and coordinating all operations involving hazardous materials/weapons of mass destruction (WMD) as assigned by the incident commander (IC).

The person designated as the hazardous materials officer is responsible for managing the hazardous materials response team (HMRT) under the direction of the incident commander. Rescue operations in the control zones also come under the direction of the hazardous materials officer. This position is also called the hazardous materials group supervisor.

A.3.3.34 Hazardous Materials Officer. This individual might also serve as a technical specialist for incidents that involve hazardous materials/WMD. The National Incident Management System (NIMS) identifies this person as the hazardous materials branch director/supervisor.

3.3.35* Hazardous Materials Response Team (HMRT). An organized group of trained response personnel operating under an emergency response plan and applicable standard operating procedures who perform hazardous material technician level skills at hazardous materials/weapons of mass destruction (WMD) incidents.

The HMRT is made up of various personnel. In some cases, all of the responders might come from the same agency. In others, responders might be drawn from different agencies and/or disciplines. However, all HMRT members must operate under one set of procedures, have an organizational structure, and train together on a regular basis as shown in Exhibit I.3.6.

Personnel on the HMRT do not need to be trained to the same level. The important factor, however, is that the duties and responsibilities of each member are commensurate with their levels of training. For example, if the incident calls for operations to control the release and for work in specialized CPC, these functions should only be attempted by certified hazardous materials technicians or specialist employees A. See Section 9.4 of NFPA 472 for competence requirements for a specialist employee A.

EXHIBIT I.3.6

Safety is ensured by frequent practices and drills. In this illustration, personnel train for a hazmat mass casualty incident. (Courtesy of BenDC/iStock/Thinkstock)

A.3.3.35 Hazardous Materials Response Team (HMRT). The team members respond to releases or potential releases of hazardous materials/WMD for the purpose of control or stabilization of the incident.

Δ **3.3.36* Hazardous Materials Safety Officer.** The person who works within an incident management system (IMS) (specifically, the hazardous materials branch/group) to ensure that recognized hazardous materials/weapons of mass destruction (WMD) safe practices are followed at hazardous materials/WMD incidents.

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N **A.3.3.36 Hazardous Materials Safety Officer.** The hazardous materials safety officer will be called on to provide technical advice or assistance regarding safety issues to the hazardous materials officer and incident safety officer at a hazardous materials/WMD incident. The National Incident Management System (NIMS) identifies this person as the assistant safety officer — hazardous materials.

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

3.3.38 Incident. An emergency involving the release or potential release of hazardous materials/weapons of mass destruction (WMD).

N **3.3.39 Incident Analysis.** The process of analyzing the risk at an incident by identifying the materials and containers involved, predicting the likely behavior of each container and its contents, and estimating the potential harm/outcomes associated with that behavior.

3.3.40* Incident Commander (IC). The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and the release of resources.

A.3.3.40 Incident Commander (IC). This position is equivalent to the on-scene incident commander as defined in OSHA 1910.120(8), *Hazardous Waste Operations and Emergency Response*. The IC has overall authority and responsibility for conducting incident operations and is responsible for the management of all incident operations at the incident site.

The incident command system (ICS) establishes the following functions as the primary responsibilities of the incident commander (IC):

- Have clear authority and know agency policy
- Ensure incident safety
- Establish the incident command post (ICP)
- Set priorities and determine incident objectives and strategies to be followed
- Establish the ICS organization needed to manage the incident
- Approve the incident action plan (IAP)
- Coordinate command and general staff activities
- Approve resource requests and use of volunteers and auxiliary personnel
- Order demobilization as needed
- Ensure after-action reports are completed

The IC is responsible for the overall control of operations. Where multiple agencies are likely to be involved, which is generally the case when hazardous materials are present, roles and responsibilities of the various agencies should be clarified ahead of time. The actual command can change from one person to another as the incident develops and becomes more complex.

Two important factors from an incident management standpoint are that a designated person is in charge and that the person is clearly identified in the local emergency response plan. The IC works from the strategic level and develops the overall response objectives; however, the IC should not be personally involved in carrying out tactical operations. Broadly speaking, the IC is responsible for the following:

- Ensuring the safety of response personnel and the public
- Controlling the incident
- Minimizing harm to the environment and property

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Even though the IC is responsible for directing and coordinating the response, some management functions might have to be delegated to others. The IC might establish a hazardous materials group or hazardous materials branch to manage activities in the warm and hot control zones. These would be managed by a hazardous materials group supervisor or materials branch director, who reports to the IC or to operations.

A number of agencies might be responsible for controlling and cleaning up the more complex hazardous materials incidents. These agencies would be local, county, state, or federal agencies, and some incidents would involve more than one agency from each jurisdiction. A vital step during pre-incident planning is to identify these agencies. The plans must establish protocols that spell out which agency is to be the lead agency during an incident. Some IMSs establish a unified command for multiagency or multijurisdictional incidents. Each participating agency maintains its authority, responsibility, or accountability. Collectively, these lead persons manage the incident. (See Exhibit I.3.7.)

EXHIBIT I.3.7

When a unified command has been established, agency representatives with direct responsibility work together to establish a single set of objectives for the entire incident.

3.3.41 Incident Command System (ICS). A component of an incident management system (IMS) designed to enable effective and efficient on-scene incident management by integrating organizational functions, tactical operations, incident planning, incident logistics, and administrative tasks within a common organizational structure.

3.3.42* Incident Management System (IMS). A process 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 to include the incident command system (ICS), unified command, multiagency coordination system, training, and management of resources.

An effective IMS is one of the most important aspects of operating safely during an emergency. NFPA 1561 provides excellent information for developing an effective IMS and clearly addresses the components that must be included for personnel to operate at an incident in an organized and safe manner.

A.3.3.42 Incident Management System (IMS). The IMS provides a consistent approach for all levels of government, private sector, and volunteer organizations to work effectively and efficiently together to prepare for, respond to, and recover from domestic incidents, regardless

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of cause, size, or complexity. An IMS provides for interoperability and compatibility among all capability levels of government, the private sector, and volunteer organizations. The IMS includes a core set of concepts, principles, terminology, and technologies covering the incident command system, multiagency coordination systems, training, and identification and management of resources.

3.3.43 Match. To provide with a counterpart.

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

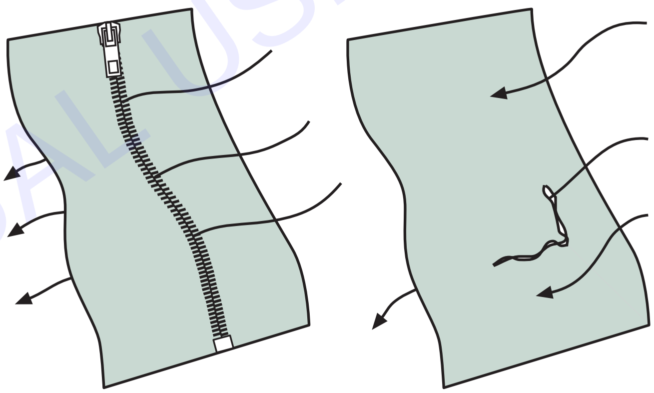
•

3.3.45 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.

Responders to hazardous materials incidents must ensure that the protection provided by CPC is not compromised by openings in the suit's material. See Exhibit I.3.8.

EXHIBIT I.3.8

Penetration involves the movement of a material through a suit's closures, such as zippers, buttonholes, and seams, or through rips, tears, or flaws in the fabric.



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

As shown in Exhibit I.3.9, different fabrics have different levels of resistance to chemical permeation, and all fabrics absorb chemicals over a period of time. Guidelines for manufacturer permeation testing and certification of CPC are provided in NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies* [4], and NFPA 1992, *Standard on Liquid Splash–Protective Ensembles and Clothing for Hazardous Materials Emergencies* [5]. When purchasing CPC, an important step is to verify that the garments meet the appropriate standard and are certified as meeting that standard. In any event, the user should exercise extreme caution that the garments selected are appropriate for the hazardous material at the incident.

Proper care of CPC, including appropriate decontamination and storage procedures, should be emphasized in training programs and standard operating procedures. Proper care, or the lack of it, can significantly affect the protection afforded by CPC.

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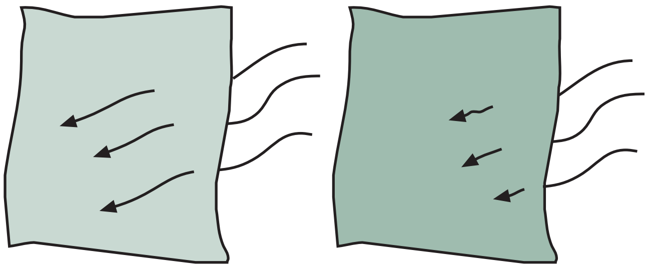

EXHIBIT I.3.9

Permeation is chemical movement, on a molecular level, through intact material, and different fabrics permit different levels of permeation.

3.3.47* Personal Protective Equipment (PPE). The protective clothing and respiratory protective equipment provided to shield or isolate a person from the hazards encountered at hazardous materials/weapons of mass destruction (WMD) incident operations.

PPE is designed to protect the individual responder against anticipated or expected hazards. Responders must be trained to use, care for, and select appropriate PPE.

• **A.3.3.47 Personal Protective Equipment (PPE).** 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.

3.3.48 Plan.

3.3.48.1* Emergency Response Plan (ERP). A plan — developed by the authority having jurisdiction (AHJ) with the cooperation of all participating agencies and organizations, including a jurisdiction with emergency responsibilities and those outside the jurisdiction who have entered into response/support agreements — that identifies goals and objectives for that emergency type, agency roles, and overall strategies.

Δ ***A.3.3.48.1 Emergency Response Plan (ERP).*** Emergency response plans can be developed at organizational and governmental levels (agency, local, state, regional, provincial, territorial, tribal, and federal).

Whether developed for a community, county, state, or industrial facility, an emergency response plan must identify the hazards that exist within given sites in a community or region and must establish written procedures for handling such incidents. Regarding hazardous materials response, the Code of Federal Regulations [6] is clear. In addition to emergency responders and government authorities, employers whose workers could potentially be exposed to hazardous materials while on the job are required to develop emergency response plans. To avoid duplication, private sector employers can use the appropriate plan developed by local or state authorities as part of their own emergency response plan.

3.3.48.2* Incident Action Plan (IAP). An oral or written plan approved by the incident commander containing general objectives reflecting the overall strategy for managing an incident for a specific time frame and target location.

A.3.3.48.2 Incident Action Plan. It can include the identification of operational resources and assignments. It can also include attachments that provide direction and important information for management of the incident during one or more operational periods.

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3.3.48.3* Site Safety and Control Plan. A site-specific safety document used within the incident command system (ICS) to organize information important to hazardous materials response operations.

N ***A.3.3.48.3 Site Safety and Control Plan.*** Reflective of the objectives identified in the IAP, the site safety and control plan is used to communicate incident conditions, incident hazards, and branch operations to the hazardous materials team during the safety briefing. Components of a typical site safety and control plan include an overview of the hazardous materials branch organization; personnel assignments; summary of incident hazards, both physical and chemical; branch tactical objectives; site control practices; identification of personal protective equipment or ensembles; hazardous materials branch communications; identification of decontamination practices and medical care; and monitoring of the identified hazards.

3.3.49* Planned Response. The incident action plan, with the site safety and control plan, consistent with the emergency response plan and/or standard operating procedures for a specific hazardous materials/weapon of mass destruction (WMD) incident.

Appropriate control actions are identified based on the magnitude of the problem. This process considers available resources and training levels of responders and then determines the direction the response effort must take to influence the events and to change the outcome favorably. The material in 3.3.49 also describes various areas of concern that should be included in a complete incident plan.

A.3.3.49 Planned Response. The following site safety plan considerations are from the EPA's *Standard Operating Safety Guides:*

(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

3.3.50 Predict. The process of estimating or forecasting the future behavior of a hazardous materials/weapons of mass destruction (WMD) container and/or its contents within the training and capabilities of the emergency responder.

3.3.51* Protective Clothing. Equipment designed to protect the wearer from thermal hazards, hazardous materials, or from the hazardous component of a weapon of mass destruction contacting the skin or eyes.

A.3.3.51 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

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N ***3.3.51.1 Ballistic Protective Clothing (BPC).*** An item of personal protective equipment that provides protection against specific ballistic threats by helping to absorb the impact and reduce or prohibit the penetration to the body from bullets and steel fragments from handheld weapons and exploding munitions.

3.3.51.2* Chemical-Protective Clothing (CPC). The ensemble elements (garment, gloves, and footwear) provided to shield or isolate a person from the hazards encountered during hazardous materials/WMD incident operations.

A.3.3.51.2 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.

CPC allows responders to work for a specified length of time in or near an area contaminated by hazardous materials by isolating their bodies from chemical hazards. Exhibit I.3.10 shows responders donning CPC ensembles. The type of CPC ensemble needed depends on the hazardous materials and conditions present. CPC ensembles and ensemble elements are certified as compliant with either NFPA 1991 for vapor-protective ensembles or NFPA 1992 for liquid splash-protective ensembles, and comes with a list of specific chemicals that the ensemble has been tested for and certified as providing protection from those chemicals. Vapor protective ensembles are also known as Level A ensembles, and liquid splash-protective ensembles could also be Level B or Level C ensembles.

EXHIBIT I.3.10

County hazmat technicians don CPC ensembles to respond to an incident. (Courtesy of BenDC/iStock/Thinkstock)

3.3.51.2.1* Liquid Splash–Protective Clothing. Multiple elements of compliant protective clothing and equipment products that when worn together provide protection from some, but not all, risks of hazardous materials/WMD emergency incident operations involving liquids.

Δ ***A.3.3.51.2.1 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.

3.3.51.2.2* Vapor-Protective Clothing. Multiple elements of compliant protective clothing and equipment that when worn together provide protection from some, but not all, risks of vapor, liquid-splash, and particulate environments during hazardous materials/WMD incident operations.

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Δ ***A.3.3.51.2.2 Vapor-Protective Clothing.*** This type of protective clothing is a component of Level A chemical protection. Vapor-protective clothing should meet the requirements of NFPA 1991 or NFPA 1994.

Totally encapsulating vapor-protective Level A ensembles must be worn when the greatest level of skin, respiratory, and eye protection is needed. This protection should be worn when the hazard cannot be determined or is identified as immediately dangerous to life and health.

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

A.3.3.51.3 High Temperature–Protective Clothing. This type of clothing is usually of limited use in dealing with chemical commodities.

Specialized protective ensembles, as defined in 3.3.51.2, are designed to provide brief protection against radiant heat exposure to temperatures as high as 2000°F (1093°C). Requirements for the design, performance, testing, and certification of proximity fire-fighting ensembles are provided in NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting* [7]. These protective ensembles consist of a one- or two-piece upper and lower torso garment, helmet, shroud, gloves, and footwear that provide the radiant reflective protection for the wearer.

Fire entry suits are another type of specialized high-temperature ensemble designed to protect the wearer against abnormally high temperatures during direct entry into flames. Fire entry suits are designed and constructed for specific expected exposures, temperatures, and duration of the anticipated operations that will be conducted.

3.3.51.4* Structural Fire-Fighting Protective Clothing. The fire-resistant protective clothing normally worn by fire fighters during structural fire-fighting operations, which includes a helmet, coat, pants, boots, gloves, PASS device, and a fire-resistant hood to cover parts of the head and neck not protected by the helmet and respirator facepiece.

A.3.3.51.4 Structural Fire-Fighting Protective Clothing. Structural fire-fighting protective clothing provides limited protection from heat but might not provide adequate protection from the harmful gases, vapors, liquids, or dusts that are encountered during hazardous materials/WMD incidents. The NFPA 1971 CBRN option is intended to add chemical protection to structural fire-fighting protective clothing.

Structural fire-fighting protective ensembles certified as compliant with NFPA 1971 consist of upper and lower torso single or two-piece garments (i.e., coverall or coat and trousers), helmet, hood, gloves, and footwear. A personal alert safety system (PASS) is worn either attached to the upper or lower torso garment or as an integrated part of the self-contained breathing apparatus (SCBA). When properly worn, this ensemble provides protection from hazards normally encountered in structural fire-fighting operations. In most cases, this clothing does not offer adequate protection from hazardous materials. However, NFPA 1971 contains additional optional requirements for chemical, biological, radiological, and nuclear (CBRN) protection, including specific CBRN respiratory protection, to protect the wearer without having to add or subtract any parts of the ensemble, and without compromising the fire-fighting protection afforded by the ensemble. This additional CBRN safeguard is intended to protect fire department first responders who could be involved at a CBRN terrorism incident before additional specialized responders arrive with more highly protective ensembles for lengthy operations.

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N **3.3.52 Public Safety Sampling.** The detection, monitoring, or collection of a material for the purposes of determining the hazards present and to guide public safety response decisions.

3.3.53 Qualified. Having knowledge of the installation, construction, or operation of apparatus and the hazards involved.

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

A.3.3.54 Respiratory Protection. Respiratory protection is divided into four types:

(1) Self-contained breathing apparatus (should meet the requirements of NFPA 1981, which also incorporates the Statement of Standard for NIOSH CBRN SCBA Testing)
(2) Supplied air respirators
(3) Powered air-purifying respirators (should meet the Statement of Standard for NIOSH CBRN PAPR Testing)
(4) Air-purifying respirators (should meet the Statement of Standard for NIOSH CBRN APR Testing)

Closer Look

Respiratory Protection

Because inhalation of toxins is one of the principal causes of serious injury to responders, respiratory protection is of the utmost importance. Guidance on selection of appropriate respiratory protection is in Chapter 5 of NFPA 472.

Positive pressure SCBA is the type of equipment fire fighters normally use. The wearer's mobility is not restricted except for the physical limitation of the SCBA's size, and SCBA provides the highest level of respiratory protection based on laboratory testing. The most commonly used units are National Institute for Occupational Safety and Health (NIOSH) approved for rated times at 30 to 60 minutes of protection. However, closed-circuit SCBA are available that provide longer periods of use. NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services* [8], provides design, performance, testing, and certification requirements for SCBA. The actual time protection provided by SCBA is substantially less for persons not at their best level of physical fitness and for those performing exhausting and demanding work. On-scene medical evaluation and careful timekeeping help to prevent reliance on SCBA beyond the optimal time limits established for each worker and their unit.

NFPA 1981 establishes the mandatory requirement that all SCBA for emergency services also be NIOSH certified as CBRN SCBA in accordance with the NIOSH *Statement of Standard for NIOSH CBRN SCBA Testing* [9]. This requirement provides respiratory protection from CBRN agents (specified chemicals, biological agents, and radiological particulate) that could be released as a result of a terrorism attack.

While major metropolitan areas might be more likely targets of a terrorist event, emergency responders from small communities and rural areas could be called on to respond to urban areas where the emergency services require assistance. Terrorists themselves might reside in small or rural communities while they await an opportunity to strike. They might have chemical, biological, or nuclear material in their possession, making the possibility of exposure greater for small communities and rural areas. Terrorist attacks aside, CBRN-certified SCBA offers improved protection for emergency services for a minimal cost.

CBRN protection offers verification of enhanced protection for emergency responders that is not available otherwise. Without CBRN protection evaluation, no SCBA components are tested for permeation, penetration, corrosion resistance, or other detrimental effects from exposure to toxic industrial chemicals during hazardous materials incidents and hazardous chemical warfare atmospheres. NIOSH benchmark testing of non-CBRN–hardened SCBA against CBRN agents demonstrated that CBRN agents and toxic industrial chemicals could cause catastrophic failures within minutes of exposure.

Continues

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Closer Look *(Continued)*

The test challenge agents for CBRN protection were selected by NIOSH based on a comprehensive review of available technical data and consultations with other government agencies such as the U.S. Department of Defense, Department of Justice, and Department of Energy. Chemical data lists were analyzed, including lists from the Environmental Protection Agency (EPA); Agency for Toxic Substances and Disease Registry (ATSDR); NFPA 1994, *Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents* [10]; *The Medical NBC Battlebook*, *Technical Guide 244* [11]; and classified sources. This review established that 151 toxic industrial chemicals (TICs) and chemical warfare agents (CWAs) were potential candidates for challenge agents. The candidate agents were evaluated for permeation (molecularly diffusing through material) and penetration (seeping through interfacing components) characteristics as part of a review of their physical properties. This evaluation concluded that sarin (GB) and sulfur mustard (HD) could be selected as the two representative agents for the penetration/permeation test for the complete listing of 151 CWAs and TICs due to their physical properties and molecular structure. NIOSH is unaware of any data that indicate the CBRN-certified SCBA provide less protection against TICs than their industrial counterparts.

The evaluation for CBRN protection provides verification and assurance that the component and material combinations in the approved SCBA configurations provide high resistance to permeation and penetration of hazardous atmospheres of toxic industrial chemicals and materials into the breathing air. This is important to responders subject to extreme exposures of hazardous industrial chemicals and materials.

Positive pressure air-line respirators give the user an unlimited supply of air from a remote source and are lighter than SCBA. However, these respirators restrict the travel distance of the user to a maximum of 300 ft (91 m) and must be equipped with an escape breathing air cylinder. In addition, the path of travel must be kept clear of obstructions while the user traverses the incident scene. Nonetheless, these respirators are ideal for supplying air to the emergency worker under certain conditions.

Air purifying respirators (APRs) and powered air purifying respirators (PAPRs) use a filter or sorbent to remove airborne contaminants. These respirators should not be used by the initial responders at an incident involving hazardous materials. APRs and PAPRs should be used only when the hazard and the concentration of the hazardous material are known and the ambient atmosphere at the scene is verified to contain more than 19.5 percent oxygen.

3.3.55* Response. That portion of incident management in which personnel are involved in controlling hazardous materials/weapons of mass destruction (WMD) incidents.

A.3.3.55 Response. The activities in the response portion of a hazardous materials/WMD incident include analyzing the incident, planning the response, implementing the planned response, evaluating progress, and terminating the emergency phase of the incident.

N **3.3.56 Risk.** The probability or threat of suffering harm or loss.

3.3.57 Risk-Based Response Process. Systematic process by which responders analyze a problem involving hazardous materials/weapons of mass destruction (WMD), assess the hazards, evaluate the potential consequences, and determine appropriate response actions based upon facts, science, and the circumstances of the incident.

Analysis of hazardous materials/WMD incidents where emergency responders have been injured or killed (as well as "close calls") has shown that risk evaluation is a critical element for a safe and effective response.

• *N* **3.3.58* Safety Data Sheet (SDS).** Formatted information provided by chemical manufacturers and distributors of hazardous products that contains information about chemical composition, physical and chemical properties, health and safety hazards, emergency response, and waste disposal of the material.

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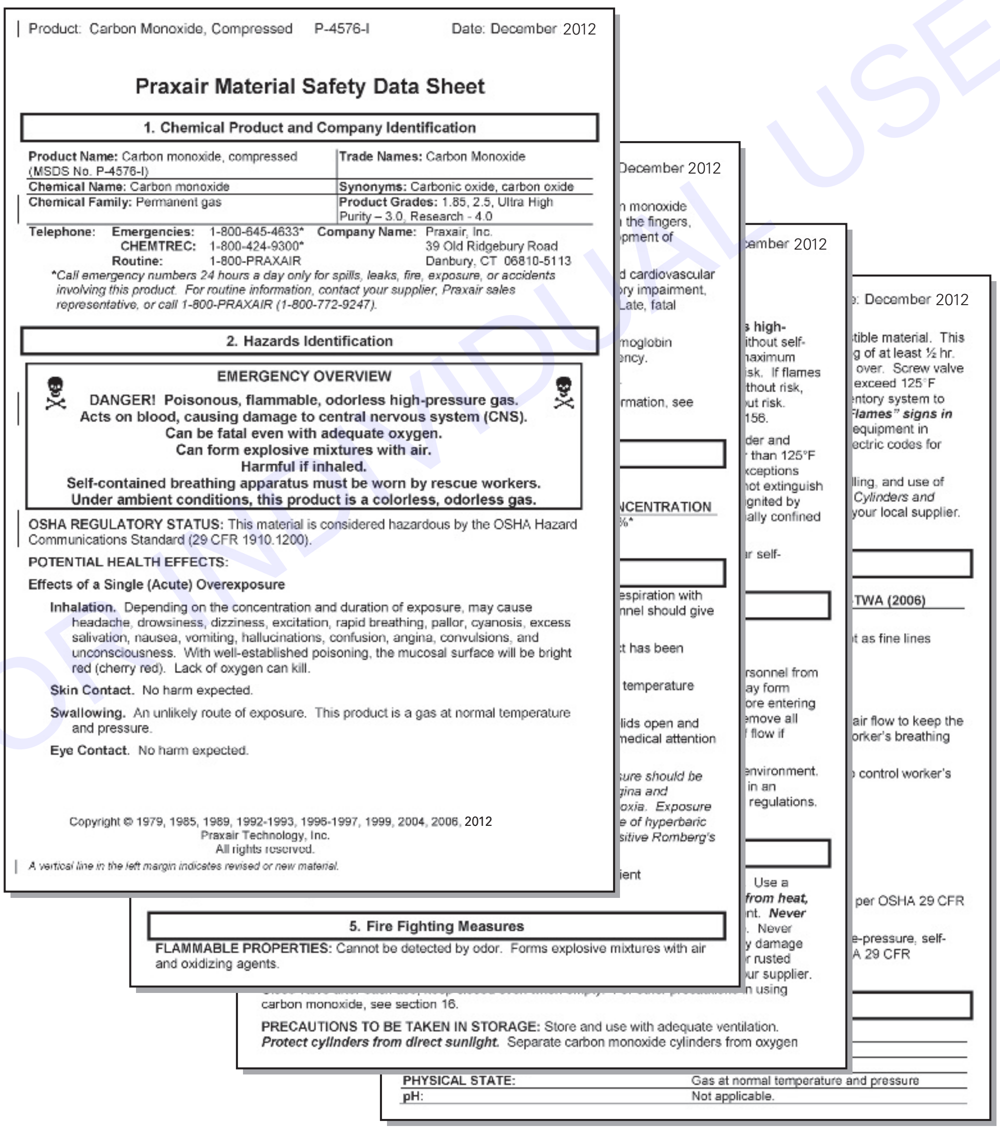
N **A.3.3.58 Safety Data Sheet (SDS).** SDS is a component of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) and replaces the term material safety data sheet (MSDS). GHS is an internationally agreed-upon system, created by the United Nations in 1992. It replaces the various classification and labeling standards used in different countries by using consistent criteria on a global level. It supersedes the relevant European Union (EU) system, which has implemented the GHS into EU law as the Classification, Labelling and Packaging (CLP) Regulation, and United States Occupational Safety and Health Administration (OSHA) standards. The SDS requires more information than MSDS regulations and provides a standardized structure for presenting the required information.

Exhibit I.3.11 shows a sample material safety data sheet (MSDS). Note that this MSDS is provided as an illustration only; its content should not be relied on as it may not be the most recent information that is available. As noted in A.3.3.80, the term *material safety data sheet* has been replaced by the term *safety data sheet* (*SDS*).


Product: Carbon Monoxide, Compressed P-4576-I Date: December 2012

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Carbon monoxide, compressed (MSDS No. P-4576-I) | **Trade Names:** Carbon Monoxide
Chemical Name: Carbon monoxide | **Synonyms:** Carbonic oxide, carbon oxide
Chemical Family: Permanent gas | **Product Grades:** 1.85, 2.5, Ultra High Purity – 3.0, Research - 4.0

Telephone: **Emergencies:** 1-800-645-4633* **CHEMTREC:** 1-800-424-9300* **Routine:** 1-800-PRAXAIR
Company Name: Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113

**Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).*

2. Hazards Identification

EMERGENCY OVERVIEW

DANGER! Poisonous, flammable, odorless high-pressure gas.
Acts on blood, causing damage to central nervous system (CNS).
Can be fatal even with adequate oxygen.
Can form explosive mixtures with air.
Harmful if inhaled.
Self-contained breathing apparatus must be worn by rescue workers.
Under ambient conditions, this product is a colorless, odorless gas.

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

POTENTIAL HEALTH EFFECTS:

Effects of a Single (Acute) Overexposure

Inhalation. Depending on the concentration and duration of exposure, may cause headache, drowsiness, dizziness, excitation, rapid breathing, pallor, cyanosis, excess salivation, nausea, vomiting, hallucinations, confusion, angina, convulsions, and unconsciousness. With well-established poisoning, the mucosal surface will be bright red (cherry red). Lack of oxygen can kill.

Skin Contact. No harm expected.

Swallowing. An unlikely route of exposure. This product is a gas at normal temperature and pressure.

Eye Contact. No harm expected.

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A vertical line in the left margin indicates revised or new material.

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Cannot be detected by odor. Forms explosive mixtures with air and oxidizing agents.

carbon monoxide, see section 16.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation. *Protect cylinders from direct sunlight.* Separate carbon monoxide cylinders from oxygen

PHYSICAL STATE: Gas at normal temperature and pressure
pH: Not applicable.

EXHIBIT I.3.11

An MSDS contains information about the material that can be useful to incident responders. (Courtesy of Praxair Technology, Inc.)

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N **3.3.59* Sampling.** The process of selecting materials to analyze.

N **A.3.3.59 Sampling.** During a hazardous materials incident, sampling can be used to determine requirements for public protective actions, decontamination, medical treatments, mitigation, or other related functions. The collection of evidence for the purposes of investigation is a form of sampling that has extensive enhanced requirements determined by the law enforcement AHJ.

3.3.60 Scenario. A sequence or synopsis of actual or imagined events used in the field or classroom to provide information necessary to meet student competencies; can be based upon threat assessment.

3.3.61 SETIQ. The Emergency Transportation System for the Chemical Industry in Mexico that provides emergency response information and assistance on a 24-hour basis for responders to emergencies involving hazardous materials/weapons of mass destruction (WMD).

SETIQ is the Mexican equivalent to CHEMTREC.

3.3.62 Specialist Employees.

3.3.62.1* 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.

A.3.3.62.1 Specialist Employee A. Consistent with the organization's emergency response plan and/or standard operating procedures, the specialist employee A is able to analyze an incident involving chemicals within the 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. 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/WMD in their organization's area of specialization, they could be called on to provide technical advice or assistance to the incident commander relative to specific chemicals or containers for chemicals. Specialist employees should receive training or demonstrate competency in their area of specialization annually. Specialist employees also should receive additional training to meet applicable DOT, OSHA, EPA, and other appropriate state, local, or provincial occupational health and safety regulatory requirements. Specialist employees respond to hazardous materials/WMD incidents under differing 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 members of a hazardous materials response team or as specialist employees as outlined in this definition and in Chapter 9. When responding to incidents away from their assigned work area, specialist employees should be permitted to perform only at the response level at which they have been trained.

Persons responding to a hazardous materials/WMD 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 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.

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3.3.62.2* Specialist Employee B. That person who, in the course of his or her regular job duties, works with or is trained in the hazards of specific chemicals or containers within the individual's area of specialization.

A.3.3.62.2 Specialist Employee B. Because of the employee's education, training, or work experience, the specialist employee B can be called on to respond to incidents involving specific chemicals or containers. The 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/or standard operating procedures and the emergency response plan. See 3.3.48.1.

Specialist employees B are expected by their organization to respond *only* within their areas of expertise. The specialists might have expertise in the following topics:

- Product specialties
- Industrial hygiene/toxicological specialties
- Environmental waste/remediation specialties
- Monitoring specialties
- Container specialties
- Material handling, such as loaders and unloaders
- Maintenance specialties

Specialist employees B need to meet only the competencies required in their area of specialization.

3.3.62.3* Specialist Employee C. That person who responds to emergencies involving chemicals and/or containers within the organization's area of specialization.

A.3.3.62.3 Specialist Employee C. Consistent with the organization's emergency response plan and/or standard operating procedures, the specialist employee C can be called on to gather and record information, provide technical advice, and/or arrange for technical assistance. A specialist employee C does not enter the hot or warm zone at an emergency. See 3.3.14.

3.3.63 Stabilization. The point in an incident when the adverse behavior of the hazardous material, or the hazardous component of a weapon of mass destruction (WMD), is controlled.

The term *stabilization* does not mean that the incident is over but rather that the hazardous conditions are not likely to escalate or intensify. Stabilization could also mean that the cleanup operations following stabilization are prolonged and that specialized types of equipment and expertise are needed before the operations are completed.

N **3.3.64 Standard Operating Procedure (SOP).** A written directive that establishes specific operational or administrative methods to be followed routinely for the performance of a task or for the use of equipment.

N **3.3.65 Surrounding Conditions.** Conditions to be taken into consideration when identifying the scope of a hazardous materials/WMD incident, including but not limited to topography; land use, including utilities and fiber-optic cables; accessibility; weather conditions; bodies of water, including recharge ponds; public exposure potential; patient presentation; overhead and underground wires and pipelines; storm and sewer drains; possible ignition sources; adjacent land use such as rail lines, highways, and airports; and the nature and extent of injuries.

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3.3.66* Termination. That portion of incident management after the cessation of tactical operations in which personnel are involved in documenting safety procedures, site operations, hazards faced, and lessons learned from the incident and include specifications for debriefing, post-incident analysis and critique in a specific sequence: critique, debriefing, and post-incident analysis.

A.3.3.66 Termination. Termination is divided into three phases: debriefing the incident, post-incident analysis, and critiquing the incident.

N ***3.3.66.1 Critique.*** An element of incident termination that examines the overall effectiveness of the emergency response effort and develops recommendations for improvement.

N ***3.3.66.2 Debriefing.*** An element of incident termination that focuses on the following: (1) informing responders exactly what hazmat they were (possibly) exposed to and the signs and symptoms of exposure; (2) identifying damaged equipment requiring replacement or repair; (3) identifying equipment or supplies requiring specialized decontamination or disposal; (4) identifying unsafe work conditions; (5) assigning information-gathering responsibilities for a post-incident analysis.

N ***3.3.66.3 Post-Incident Analysis.*** An element of incident termination that includes completion of the required incident reporting forms, determining the level of financial responsibility, and assembling documentation for conducting a critique.

3.3.67* UN/NA Identification Number. The four-digit number assigned to a hazardous material/weapon of mass destruction (WMD), which is used to identify and cross-reference products in the transportation mode.

A.3.3.67 UN/NA Identification Number. United Nations (UN) numbers are four-digit numbers used in international commerce and transportation to identify hazardous chemicals or classes of hazardous materials. These numbers generally range between 0000 and 3500 and usually are preceded by the letters “UN” (e.g., “UN1005”) to avoid confusion with number codes.

North American (NA) numbers are identical to UN numbers. If a material does not have a UN number, it may be assigned an NA number. These usually are preceded by “NA” followed by a four-digit number starting with 8 or 9.

3.3.68* Weapon of Mass Destruction (WMD). (1) Any destructive device, such as any explosive, incendiary, or poison gas bomb, grenade, rocket having a propellant charge of more than four ounces, missile having an explosive or incendiary charge of more than one quarter ounce (7 grams), mine, or device similar to the preceding description; (2) any weapon involving toxic or poisonous chemicals; (3) any weapon involving a disease organism; or (4) any weapon that is designed to release radiation or radioactivity at a level dangerous to human life.

A.3.3.68 Weapon of Mass Destruction (WMD). The source of this definition is 18 USC 2332a. Weapons of mass destruction (WMD) are known by many different abbreviations and acronyms, the most common of which is CBRNE, which is the acronym for chemical, biological, radiological, nuclear, and explosive problems that could be released as the result of a terrorist attack.

3.3.68.1* Radiological Weapons of Mass Destruction.

A.3.3.68.1 Radiological Weapons of Mass Destruction. The intent of this annex material is to provide information on the different types of radiological/nuclear devices that can be used as a weapon by those with malicious intent.

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3.3.68.1.1* Improvised Nuclear Device (IND). An illicit nuclear weapon that is bought, stolen, or otherwise obtained from a nuclear state (i.e., a national government with nuclear weapons), or a weapon fabricated from fissile material that is capable of producing a nuclear explosion.

A.3.3.68.1.1 Improvised Nuclear Device (IND). The nuclear explosion from an IND produces extreme heat, powerful shockwaves, and prompt radiation that would be acutely lethal for a significant distance. It also produces potentially lethal radioactive fallout, which may spread and deposit over very large areas. A nuclear detonation in an urban area could result in over 100,000 fatalities (and many more injured), massive infrastructure damage, and thousands of square kilometers of contaminated land. If the IND fails to work correctly and does not create a nuclear explosion, then the detonation of the conventional explosives would likely disperse radioactive material like an explosive RDD.

3.3.68.1.2* Radiation Dispersal Device (RDD). A device designed to spread radioactive material through a detonation of conventional explosives or other means.

Δ ***A.3.3.68.1.2 Radiation Dispersal Device (RDD).*** Any device that intentionally spreads radioactive material across an area with the intent to cause harm, without a nuclear explosion occurring. An RDD that uses explosives for spreading or dispersing radioactive material is commonly referred to as a “dirty bomb” or “explosive RDD.” Nonexplosive RDDs could spread radioactive material using common items such as pressurized containers, fans, building air-handling systems, sprayers, crop dusters, or even by hand.

3.3.68.1.3* Radiation Exposure Device (RED). A device intended to cause harm by exposing people to radiation without spreading radioactive material.

A.3.3.68.1.3 Radiation Exposure Device (RED). A device, used interchangeably with the term “radiological exposure device” or “radiation emitting device,” consisting of radioactive material, either as a sealed source or as material within some type of container, or a radiation-generating device, to cause harm by exposure to ionizing radiation.

3.4 Operations Level Responders Definitions.

If an individual is assigned to respond to the scene of a hazardous materials/WMD incident during the emergency phase, that individual is considered to be an operations level responder. This would include fire, rescue, law enforcement, emergency medical services, private industry, and other allied professionals. Competencies for operations level responders are in the following two categories:

1. *Core Competencies* (Chapter 5) are required of all emergency responders at this level.
2. *Mission-Specific Competencies* (Chapter 6) are optional and are provided so that the AHJ can match the expected tasks and duties of its personnel with the required competencies to perform those tasks.

Mission-specific competencies are available for operations level responders who are assigned to perform the following tasks:

- Use PPE, as provided by the AHJ
- Perform technical decontamination
- Perform mass decontamination
- Perform product control
- Perform air monitoring and sampling
- Perform victim rescue and recovery operations
- Provide evidence preservation and sampling
- Respond to illicit laboratory incidents

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- Perform disablement/disruption of improvised explosives devices (IED), improvised WMD dispersal devices, and operations at improvised explosive laboratories

Operations level mission-specific tasks must be performed under the guidance of a hazardous materials technician, allied professional, or standard operating procedure. The competencies for personnel are referenced as follows:

- Chapter 5: Core Competencies
- Section 6.2: Mission-Specific Competencies: Personal Protective Equipment
- Section 6.6: Mission-Specific Competencies: Product Control

See the NFPA 472 Operations Level Responder Matrix (Table A.5.1.1.1) for examples on the application and use of the operations level core and mission-specific competencies.

3.4.1 Agent-Specific Competencies. The knowledge, skills, and judgment needed by operations level responders who have completed the operations level competencies and who are designated by the authority having jurisdiction to respond to releases or potential releases of a specific group of WMD agents.

• **3.4.2 Mission-Specific Competencies.** The knowledge, skills, and judgment needed by operations level responders who have completed the operations level competencies and who are designated by the authority having jurisdiction to perform mission-specific tasks, such as decontamination, victim/hostage rescue and recovery, evidence preservation, and sampling.

3.4.3* Operations Level Responders. Persons who respond to hazardous materials/weapons of mass destruction (WMD) incidents for the purpose of implementing or supporting actions to protect nearby persons, the environment, or property from the effects of the release.

A.3.4.3 Operations Level Responders. The source of this definition is 29 CFR 1910.120. These responders can have additional competencies that are specific to their response mission, expected tasks, and equipment and training as determined by the AHJ.

3.4.4 Operations Level Responders Assigned to Disablement/Disruption of Improvised Explosives Devices (IED), Improvised WMD Dispersal Devices, and Operations at Improvised Explosive Laboratories. Persons, competent at the operations level, who are assigned to interrupt the functioning of improvised explosive devices (IED) and improvised WMD dispersal devices and to conduct operations at improvised explosive laboratories.

3.4.5 Operations Level Responders Assigned to Perform Air Monitoring and Sampling. Persons, competent at the operations level, who are assigned to implement air monitoring and sampling operations at hazardous materials/weapons of mass destruction (WMD) incidents.

3.4.6 Operations Level Responders Assigned to Perform Evidence Preservation and Sampling. Persons, competent at the operations level, who are assigned to preserve forensic evidence, take samples, and/or seize evidence at hazardous materials/weapons of mass destruction (WMD) incidents involving potential violations of criminal statutes or governmental regulations.

3.4.7 Operations Level Responders Assigned to Perform Mass Decontamination. Persons, competent at the operations level, who are assigned to implement mass decontamination operations at hazardous materials/weapons of mass destruction (WMD) incidents.

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3.4.8 Operations Level Responders Assigned to Perform Product Control. Persons, competent at the operations level, who are assigned to implement product control measures at hazardous materials/weapons of mass destruction (WMD) incidents.

3.4.9 Operations Level Responders Assigned to Perform Technical Decontamination. Persons, competent at the operations level, who are assigned to implement technical decontamination operations at hazardous materials/weapons of mass destruction (WMD) incidents.

3.4.10 Operations Level Responders Assigned to Perform Victim Rescue/Recovery. Persons, competent at the operations level, who are assigned to rescue and/or recover exposed and contaminated victims at hazardous materials/weapons of mass destruction (WMD) incidents.

3.4.11 Operations Level Responders Assigned to Respond to Illicit Laboratory Incidents. Persons, competent at the operations level, who, at hazardous materials/weapons of mass destruction (WMD) incidents involving potential violations of criminal statutes specific to the illegal manufacture of methamphetamines, other drugs, or weapons of mass destruction (WMD), are assigned to secure the scene, identify the laboratory/process, and preserve evidence.

3.4.12 Operations Level Responders Assigned Responsibilities for Biological Response. Persons, competent at the operations level, who, at hazardous materials/weapons of mass destruction (WMD) incidents involving biological materials, are assigned to support the hazardous materials technician and other personnel, provide strategic and tactical recommendations to the on-scene incident commander, serve in a technical specialist capacity to provide technical oversight for operations, and act as a liaison between the hazardous materials technician, response personnel, and other outside resources regarding biological issues.

3.4.13 Operations Level Responders Assigned Responsibilities for Chemical Response. Persons, competent at the operations level, who, at hazardous materials/weapons of mass destruction (WMD) incidents involving chemical materials, are assigned to support the hazardous materials technician and other personnel, provide strategic and tactical recommendations to the on-scene incident commander, serve in a technical specialist capacity to provide technical oversight for operations, and act as a liaison between the hazardous material technician, response personnel, and other outside resources regarding chemical issues.

3.4.14 Operations Level Responders Assigned Responsibilities for Radioactive Material Response. Persons, competent at the operations level, who, at hazardous materials/weapons of mass destruction (WMD) incidents involving radioactive materials, are assigned to support the hazardous materials technician and other personnel, provide strategic and tactical recommendations to the on-scene incident commander, serve in a technical specialist capacity to provide technical oversight for operations, and act as a liaison between the hazardous material technician, response personnel, and other outside resources regarding radioactive material issues.

3.4.15 Operations Level Responders Assigned to Use Personal Protective Equipment (PPE). Persons, competent at the operations level, who are assigned to use personal protective equipment (PPE) at hazardous materials/weapons of mass destruction (WMD) incidents.

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N 3.5 Hazardous Materials Technician.

A person who responds to hazardous materials/weapons of mass destruction (WMD) incidents using a risk-based response process by which they analyze a problem involving hazardous materials/WMD, plan a response to the problem, implement the planned response, evaluate progress of the planned response and adjust accordingly, and assist in terminating the incident.

The role of the hazardous materials technician is significantly different from the roles of awareness level personnel and operations level responders. At those levels, individuals are likely to be the first on the scene or are likely to have duties that normally include initial response to emergencies that involve hazardous materials. Accordingly, their actions are limited because their main duties are to reduce or eliminate access to the immediate area of the incident and to minimize the potential harm of a release of hazardous materials.

The hazardous materials technician, on the other hand, assumes a more aggressive role in controlling an incident. The hazardous materials technician needs to approach the point of release to plug, patch, or otherwise stop a hazardous substance spill.

In the 2013 edition of NFPA 472, definitions were added to correlate with Chapter 18, Competencies for the Hazardous Materials Technician with a Radioactive Material Specialty.

N **3.5.1 Hazardous Materials Technician with a Cargo Tank Specialty.** A person who provides technical support pertaining to cargo tanks, provides oversight for product removal and movement of damaged cargo tanks, and acts as a liaison between the hazardous materials technician and other outside resources.

N **3.5.2 Hazardous Materials Technician with a Flammable Gases Bulk Storage Specialty.** A person who, in incidents involving flammable gas bulk storage tanks, provides support to the hazardous materials technician and other personnel, provides strategic and tactical recommendations to the on-scene incident commander, provides oversight for fire control and product removal operations, and acts as a liaison between technicians, fire-fighting personnel, and other resources.

N **3.5.3 Hazardous Materials Technician with a Flammable Liquids Bulk Storage Specialty.** A person who, in incidents involving bulk flammable liquid storage tanks and related facilities, provides support to the hazardous materials technician and other personnel, provides strategic and tactical recommendations to the on-scene incident commander, provides oversight for fire control and product removal operations, and acts as a liaison between technicians, response personnel, and outside resources.

N **3.5.4 Hazardous Materials Technician with an Intermodal Tank Specialty.** A person who provides technical support pertaining to intermodal tanks, provides oversight for product removal and movement of damaged intermodal tanks, and acts as a liaison between the hazardous materials technician and other outside resources.

N **3.5.5 Hazardous Materials Technician with a Marine Tank and Non-Tank Vessel Specialty.** A person who provides technical support pertaining to marine tank and non-tank vessels, provides oversight for product removal and movement of damaged marine tank and non-tank vessels, and acts as a liaison between the hazardous materials technician and other outside resources.

N **3.5.6 Hazardous Materials Technician with a Radioactive Material Specialty.** A person who provides support to the hazardous materials technician and other personnel, uses radiation detection instruments, manages the control of radiation exposure, conducts hazards assessment, and acts as a liaison between hazardous materials technicians at incidents involving radioactive materials.

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N **3.5.7 Hazardous Materials Technician with a Tank Car Specialty.** A person who provides technical support pertaining to tank cars, provides oversight for product removal and movement of damaged tank cars, and acts as a liaison between the hazardous materials technician and other outside resources.

References Cited in Commentary

1. *Emergency Response Guidebook* (ERG). Office of Hazardous Materials Initiatives and Training, PHH-50, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, 1200 New Jersey Avenue, SE East Building, 2nd Floor, Washington, DC 20590, https://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/Hazmat/ERG2016.pdf.
2. NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety*, National Fire Protection Association, Quincy, MA, 2014.
3. Title 49, Code of Federal Regulations, Part 173, Subpart I, "Class 7 Radioactive Materials." U.S. Department of Transportation, 1200 New Jersey Ave, SE, Washington, DC 20590.
4. NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies*, National Fire Protection Association, Quincy, MA, 2016.
5. NFPA 1992, *Standard on Liquid Splash–Protective Ensembles and Clothing for Hazardous Materials Emergencies*, National Fire Protection Association, Quincy, MA, 2018.
6. Title 29, Code of Federal Regulations, Part 1910.120, U.S. Government Publishing Office, Washington, DC.
7. NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, National Fire Protection Association, Quincy, MA, 2018.
8. NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services,* National Fire Protection Association, Quincy, MA, 2013.
9. NIOSH *Statement of Standard for NIOSH CBRN SCBA Testing*, National Institute for Occupational Safety and Health (NIOSH), 395 E Street, S.W. Suite 9200, Patriots Plaza Building, Washington, DC 20201.
10. NFPA 1994, *Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents*, National Fire Protection Association, Quincy, MA, 2018.
11. *The Medical NBC Battlebook, U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) Technical Guide 244.* United States Army Center for Health Promotion and Preventive Medicine, 5158 Blackhawk Road, Aberdeen Proving Ground, MD 21010-5403.

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4 Competencies for Awareness Level Personnel

The term *awareness level personnel* as discussed in this chapter includes anyone who in the course of their normal duties could encounter hazardous materials or weapons of mass destruction. Awareness level personnel are trained to recognize these kinds of materials, protect themselves from the materials, inform others (including trained response personnel), and secure the area.

4.1 General.

4.1.1 Introduction.

4.1.1.1 Awareness level personnel shall be persons who, in the course of their normal duties, could encounter an emergency involving hazardous materials/weapons of mass destruction (WMD) and who are expected to recognize the presence of the hazardous materials/WMD, protect themselves, call for trained personnel, and secure the area.

Awareness level personnel include public works employees, maintenance workers, and others who can see an event occur and can follow the actions prescribed in this chapter.

4.1.1.2 Awareness level personnel shall be trained to meet all competencies defined in Sections 4.2 through 4.4 of this chapter.

4.1.1.3 Awareness level personnel shall receive additional training to meet applicable governmental occupational health and safety regulations.

Regardless of the entity they represent, awareness level personnel should have the required skills to accomplish the activities at a hazardous materials/WMD incident that are critical to safely and effectively performing the duties described in this chapter.

4.1.2 Goal.

4.1.2.1 The goal of the competencies in this chapter shall be to provide personnel who in the course of normal duties encounter hazardous materials/WMD incidents with the knowledge and skills to perform the tasks in 4.1.2.2 in a safe and effective manner.

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Δ **4.1.2.2** Given a hazardous materials/WMD incident, policies and procedures, approved reference sources, and approved communications equipment, the awareness level personnel shall be able to perform the following tasks:

(1) Analyze the incident to identify both the hazardous materials/WMD present and the basic hazards for each hazardous materials/WMD agent involved by completing the following tasks:

(a) Recognize the presence of hazardous materials/WMD.

When detecting or confirming the presence of hazardous materials, personnel must take appropriate safety precautions. Personnel at this level do not have any specialized protective clothing or equipment and must therefore exercise caution when confirming the presence of hazardous materials or WMD at an incident.

At this level, personnel must also be made aware of the potential of further activity taking place if the incident has been caused intentionally by individuals seeking to cause harm for any purpose.

(b) Identify the name, UN/NA identification number, type of placard, or other distinctive marking applied for the hazardous materials/WMD involved from a safe location.

(c) Identify potential hazards from the current edition of the *Emergency Response Guidebook* (ERG), safety data sheets (SDS), shipping papers, and other approved reference sources.

The first step in analyzing the incident, as required in 4.1.2.2(1), is to determine whether hazardous materials/WMD are present. A few typical indicators that awareness level personnel should immediately recognize include the following:

- Operators or witnesses who report the presence of a hazard or a breach of a container
- Individuals who exhibit signs of exposure
- Occupancy type (paint supply stores, gas stations, warehouses, industrial and manufacturing plants, etc.)
- Placards, labels, and markings
- Type of containers involved
- Written resources (shipping papers indicating the presence of hazardous materials)
- Fume exhaust stacks on building roofs and the presence of fires or explosions

Hazardous materials can also be indicated on pre-incident surveys, pre-plans, and response plans maintained by local emergency planning committees (LEPCs). NFPA 472 clearly indicates that training in recognizing and identifying a hazardous materials/WMD incident for awareness level personnel is required and that the employer, whether in the public or private sector, is responsible for seeing that employees likely to be on the scene receive such training.

The Pipeline and Hazardous Materials Administration (PHMSA) of the U.S. Department of Transportation (DOT) has posted a notice of errata at their website regarding the 2016 edition *Emergency Response Guidebook*: http://phmsa.dot.gov/hazmat/corrections-to-the-erg.

(2) Implement actions consistent with the authority having jurisdiction (AHJ), and the current edition of the ERG or an equivalent document by completing the following tasks:

(a) Isolate the hazard area

(b) Initiate required notifications

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The actions required in 4.1.2.2(2) must be taken with appropriate safety precautions. Personnel at this level do not have any specialized protective clothing or equipment and must, therefore, exercise extreme caution when confirming the presence of hazardous materials/WMD. These personnel also must be trained in the appropriate community response procedures and know how to initiate them. Personnel should be familiar with their own organization's response plan and with their roles. In many cases, these actions consist of notifying the local emergency responders, such as the fire department, and securing the immediate area to prevent exposure to others.

4.2 Competencies — Analyzing the Incident.

Δ **4.2.1* Recognizing the Presence of Hazardous Materials/WMD.** Given a hazardous materials/WMD incident and approved reference sources, awareness level personnel shall recognize those situations where hazardous materials/WMD are present by completing the following requirements:

A.4.2.1 The AHJ should identify local situations where hazardous materials/WMD might be encountered. This can include areas where hazardous materials are transported, local industries and facilities where hazardous materials are used or stored, and locations where illicit laboratories might be likely.

(1)* Define the terms *hazardous material* (or *dangerous goods*, in Canada) and *WMD*

A.4.2.1(1) See Annex F.

(2) Identify the hazard classes and divisions of hazardous materials/WMD and identify common examples of materials in each hazard class or division

Because proper identification of hazardous materials/WMD is extremely important, the actions of personnel trained to the awareness level can be critical to a successful emergency response. By being able to identify the hazard classes as is required in 4.2.1(2), these personnel have a better understanding of potential problems that might arise (see Annex G of NFPA 472).

(3)* Identify the primary hazards associated with each hazard class and division

A.4.2.1(3) See Annex G.

By accurately identifying the type of hazardous materials/WMD present and the primary hazards the materials involve as required in 4.2.1(3), awareness level personnel can begin to take the correct protective actions early, if it is safe to do so. In addition, awareness level personnel can give this information to the hazardous materials/WMD response team members, who will then understand the type of incident they are responding to and be able to request specialized equipment or additional resources needed. For example, a responder would initiate considerably different actions dealing with a Class 1, Division 1.1 material (mass detonating explosives) than dealing with a Class 2, Division 2.2 (nonflammable gases) material. See Commentary Table I.4.1 for a full listing of DOT hazard classes.

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COMMENTARY TABLE I.4.1 *International Hazard Classes and Divisions*

Classes and Divisions	*Examples of Materials (by Hazard Class or Division)*	*General Hazard Properties (Not All-Inclusive)*
Class 1: Explosives and blasting agents		
Division 1.1: explosives with mass explosion hazard	Dynamite, TNT, black powder	Explosive; exposure to heat, shock, or contamination could result in thermal and mechanical hazards
Division 1.2: explosives with projection hazard	Projectiles with bursting charges	
Division 1.3: explosives with fire, minor blast, or minor projection hazard	Propellant explosives, rocket motors, special fireworks	
Division 1.4: explosive devices with minor explosion hazard	Common fireworks	
Division 1.5: very insensitive explosives	Ammonium nitrate–fuel oil mix, blasting agent	
Division 1.6: extremely insensitive explosives		
Class 2: Gases		
Division 2.1: flammable gases	Propane, butadiene, acetylene, methyl chloride	Under pressure; container may rupture violently (fire and nonfire); may be flammable, poisonous, corrosive, asphyxiant, and/or thermally unstable
Division 2.2: nonflammable, nonpoisonous (nontoxic) gas	Carbon dioxide, anhydrous ammonia	
Division 2.3: poisonous (toxic) gas by inhalation	Arsine, phosgene, chlorine, methyl bromide	
Class 3: Flammable liquids		
(flashpoint less than 141°F [60°C])	Acetone, amyl acetate, gasoline, methyl alcohol	Flammable; container may rupture violently from heat/fire; may be corrosive, toxic, and/or thermally unstable
Class 4: Flammable solids and reactive liquids and solids		
Division 4.1: flammable solids	Nitrocellulose, matches	Flammable, some spontaneously; may be water reactive, toxic, and/or corrosive; may be extremely difficult to extinguish
Division 4.2: spontaneously combustible materials	Phosphorus, aluminum alkyls, charcoal	
Division 4.3: dangerous when wet materials	Calcium carbide, potassium	
Class 5: Oxidizers and organic peroxides		
Division 5.1: oxidizers	Ammonium nitrate fertilizer	Supplies oxygen to support combustion; sensitive to heat, shock, friction, and/or contamination
Division 5.2: organic peroxides	Dibenzoyl peroxide	
Class 6: Toxic (poisonous) materials		
Division 6.1: poisonous (toxic) material	Aniline, arsenic, tear gas, carbon tetrachloride	Toxic by inhalation, ingestion, and skin/eye contact; may be flammable
Division 6.2: infectious substances	Anthrax, botulism, tetanus	
Class 7: Radioactive materials	Cobalt, uranium hexafluoride	May cause burns and biologic effects; may be in form of energy or matter
Class 8: Corrosive materials	Hydrochloric acid, sulfuric acid, sodium hydroxide	Disintegration of contacted tissues; may be fuming and/or water reactive
Class 9: Miscellaneous hazardous materials	Adipic acid, molten sulfur, dry ice, PCBs	

Source: *Fire Protection Handbook,* 20th edition, Table 13.8.1.

◆ **NFPA 1072 NOTE**

NFPA 1072 moves most WMD competencies to Chapter 5. If taught as awareness level, they would fall under 4.2(A) Requisite Knowledge "Other Indicators."

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(4) Identify the difference(s) between hazardous materials/WMD incidents and other emergencies

Adverse consequences of exposure to a hazardous material can be far-reaching and severe. In a large-scale emergency, responders of all levels can be at risk simply because a complex incident, such as the train wreck shown in Exhibit I.4.1, involves so many factors, including hazardous material exposure. Hazardous materials/WMD emergencies stand apart from other types of emergencies because they present such potential for doing great harm and because personnel must be specifically trained and equipped to deal with them properly. NFPA 472 also requires that personnel take care to avoid worsening the situation.

EXHIBIT I.4.1

At this Ohio incident, fires from a train wreck ignited chemicals transported on board, and one person died. (Source: Chagrin/Southeast Hazmat Team, Cuyahoga County, OH)

Incidents involving WMDs have additional differences including the following:

- **Intent:** An act of terrorism involving a WMD is different from normal emergencies in that it is intended to cause damage, inflict harm, and kill.
- **Severity and Complexity:** WMD incidents can involve large numbers of casualties or unusual materials (such as radioactive materials) with which awareness level personnel might have little practical experience.
- **Crime Scene Management:** Terrorist attacks are crimes, and preservation of evidence becomes an extremely important consideration during a response to a terrorist attack.
- **Incident Command:** All terrorist incidents require some form of unified command. Federal law enforcement will have jurisdiction over the investigation during incidents involving terrorism.
- **Secondary Devices/Attacks and Armed Resistance:** Attacks designed to incapacitate emergency responders include the following:
  - Secondary events intended to kill, incapacitate, or delay emergency responders
  - Armed resistance and assault
  - Use of weapons
  - Booby traps

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(5) Identify typical occupancies and locations in the community where hazardous materials/WMD are manufactured, transported, stored, used, or disposed of

Individuals involved with hazardous materials/WMD response planning at the awareness level are required in 4.2.1(5) to know where in a given community or industrial or manufacturing location that hazardous materials/WMD are most likely to be found. This knowledge helps personnel select appropriate emergency actions that can be planned and coordinated as necessary with responders from the public and private sectors. Local planning for response should be based, in part, on the knowledge that particular hazardous materials/WMD might be present at certain fixed sites within a specified area or community. For example, an area fire chief should know where auto body painting businesses are in the community and the chemicals and solvents that these sites are likely to contain. Similarly, the plant manager of a pharmaceutical company should be aware of the chemicals and chemical compounds that are on the site. The manager should be able to advise personnel what chemicals are present, where and how they are stored, and what, if any, built-in precautions have been taken.

(6) Identify typical container shapes that can indicate the presence of hazardous materials/WMD

The configuration of some containers is so unusual that it signals the presence of some hazardous materials/WMD. Containers that provide clues include those used for radioactive materials, pressurized products, cryogenics, and corrosives. Exhibit I.4.2 through Exhibit I.4.7 show container shapes that should alert awareness level personnel to the presence of hazardous materials. Examples of container shapes that should clue awareness level personnel to the possible presence of hazardous materials are in the front of the current edition of the *Emergency Response Guidebook* (ERG) [1].

(7) Identify facility and transportation markings and colors that indicate hazardous materials/WMD, 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

EXHIBIT I.4.2

Some basic features of a tank car tank are identified in this illustration. (Source: Union Tank Car Company)

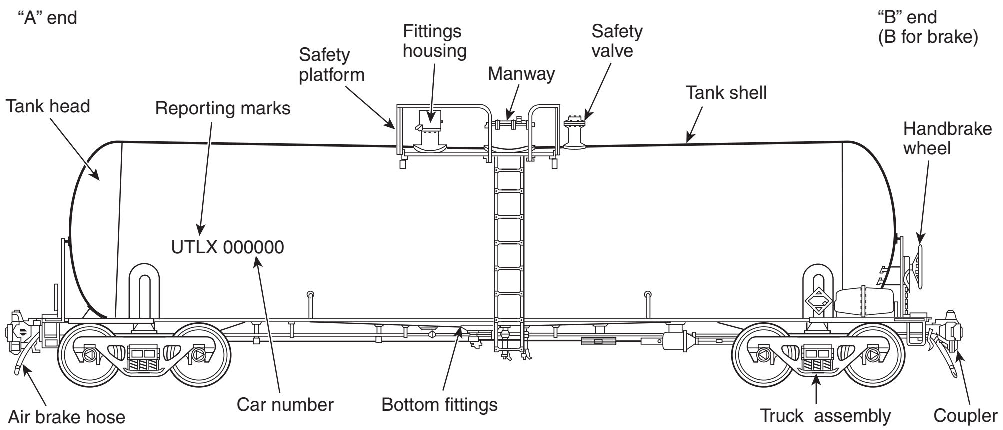

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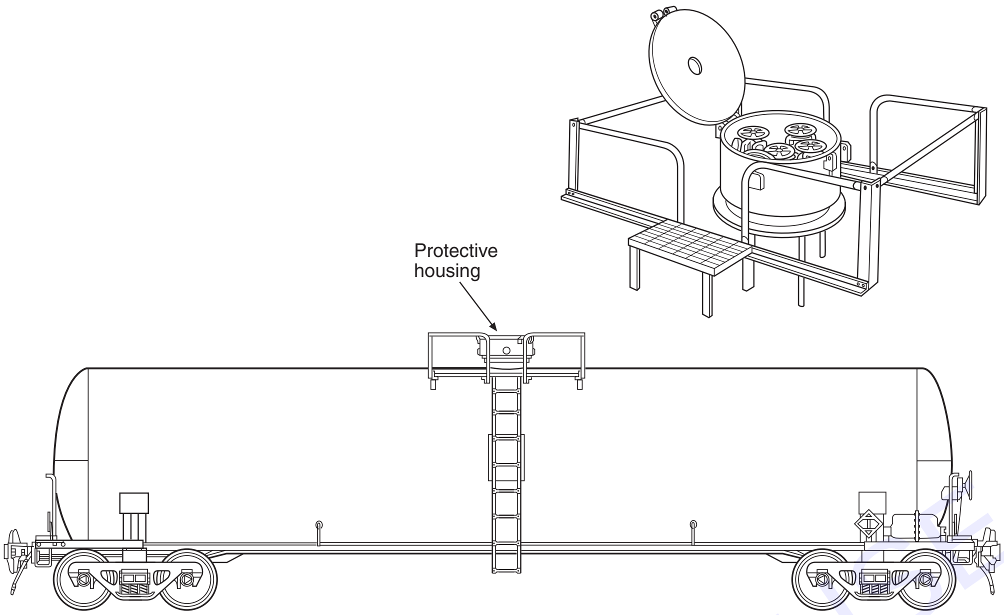
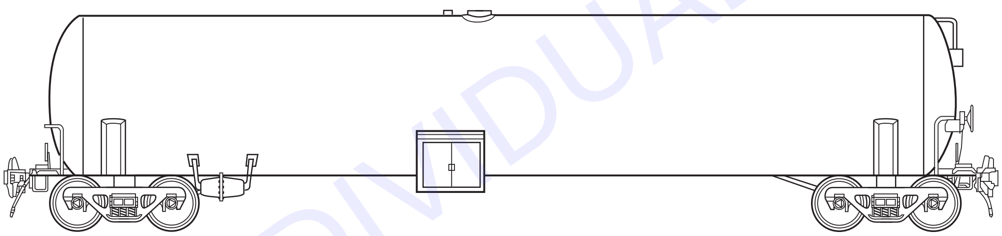
EXHIBIT I.4.3



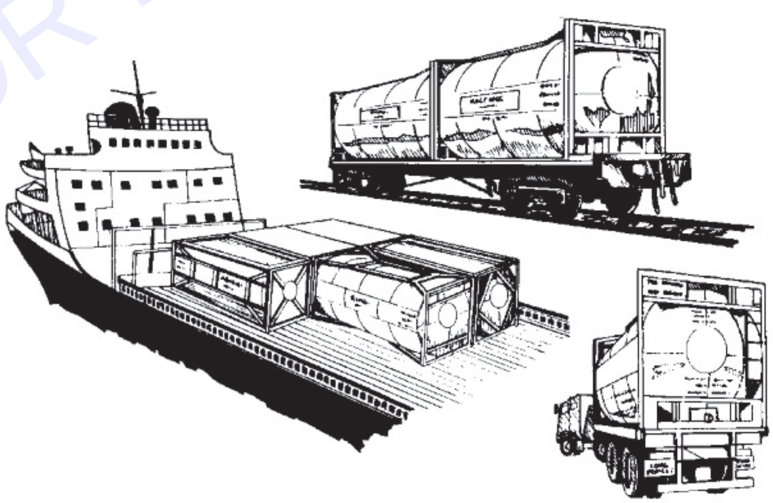
A typical pressure tank car is shown with protective housing (inset). (Source: Union Pacific Railroad)

EXHIBIT I.4.4



A typical cryogenic liquid tank car is shown in this illustration. (Source: Union Pacific Railroad)

EXHIBIT I.4.5



Various modes of transportation can be used for intermodal tank containers.

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EXHIBIT I.4.6

The diagram illustrates an intermodal nonpressure tank container. (Source: Union Pacific Railroad)

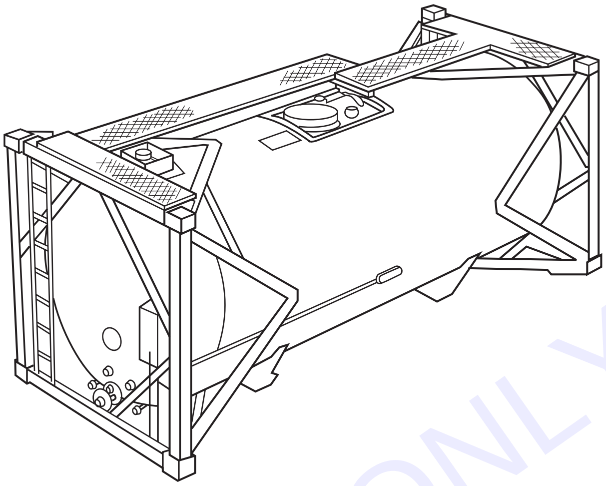


EXHIBIT I.4.7

The diagram depicts a typical intermodal pressure tank container. (Source: Union Pacific Railroad)

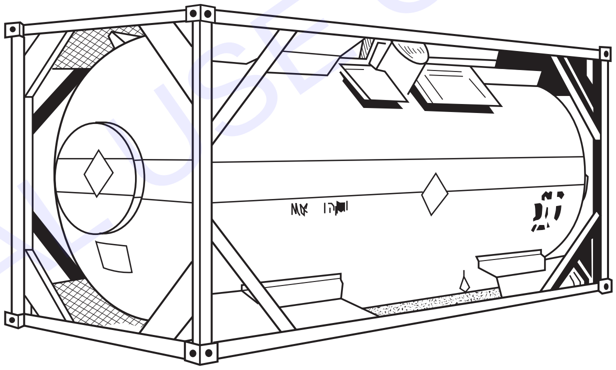
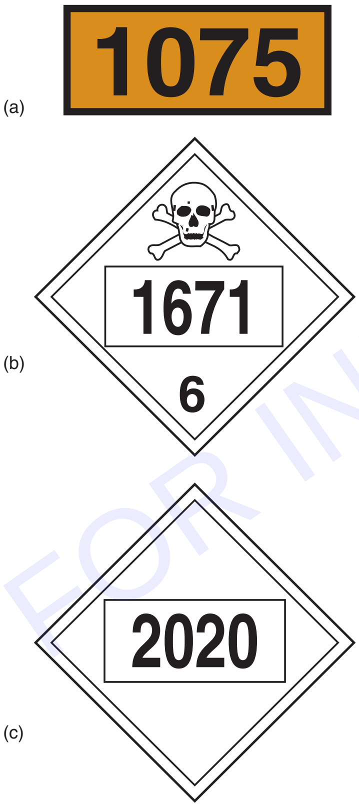


EXHIBIT I.4.8



These placards show how numbers are displayed: (a) and (c) show two ways to depict the four-digit product identification number on a placard, and (b) shows the class or division number on the placard as well.

Exhibit I.4.8 shows several numbers used on placards. Exhibits I.4.8(a) and I.4.8 (c) illustrate two ways to show the four-digit product identification number on a placard. Exhibit I.4.8(b) illustrates the use of the class or division number and the product identification number on the same placard. For example, the class or division number might be displayed at the bottom of the placard, as the number 6 is shown in Exhibit I.4.8(b). Personnel should also be familiar with the intermodal container requirements in the *European Agreement Concerning the International Carriage of Dangerous Goods by Road* (ADR) [2] and the *International Regulations Concerning the Carriage of Dangerous Goods by Rail* (RID) [3] markings. The colors of the placards also indicate the hazard class. For example, yellow is used for Class 5, Oxidizing Substances, and black and white is used to denote Class 8, Corrosives.

(b) NFPA 704 markings

See 4.2.1(8).

(c)* Military hazardous materials/WMD markings

A.4.2.1(7)(c) The responder should understand the standard military fire hazard and chemical hazard markings.

The military uses different markings for shipments on military facilities, and knowledge of this labeling is required by 4.2.1(7)(c). The military marking system establishes the following four hazard classes:

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1. Class 1: Materials that present a mass detonation hazard.
2. Class 2: Materials that present an explosive with fragmentation hazard.
3. Class 3: Materials with a mass fire hazard.
4. Class 4: Materials that present a moderate fire hazard.

In addition, four special warnings are indicated separately as follows:

- Chemical hazard
  - Highly toxic
  - Harassing agents
  - White phosphorus munitions
- Apply no water
- Wear protective breathing apparatus
- Special hazard communication markings

These warnings are in some facilities and identify hazardous materials/WMD. The U.S. military uses both special hazard symbols and detonation hazard symbols, which are shown in Exhibit I.4.9.

(d) Special hazard communication markings for each hazard class
(e) Pipeline markings

Pipeline markings are usually metal signs or plastic poles placed adjacent to and above a hazardous materials pipeline. The markings contain information about the ownership of the pipeline, the product it carries, and a 24-hour emergency contact number.

(f) Container markings

Often, markings on a container provide some indication as to the type of product it holds. These markings may include product names such as chlorine.

(8) Given an NFPA 704 marking, describe the significance of the colors, numbers, and special symbols

NFPA's *Fire Protection Guide to Hazardous Materials* contains a great deal of information about hazardous chemicals, their fire hazard properties, and hazardous chemical reactions [4]. In addition, the guide includes NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response* [5]. The NFPA 704 marking system is based on the "704 diamond," which visually presents information on the following three principal categories of hazard as well as the degree of severity of each hazard for hazardous materials at fixed facilities:

1. Health (Blue)
2. Flammability (Red)
3. Instability (Yellow)

In addition, the fourth part of the diamond at the six o'clock position is reserved for indicating special hazards. (See Exhibit I.4.10.) These special hazards are as follows:

1. Reactivity with water
2. Oxidizing ability (see Annex G of NFPA 472)

The NFPA 704 diamond symbol provides immediate general information to awareness level personnel and emergency responders who are required in 4.2.1(8) to be able to interpret the placard.

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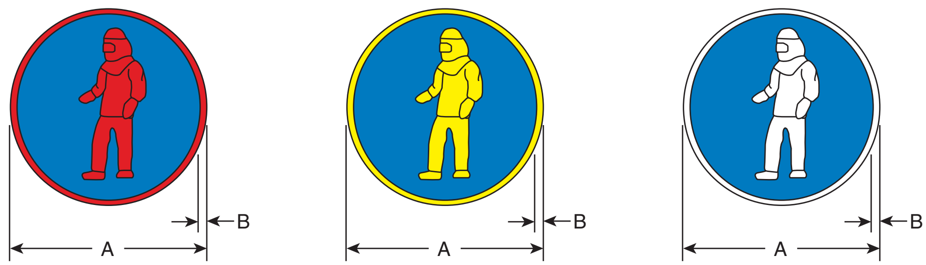
EXHIBIT I.4.9

Special hazard symbols are used by the U.S. military. (Source: U.S. Air Force Manual 91-201, January 12, 2011)



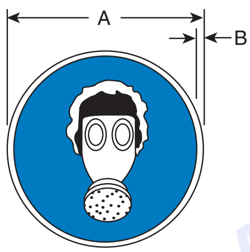
<u>Symbol 1.</u> Wear full protective clothing.

Background is blue, and figure and rim are as follows:

<u>Red for Set 1 Protect Clothing:</u>
24–inch: NSN 7690 – 01– 081– 9586
12–inch: NSN 7690 – 01– 081– 9585

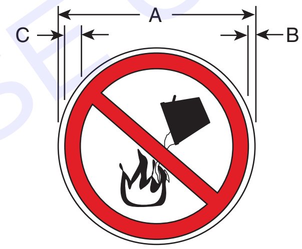
<u>Yellow for Set 2 Protective Clothing:</u>
24–inch: NSN 7690 – 01– 081– 9587
12–inch: NSN 7690 – 01– 082– 0291

<u>White for set 3 Protective Clothing:</u>
24–inch: NSN 7690 – 01– 083– 6272
12–inch: NSN 7690 – 01– 081– 9588



<u>Symbol 2.</u> Wear breathing apparatus.

Background is blue.
Figure and rim are white.
24–inch: NSN 7690 – 01– 081– 9589
12–inch: NSN 7690 – 01– 082– 6710



<u>Symbol 3.</u> Apply no water.

Background is white.
Circle and Diagonal are red
Figures are in black.
24–inch: NSN 7690 – 01– 082– 2254
12–inch: NSN 7690 – 01– 082– 0292

Dimensions	Large Symbol		Small Symbol	
	inches	metric (mm)	inches	metric (mm)
A	24	610	12	305
B	.5	13	.25	6
C	2	51	1	25

<u>Colors</u> (per Federal Standard 595B or GSA Catalog)
Red #11105 White #17875
Blue #15102 Black #17038
Yellow #13538

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The five degrees of hazard, in descending order, have the following general meanings to fire fighters.

- **Degree of Hazard 4:** Fire is too dangerous to approach with standard fire-fighting equipment and procedures. Withdraw and obtain expert advice on how to handle fire.
- **Degree of Hazard 3:** Fire can be fought using methods intended for extremely hazardous situations, such as remote-control monitors or PPE that prevents all bodily contact.
- **Degree of Hazard 2:** Fire can be fought with standard procedures, but hazards are present that can be handled safely only with certain special equipment or procedures.
- **Degree of Hazard 1:** Nuisance hazards are present that require some care, but standard fire-fighting procedures can be used.
- **Degree of Hazard 0:** No special hazards are present; therefore, no special measures are needed.

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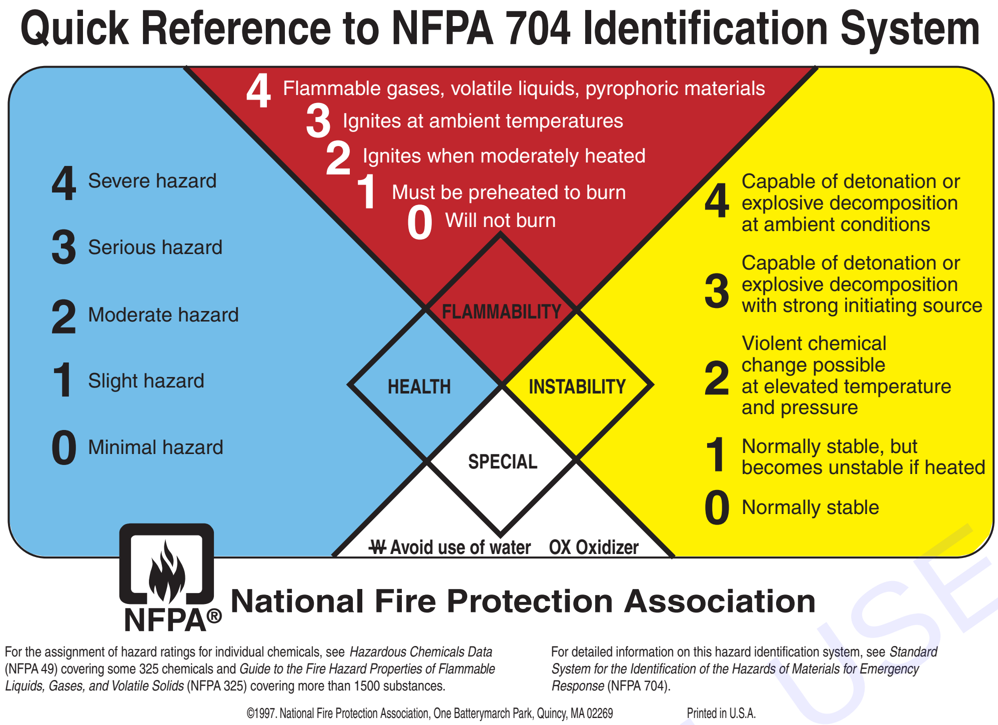

EXHIBIT I.4.10

This quick reference explains how the NFPA 704 identification system is used.

NFPA 704 describes the hazard categories and the security levels that the numbers indicate for each hazard. The following, which is adapted from NFPA 704, summarizes the hazard information and recommends protective actions.

The numbers from 0 through 4 are placed in the three upper squares of the diamond to show the degree of hazard present for each of the three hazard categories. The 0 indicates the lowest degree of hazard (but not NO hazard), and the 4 indicates the highest. The fourth square, at the bottom, is used for special information. Two symbols for this bottom space are recognized by NFPA 704. Either symbol, or both, can appear in this square, or it may be blank.

The recognized symbols are as follows:

- A letter W with a bar through it (₩) indicates that a material is unusually reactive with water. This symbol does not mean that water should not be used, since some forms of water, such as fog or spray, can be used in some cases. What it does mean is that water can cause a hazard, so it must be used very cautiously pending proper information.
- The letters OX indicate an oxidizer.

Although not recognized by NFPA 704, some users insert the letters ALK for alkaline materials, and ACID for acidic materials, in this square.

Health Hazards. In general, the health hazard in fire fighting is that of a single exposure, the duration of which can vary from a few seconds up to an hour. The physical exertion demanded in fire fighting or other emergencies can be expected to intensify the effects of any exposure. In assigning degrees of danger, local conditions must be considered. The following explanation is based on the use of protective equipment normally worn by fire fighters.

- **Degree of Hazard 4:** Materials that under emergency conditions can be lethal. A few whiffs of the vapor could cause death, or the vapor or liquid could be fatal on penetrating the fire fighter's normal full-protective clothing. The normal full-protective clothing and breathing apparatus available to the average fire department does not provide adequate protection against inhalation or skin contact with these materials.

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- **Degree of Hazard 3:** Materials that under emergency conditions can cause serious or permanent injury. Full-protective clothing, self-contained breathing apparatus (SCBA), gloves, boots, and bands around legs, arms, and waist should be provided. No skin surfaces should be exposed.
- **Degree of Hazard 2:** Materials that under emergency conditions can cause temporary incapacitation or residual injury. Full-face mask SCBA that provides eye protection should be provided.
- **Degree of Hazard 1:** Materials that under emergency conditions can cause significant irritation. Wearing SCBA might be desirable.
- **Degree of Hazard 0:** Materials that, under emergency conditions, would offer no health hazard beyond that of ordinary combustible materials.

Flammability Hazards. Susceptibility to burning is the basis for assigning the following degrees within this category (see Exhibit I.4.10). The method of attacking the fire is influenced by this susceptibility factor.

- **Degree of Hazard 4:** Flammable gases, flammable cryogenic materials, very volatile flammable liquids, Class IA liquids, or materials that ignite spontaneously in air (pyrophoric). If possible, shut on/off flow and keep cooling water streams on exposed tanks or containers. Withdrawal might be necessary.
- **Degree of Hazard 3:** Materials that can be ignited under almost all normal temperature conditions (Class IB). Water might be ineffective because of the low flash point.
- **Degree of Hazard 2:** Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition occurs (Class II and Class IIIA liquids). Water spray can be used to extinguish the fire because the material can be cooled below its flash point.
- **Degree of Hazard 1:** Materials that must be preheated before ignition can occur (Class IIIB liquids). Water can cause frothing if it gets below the surface of the liquid and turns to steam. If this occurs, water fog gently applied to the surface causes a frothing that extinguishes the fire.
- **Degree of Hazard 0:** Materials that do not burn.

Instability Hazards. The assignment of the following relative degrees of hazard in the reactivity category is based on the susceptibility of materials to release energy either by themselves or in combination with other materials (see Exhibit I.4.10). Fire exposure was one factor considered along with conditions of shock and pressure.

- **Degree of Hazard 4:** Materials that are readily capable of detonation or explosive decomposition at normal temperatures and pressures. Includes materials that are sensitive to localized thermal or mechanical shock. If they are involved in a massive fire, vacate the area.
- **Degree of Hazard 3:** Materials that are capable of detonation, explosive decomposition, or explosive reaction, but require a strong initiating source, or that must be heated under confinement before initiation. Includes materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures, or that can react explosively with water without requiring heat or confinement. Fire fighting should be conducted from behind explosion-resistant locations.
- **Degree of Hazard 2:** Materials that readily undergo a violent chemical change at elevated temperatures and pressures. Includes materials that react violently with water or that can form potentially explosive mixtures with water. Use portable monitors, hose holders, or straight hose streams from a distance to cool the tanks and the material in them. Use caution.
- **Degree of Hazard 1:** Materials that are normally stable but can become unstable at elevated temperatures and pressures or that react vigorously but not violently with water. Includes materials that change or decompose on exposure to air, light, or moisture. Use normal precautions as in approaching any fire.
- **Degree of Hazard 0:** Materials that are normally stable and thus do not present any reactivity hazard to fire fighters.

Special Information. When ₩ appears at the bottom in the fourth space (see Exhibit I.4.10):

- **Degree of Hazard 4:** ₩ is not used with reactivity hazard 4.
- **Degree of Hazard 3:** In addition to the three hazards, these materials can react explosively with water. Explosion protection is essential if water is to be used.
- **Degree of Hazard 2:** In addition to the three hazards, these materials can react with water or form potentially explosive mixtures with water.

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- **Degree of Hazard 1:** In addition to the three hazards, these materials can react vigorously but not violently with water.
- **Degree of Hazard 0:** ₩ is not used with reactivity hazard 0.

Methods of Presentation. Several methods for presentation of the ratings are shown in Exhibit I.4.10. A basic requirement is that numbers be spaced as though they were in the diamond outline. Chapter 6 of NFPA 704 presents a recommended layout and sizes for the symbol, a distance-legibility table, and several examples using the symbol.

Assigning Degrees of Hazard. Numbers (degrees of hazard) for use in the diamond are assigned on the basis of the worst hazard expected in the area, whether it is from hazards of the original material or of its combustion or breakdown products. The effects of local conditions must be considered. For instance, a drum of carbon tetrachloride sitting in a well-ventilated storage shed presents a different hazard than a drum holding the same material sitting in an unventilated basement.

Advantages of the NFPA 704 System. The NFPA 704 system can warn against hazards under fire conditions of materials that other information systems categorize as nonhazardous. For example, edible tallow produces toxic and irritating combustion products. The tallow would be given a "2" degree of health hazard, indicating the need for air-supplied respiratory equipment.

NFPA 704 markings also can warn against overall fire hazards in an area. On the door of a laboratory or storage room, the system can warn of the worst hazards likely in a fire situation. Such information is useful both in preplanning and in actual fires.

The NFPA 704 system also can be used without a supplementary manual. Because of its simplicity, the general meanings of the numbers are easily understood and the whole symbol is read and interpreted quickly on the spot, in poor light, and at a distance.

Limitations of the NFPA 704 System. The NFPA 704 system supplies only minimum information on the hazards themselves. Because the system informs on protective measures, the same number can be used for various types of hazards so that, for instance, a health hazard "3" means "serious hazard" without saying whether the hazard is corrosive to the skin or toxic by absorption through the skin. Thus, the symbol is most useful to trained or informed persons.

(9) Identify placards and labels that indicate hazardous materials/WMD

(10) Identify the following basic information on safety data sheets (SDS) and shipping papers for hazardous materials:

In 4.2.1(10), awareness level personnel are required to identify the following information:

- Manufacturer's name and location
- Name and family of the chemical
- Hazardous ingredients
- Physical data
- Fire and explosion hazard data
- Health hazard data
- Spill or leak procedures
- Special protection information
- Special precautions needed when dealing with the material

While these are the sections required in a safety data sheet (SDS) by mandatory Occupational Safety and Health Administration (OSHA) standards, OSHA encourages supplemental information be provided as well. ANSI Standard Z400.1, *Hazardous Industrial Chemicals — Material Safety Data Sheets — Preparation* [6], specifies 16 sections for an MSDS. OSHA now recommends that the ANSI format be used, although this format is not presently required. See Commentary Table I.4.2 for the minimum information needed on a safety data sheet (SDS).

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COMMENTARY TABLE I.4.2 *Safety Data Sheet Minimum Requirements*

Globally Harmonized System (GHS) Requirements	
Category	***Information***
1. Identification of the substance or mixture and of the supplier	• GHS product identifier • Other means of identification • Recommended use of the chemical and restrictions on use • Supplier's details (including name, address, phone number, etc.) • Emergency phone number
2. Hazards identification	• GHS classification of the substance/mixture and any national or regional information • GHS label elements, including precautionary statements (Hazard symbols may be provided as a graphical reproduction of the symbols in black and white or the name of the symbol, e.g., flame, skull and crossbones.) • Other hazards that do not result in classification (e.g., dust explosion hazard) or are not covered by the GHS
3. Composition/information on ingredients	*Substance* • Chemical identity • Common name, synonyms, etc. • Chemical abstract service (CAS) number, European Communities (EC) number, etc. • Impurities and stabilizing additives that are themselves classified and that contribute to the classification of the substance *Mixture* • The chemical identity and concentration or concentration ranges of all ingredients that are hazardous within the meaning of the GHS and are present above their cutoff levels Note: For information on ingredients, the competent authority rules for CBI take priority over the rules for product identification.
4. First aid measures	• Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion • Most important symptoms/effects, acute and delayed • Indication of immediate medical attention and special treatment needed, if necessary
5. Fire-fighting measures	• Suitable (and unsuitable) extinguishing media • Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products) • Special protective equipment and precautions for fire fighters
6. Accidental release measures	• Personal precautions, protective equipment and emergency procedures • Environmental precautions • Methods and materials for containment and clean up
7. Handling and storage	• Precautions for safe handling • Conditions for safe storage, including any incompatibilities
8. Exposure controls/personal protection	• Control parameters, e.g., occupational exposure limit values or biological limit values • Appropriate engineering controls • Individual protection measures, such as PPE

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COMMENTARY TABLE I.4.2 *continued*

Globally Harmonized System (GHS) Requirements

Category	*Information*
9. Physical and chemical properties	• Appearance (physical state, color, etc.) • Odor • Odor threshold • pH • Melting point/freezing point • Initial boiling point and boiling range • Flash point • Evaporation rate • Flammability (solid, gas) • Upper/lower flammability or explosive limits • Vapor pressure • Vapor density • Relative density • Solubility(ies) • Partition coefficient: n-octanol/water • Autoignition temperature • Decomposition temperature
10. Stability and reactivity	• Chemical stability • Possibility of hazardous reactions • Conditions to avoid (e.g., static discharge, shock, vibration) • Incompatible materials • Hazardous decomposition products
11. Toxicological information	Concise but complete and comprehensible description of the various toxicological (health) effects and the available data used to identify those effects, including: • Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact) • Symptoms related to the physical, chemical and toxicological characteristics • Delayed and immediate effects and also chronic effects from short- and long-term exposure • Numerical measures of toxicity (such as acute toxicity estimates)
12. Ecological information	• Ecotoxicity (aquatic and terrestrial, where available) • Persistence and degradability • Bioaccumulative potential • Mobility in soil • Other adverse effects
13. Disposal considerations	• Description of waste residues and information on their safe handling and methods of disposal, including the disposal of any contaminated packaging
14. Transport information	• United Nations (UN) number • UN proper shipping name • Transport hazard class(es) • Packing group, if applicable • Marine pollutant (Yes/No) • Special precautions that a user needs to be aware of or needs to comply with in connection with transport or conveyance either within or outside their premises
15. Regulatory information	• Safety, health and environmental regulations specific for the product in question
16. Other information including information on preparation and revision of the SDS	

Source: Adapted from Occupational Safety and Health Administration, "A Guide to the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)," Figure 4.14, www.osha.gov/dsg/hazcom/ghs.html#4.0

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"The Global Harmonization System (GHS) of Classification and Labelling of Chemicals" sets forth recommendations for minimum information to be provided on an SDS, which is the GHS equivalent of an MSDS, shown in Exhibit I.4.11. These sheets are used worldwide. SDSs include essentially the same information as recommended by ANSI for an MSDS, with some minor differences. The minimum information required for an SDS is shown in Exhibit I.4.11.

(a) Identify where to find SDS

Employers are required by 4.2.1(10)(a) to maintain an SDS for every hazardous chemical used at their facilities. This requirement is part of the "Hazard Communication Standard," 29 CFR Part 1910 [7]. SDSs are also available from manufacturers, suppliers, and shippers; they are sometimes attached to non-bulk containers and shipping papers.

(b) Identify major sections of SDS

The major categories on an SDS that indicate the presence of hazardous materials include hazardous ingredients, fire and explosion hazard data, health hazard data, reactivity data, spill or leak procedures, special protection information, and special precautions.

Shipping papers can contain several pieces of information that indicate the presence of a hazardous material. The areas required in 4.2.1(10) to be identified include the material's proper shipping name (which can be referenced in the blue-bordered pages of the ERG), the material's hazard class or division, ID number (which can be referenced in the ERG's yellow-bordered pages), the packing group (an indication of what type packaging is required for some products), total quantity, and emergency response telephone number.

Shipping documents are in the cab of a motor vehicle, in the possession of a train crew member, in a holder on the bridge of a vessel, or in the possession of an aircraft pilot. Exhibit I.4.12 illustrates the key elements of shipping papers.

(11) Identify the following basic information on shipping papers for hazardous materials:

Shipping papers provide important information about what is being transported. Once the mode of transport is identified, awareness level personnel can determine what the shipping paper is called, where it is located in or on the particular vehicle or vessel, and the responsible person who might have additional information or knowledge of the material. Commentary Table I.4.3 offers a listing by transit route of the likely location of shipping papers and the person responsible. See also the commentary for 4.2.1(10).

COMMENTARY TABLE I.4.3 *A List of the Shipping Papers by Route of Transportation, Title of Shipping Paper, Location, and Responsible Person*

Mode of Transportation	*Title of Shipping Paper*	*Location of Shipping Papers*	*Responsible Person*
Highway	Bill of lading or freight bill	Cab of vehicle	Driver
Rail	Train list or train consist and/or waybill	With member of train crew (conductor or engineer)	Conductor
Water	Dangerous cargo manifest	Wheelhouse or pipelike container on barge	Captain or master
Air	Air bill with shipper's certification for restricted articles	Cockpit (may also be found attached to the outside of packages)	Pilot

Source: Adapted from *Fire Protection Handbook*, 20th edition, Table 13.8.3.

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EXHIBIT I.4.11

Hazardous Material Data Sheet | **Containment System ID.**

Material Name ______ DOT ID № ______ STCC № ______

Synonyms ______

Hazard Class ______

NFPA 704 Marking: Health ______ Flammability ______ Instability ______ Special ______

Physical Properties

Form	Color	Odor	Chemical Formula	Molecular Wt.
☐ Solid ☐ Liquid ☐ Gas				

Chemical Properties

Actual Temp.	Boiling Point	Melting Point	Vapor Pressure	Expansion Ratio	Specific Gravity	Vapor Density	Soluble?	Degree of Solubility
							☐ Yes	

Physical Hazards

Flammable (heat/fire) ☐ Yes
Cryogenic (cold) ☐ Yes
Oxidizer (supports combustion) ☐ Yes
Explosive ☐ Yes
Reactive ☐ Yes
To What? ______

Actual Temperature	Flash Point	Ignition Temperature
Actual Concentration	**Flammable Range**	**Toxic Products of Combustion**

Health Hazards

Acute Health Hazards:
Poisonous ☐ Yes
Corrosive ☐ Yes
To What? ______
Asphyxiation ☐ Yes
Etiologic ☐ Yes
Radiation ☐ Yes
Type: alpha beta gamma

Actual Concentration	Non-Life-Threatening Exposure Limits		
	TLV-TWA(PEL)	TLV-C	TLV-STEL
Odor Threshold	**Life-Threatening Exposure Limits**		
	IDLH	LC_{50}	LD_{50}

Chronic Health Hazards:
Carcinogen ☐ Yes
Mutagen ☐ Yes
Teratogen ☐ Yes
Aquatic Hazard ☐ Yes

Route of Entry ☒ = YES		Toxicity Rating	Notes
Inhalation	☐	1 2 3 4 5 6	
Dermal	☐	1 2 3 4 5 6	
Ingestion	☐	1 2 3 4 5 6	

Response Information

Evacuation Distances ______
First Aid ______

Personal Protective Equipment ______
Decontamination ______
Extinguishing Agents ______
Neutralizing Agents ______

A hazardous material data sheet is used for recording information obtained during the task of collecting and interpreting hazard and response information.

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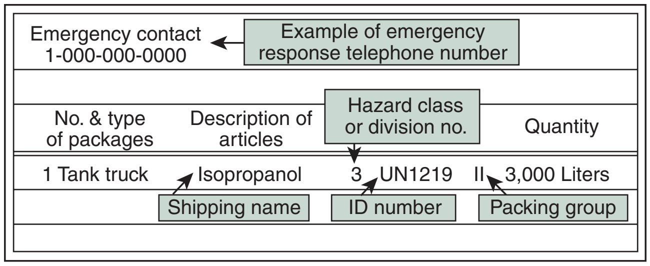
EXHIBIT I.4.12

The key elements of a shipping document provide crucial information about the material being transported. (Source: Emergency Response Guidebook, 2016)



(a) Identify the entries on shipping papers that indicate the presence of hazardous materials
(b) Match the name of the shipping papers found in transportation (air, highway, rail, and water) with the mode of transportation
(c) Identify the person responsible for having the shipping papers in each mode of transportation
(d) Identify where the shipping papers are found in each mode of transportation
(e) Identify where the papers can be found in an emergency in each mode of transportation

(12)* Identify examples of other clues, including senses (sight, sound, and odor), that indicate the presence of hazardous materials/WMD

A.4.2.1(12) These clues 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.

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One problem in using senses to evaluate the presence of hazardous materials/WMD is that if awareness level personnel are close enough to use them, he or she may have been already endangered. In addition, many gases are odorless, tasteless, and colorless. In the case of hydrogen sulfide, exposure to this toxic gas can deaden the olfactory senses, resulting in an inability to smell it. Individuals might therefore incorrectly assume the hazard has dissipated.

Awareness level personnel should pay attention to anything that arouses their curiosity and attracts their attention, including the following:

- Containers with unknown liquids or materials
- Unusual devices or containers with electronic components such as wires, circuit boards, cellular phones, antennas, and other items attached or exposed
- Devices containing quantities of fuses, fireworks, match heads, black powder, smokeless powder, incendiary materials, or other unusual materials
- Materials attached to or surrounding an item such as nails, bolts, drill bits, marbles, etc., that could be used for shrapnel
- Materials such as blasting caps, detonating cord (detcord), military explosives, commercial explosives, grenades, etc.
- Any combination of the previously described items

4.2.2 Identifying Hazardous Materials/WMD. Given examples of hazardous materials/WMD incident, awareness level personnel shall, from a safe location, identify the hazardous material(s)/WMD involved in each situation by name, UN/NA identification number, or type placard applied by completing the following requirements:

(1) Identify difficulties encountered in determining the specific names of hazardous materials/WMD at facilities and in transportation

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Even if awareness level personnel know placarding and labeling systems, and are familiar with other methods of identifying the presence of hazardous materials/WMD, they can still have difficulty determining which materials are involved in a specific incident, which is addressed in 4.2.2(1). Awareness level personnel might not be able to get close enough to make accurate identification and, in some cases, the labels or placards might be missing; the placards or labels might list only the class or division, not the specific product identifier; shipments might contain mixed loads of hazardous materials/WMD and require only the "dangerous" placard; the shipper could err in the labeling and placarding; or the shipping papers could be inaccessible.

(2) Identify sources for obtaining the names of, UN/NA identification numbers for, or types of placard associated with hazardous materials/WMD in transportation

One of the best ways to identify products or types of placards, as is required in 4.2.2(2), is to use the current edition of the ERG. The shipping papers, if available, should also contain both the four-digit identification number and the proper shipping name of the material.

(3) Identify sources for obtaining the names of hazardous materials/WMD at a facility

At fixed facilities, the sources required to be known in accordance with 4.2.2(3) are the names of hazardous materials/WMD found on the SDS and in the emergency planning documents, and signs or other markings on storage containers.

4.2.3* Collecting Hazard Information. Given the identity of various hazardous materials/WMD (name, UN/NA identification number, or type placard), awareness level personnel shall identify the basic hazard information for each material by using the current edition of the ERG or equivalent document; safety data sheet (SDS); manufacturer, shipper, and carrier documents (including shipping papers); and contacts by completing the following requirements:

(1)* Identify the three methods for determining the guidebook page for a hazardous material/WMD

A.4.2.3(1) Three methods for determining the appropriate guidebook 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

To find this information in the ERG, awareness level personnel must accomplish one of the following tasks:

- Identify the material by finding the four-digit UN/NA identification number, which is explained in 3.3.67, on a placard or orange panel, in a shipping paper, or on the package, then locate the number in the yellow-bordered pages and determine the appropriate guide page.
- Locate the name of the material in the shipping papers or on the placard or package, find the material in the alphabetical listing of products on the blue-bordered pages, and determine the appropriate guide page.
- Locate a matching placard in the table of placards and consult the three-digit guide number found next to the look-alike placard, if a name or identification number is not available but awareness

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level personnel can see the placard. If the material is an explosive, awareness level personnel should consult one of the four guides listed inside the front cover of the ERG.

(2) Identify the two general types of hazards found on each guidebook page

Each guide page of the ERG contains information on the fire and explosion hazard, and on the health hazard of the specific hazardous material or material class. In accordance with 4.2.3(2), awareness level personnel must be able to identify the two general types of hazards.

A.4.2.3 It is the intent of this standard that the awareness level personnel be taught the noted competency to a specific task level. This task level is required to have knowledge of the contents of the current edition of the DOT *Emergency Response Guidebook* or other reference material provided.

Awareness level personnel should be familiar with the information provided in those documents so they can use it to assist with accurate notification of an incident and take protective actions.

If other sources of response information, including the MSDS, are provided to the hazardous materials/WMD responder at the awareness level in lieu of the current edition of the DOT *Emergency Response Guidebook*, the responder should identify hazard information similar to that found in the current edition of the DOT *Emergency Response Guidebook*.

4.3* Competencies — Planning the Response. (Reserved)

A.4.3 No competencies are currently required at this level.

Section 4.3 is reserved because the committee felt that awareness level personnel would not be involved in planning for an emergency response but would apply standard operating procedures established by the organization or found in the local emergency response plan. At this level, the responsibilities of awareness level personnel are to identify a hazardous material, notify the authorities, and isolate the material if possible.

4.4 Competencies — Implementing the Planned Response.

Δ **4.4.1* Isolate the Hazard Area.** Given examples of hazardous materials/WMD incidents, the emergency response plan, the standard operating procedures, and the current edition of the ERG, awareness level personnel shall isolate and deny entry to the hazard area by completing the following requirements:

The competencies in 4.4.1 are designed to ensure that awareness level personnel can implement the appropriate protective actions based on the information they have acquired while analyzing the incident. Emergency response plans should establish the methods and procedures that facility owners and operators, as well as local emergency and medical response personnel, are to follow. Personnel at all levels must understand their role and its importance. If a response is to be handled effectively, awareness level personnel must assess the situation accurately and initiate the appropriate measures.

A.4.4.1 Jurisdictions that have not developed an emergency response plan can refer to the National Response Team document NRT-1, *Hazardous Materials Emergency Planning Guide*.

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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.

Addressed in A.4.4.1, National Response Team (NRT) member agencies are the Environmental Protection Agency (chair), Department of Transportation (U.S. Coast Guard) (vice chair), Department of Commerce (National Oceanic and Atmospheric Administration), Department of the Interior, Department of Agriculture, Department of Defense, Department of State, Department of Justice, Department of Transportation (Research and Special Programs Administration), Department of Health and Human Services, Federal Emergency Management Agency, Department of Energy, Department of Labor, Nuclear Regulatory Commission, General Services Administration, and Department of the Treasury.

The NRT document *Hazardous Materials Emergency Planning Guide* (NRT-1) was first published and distributed in March 1987 and discussed the planning process and elements required to develop an effective hazardous materials/WMD emergency response plan [9]. The NRT released a 2001 update to NRT-1 to address outdated information and to include guidance on integrating local emergency response plans prepared and updated by LEPCs with planning requirements in recent legislation.

(1) Identify the location of both the emergency response plan and/or standard operating procedures
(2) Identify the role of the awareness level personnel during hazardous materials/WMD incidents

To fulfill the competency as required in 4.4.1(2), the definition of personnel at the awareness level is identified in Chapter 3. The definition emphasizes the need to act defensively in the name of safety and to call for trained personnel. The role is further identified in the goal statement for awareness level personnel.

(3) Identify the following basic precautions to be taken to protect themselves and others in hazardous materials/WMD incidents:

At the awareness level, personnel are required in 4.4.1(3) to take protective actions to isolate the hazard and to evacuate threatened persons from the immediate area. If evacuation is not possible, the personnel are to provide in-place protection until additional resources become available. In some cases, in-place protection is all that is required. The *Emergency Response Guidebook* recommends that persons protected in place be warned to stay far away from windows with a direct line of sight of the scene because windows can explode during a fire or explosion and shower glass or metal fragments.

(a) Identify the precautions necessary when providing emergency medical care to victims of hazardous materials/WMD incidents

Personnel at the awareness level do not need to be concerned about providing emergency medical care to victims of hazardous materials/WMD incidents. The victim could be contaminated, and decontamination procedures must be considered. Hazards exist for both victim and responder.

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Awareness level personnel might not be wearing respiratory protection or any other personal protective clothing that would protect them from the more severe hazards. The number of times both victim and responder can be exposed is limited only by the specific circumstances of the incident. In accordance with 4.4.1(3)(a), personnel must understand potential dangers so that they do not become victims while attempting to rescue someone else.

(b) Identify typical ignition sources found at the scene of hazardous materials/WMD incidents

In accordance with 4.4.1(3)(b), personnel must recognize sources of ignition, which include open flames; smoking materials; cutting and welding operations; heated surfaces; frictional heat; radiant heat; static, electrical, and mechanical sparks; and spontaneous ignition, such as occurs during heat-producing chemical reactions or is produced by pyrophoric materials.

(c)* Identify the ways hazardous materials/WMD are harmful to people, the environment, and property

A.4.4.1(3)(c) These include thermal, mechanical, poisonous, corrosive, asphyxiating, radiological, and etiologic. They can also include psychological harm.

The term *etiologic* used in A.4.4.1(3)(c) refers to the set of factors that contributes to the cause of a disease.

(d)* Identify the general routes of entry for human exposure to hazardous materials/WMD

Each hazard class has the possibility of having multiple routes of entry into the body, but the more common ones can be described as follows:

- Contact: The process in which a corrosive material (Class 8) damages skin or body tissue through touching. Acids and alkalis can cause severe burns. If the skin is broken or an open wound is present, another entry route exists. Explosions (Class 1) would have a serious contact consequence.
- Absorption: The process in which one substance penetrates the inner structure of another. Hydrogen cyanide (Class 2), for example, can be absorbed through the skin with fatal results.
- Inhalation: Breathing the substance, which can cause severe damage. Examples of damaging substances include chlorine and ammonia (Class 2), poisonous materials and infectious substances (Class 6), and some radioactive materials (Class 7).
- Ingestion: The introduction of a hazardous material into the body through the mouth. Toxic substances can be present in drinking water and in food. Examples of hazardous materials/WMD are poisonous materials and infectious substances (Class 6). Radioactive materials (Class 7) can do even more harm when ingested.

Obviously, proper PPE is important, and personnel must fully understand both the potential hazards and the appropriate safeguards.

◆ **NFPA 1072 NOTE**

NFPA 1072 does not require knowledge of the routes of entry until Chapter 5; however, it should be included at the awareness level.

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

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Absorption includes entry through the skin, eyes, or membranes. Inhalation includes breathing the material. Ingestion involves taking the material in through the mouth. Injection includes entry through a wound or cut.

(4)* Given examples of hazardous materials/WMD and the identity of each hazardous material/WMD (name, UN/NA identification number, or type placard), identify the following response information:

A.4.4.1(4) If other sources of response information, including the MSDS, are provided to the hazardous materials/WMD responder at the awareness level in lieu of the current edition of the DOT *Emergency Response Guidebook*, the responder should identify response information similar to that found in the current edition of the DOT *Emergency Response Guidebook*.

The importance of personnel demonstrating their proficiency in using the various emergency response guides and other sources of information they might be required to consult is expressed in A.4.4.1(4). The ERG provides general information about the potential hazards of a number of products and outlines the emergency procedures to be used in handling incidents involving these products. Personnel should perform several exercises that allow them to demonstrate their skills at locating and interpreting the appropriate information both from the ERG and other documents.

(a) Emergency action (fire, spill, or leak and first aid)
(b) Personal protective equipment (PPE) recommended:

In the orange-bordered pages of the ERG, under the heading of Public Safety, each guide has PPE recommendations that personnel are required in 4.4.1(4)(b) to recognize. This section also includes equipment that is not recommended. For example, the guide for oxidizers warns that structural fire-fighters' protective clothing provides only limited protection.

◆ **NFPA 1072 NOTE**

NFPA 1072 does not address evacuation and shelter in place at the awareness level. These were deemed to be actions that are more likely to be initiated by operations level responders. At the awareness level, personnel are isolating and denying entry.

(i) Street clothing and work uniforms
(ii) Structural fire-fighting protective clothing
(iii) Positive pressure self-contained breathing apparatus (SCBA)
(iv) Chemical-protective clothing and equipment

At the awareness level, personnel are generally expected to take protective actions to isolate the hazard and to evacuate or direct threatened persons out of the hot zone without ever entering the hot zone themselves. In some cases, sheltering in-place protection is all that is required. The ERG recommends that persons sheltered in-place be warned to stay far away from windows with a direct line of sight of the scene because windows can explode during a fire or explosion and shower them with glass or metal fragments.

(5) Identify the definitions for each of the following protective actions:

Protective actions are the steps taken to preserve the health and safety of emergency personnel and the public during an incident involving the release of hazardous materials/WMD.

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(a) Isolation of the hazard area and denial of entry

Everyone not directly involved in the emergency response operations should be kept away from the affected area, and unprotected emergency personnel should not be allowed within the isolation area.

(b) Evacuation

Evacuation is the movement of everyone from a threatened area to a safe place. To perform an evacuation, enough time must be available to warn people, to get them ready to go, and to leave the area. Evacuation is likely to be the best protective action if enough time is available. Personnel should begin evacuating people who are nearby and those who are outdoors in direct view of the scene. Evacuees should be sent upwind by a specific route to a definite place far enough away from the contaminated area that they do not have to be moved again if the wind shifts. As additional help is acquired, the area should be expanded to be evacuated downwind and crosswind at least to the extent recommended in Commentary Table I.4.4. Even after people move to the distances recommended, they are not completely safe from harm and may have to be decontaminated. The evacuation distances were adjusted for many of the materials in the 2016 edition of the ERG.

(c)* Shelter-in-place

A.4.4.1(5)(c) "In-place protection," "shelter-in-place," and "protection in-place" all mean the same thing.

Sheltering in-place protection is used when an evacuation cannot be performed or when evacuating the public would put them at greater risk than directing them to stay. When using in-place protection, people are directed to go quickly inside a building and remain there until the danger has passed. People inside the building should be told to close all doors and windows and to shut off all ventilating, heating, and cooling systems.

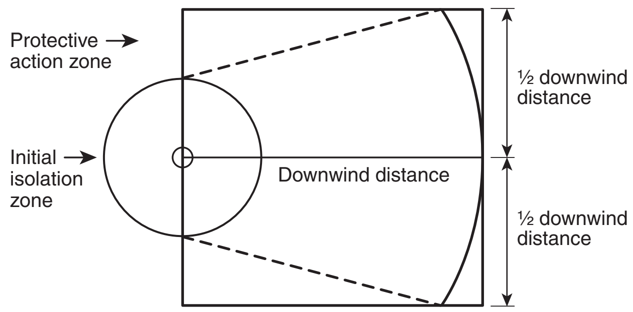
In-place protection might not be the best option if explosive vapors are present, if a long time is needed to clear the area of gas, or if the building cannot be tightly closed. Vehicles are not as effective as buildings for sheltering in-place protection but can offer some protection for a short period if the vehicle windows are closed and the ventilating system is shut off.

(6) Identify the size and shape of recommended initial isolation and protective action zones

The ERG provides initial isolation zones and protective action distances for vapors from hazardous materials/WMD that can produce poisonous effects. The shapes of those areas are shown in Exhibit I.4.13. Examples of these distances are provided in Commentary Table I.4.4 and the Table of Initial Isolation and Protective Action Distances on the green-bordered pages in the ERG.

EXHIBIT I.4.13

The shapes of the initial isolation zone and the protective action zone are identified here.



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COMMENTARY TABLE I.4.4 *Sample of Table of Initial Isolation and Protective Action Distances*

			Small Spills (from a small package or small leak from a large package)						*Large Spills (from a large package or from many small packages)*					
			First Isolate in all Directions		*Then Protect Persons Downwind During—*				*First Isolate in all Directions*		*Then Protect Persons Downwind During—*			
					Day		*Night*				*Day*		*Night*	
ID No.	*Guide*	*Name of Material*												
1005	125	Ammonia, anhydrous	30 m	(100 ft)	0.1 km	(0.1 mi)	0.2 km	(0.1 mi)	150 m	(500 ft)	0.8 km	(0.5 mi)	2.0 km	(1.3 mi)
1005	125	Anhydrous ammonia												
1008	125	Boron trifluoride	30 m	(100 ft)	0.1 km	(0.1 mi)	0.5 km	(0.4 mi)	300 m	(1000 ft)	1.7 km	(1.1 mi)	4.8 km	(3.0 mi)
1008	125	Boron trifluoride, compressed												
1016	119	Carbon monoxide	30 m	(100 ft)	0.1 km	(0.1 mi)	0.2 km	(0.1 mi)	200 m	(600 ft)	1.2 km	(0.8 mi)	4.8 km	(3.0 mi)
1016	119	Carbon monoxide, compressed												
1017	124	Chlorine	60 m	(200 ft)	0.4 km	(0.2 mi)	1.5 km	(1.0 mi)	500 m	(1500 ft)	3.0 km	(1.9 mi)	7.9 km	(4.9 mi)
1023		Coal gas	60 m	(200 ft)	0.2 km	(0.1 mi)	0.2 km	(0.1 mi)	100 m	(300 ft)	0.4 km	(0.2 mi)	0.5 km	(0.3 mi)
1023		Coal gas, compressed												
1026		Cyanogen	30 m	(100 ft)	0.1 km	(0.1 mi)	0.5 km	(0.3 mi)	60 m	(200 ft)	0.4 km	(0.2 mi)	1.7 km	(1.0 mi)
1026		Cyanogen gas												
1040		Ethylene oxide	30 m	(100 ft)	0.1 km	(0.1 mi)	0.2 km	(0.1 mi)	150 m	(500 ft)	0.9 km	(0.5 mi)	2.0 km	(1.3 mi)
1040		Ethylene oxide with Nitrogen												
1045		Fluorine	30 m	(100 ft)	0.1 km	(0.1 mi)	0.2 km	(0.1 mi)	100 m	(300 ft)	0.5 km	(0.3 mi)	2.3 km	(1.4 mi)
1045		Fluorine, compressed												
1048		Hydrogen bromide, anhydrous	30 m	(100 ft)	0.1 km	(0.1 mi)	0.3 km	(0.2 mi)	200 m	(600 ft)	1.2 km	(0.8 mi)	3.9 km	(2.4 mi)
1050		Hydrogen chloride, anhydrous	30 m	(100 ft)	0.1 km	(0.1 mi)	0.3 km	(0.2 mi)	60 m	(200 ft)	0.3 km	(0.2 mi)	1.3 km	(0.8 mi)
1051	117	AC (when used as a weapon)	60 m	(200 ft)	0.3 km	(0.2 mi)	1.0 km	(0.6 mi)	1000 m	(3000 ft)	3.7 km	(2.3 mi)	8.4 km	(5.3 mi)
1051	117													

Source: *Emergency Response Guidebook*, 2016, Table of Initial Isolation and Protective Action Distances, p. 292.

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(7) Describe the difference(s) between small and large spills as found in the Table of Initial Isolation and Protective Action Distances in the ERG or equivalent document

Awareness level personnel are required to know the ERG definitions of a small spill and a large spill, and to note the time of day that the incident has occurred. In determining the isolation and protective action distances, the ERG assumed that the maximum pool size for a small spill that formed a liquid pool was 48 ft (15 m) in diameter. A large spill pool was assumed to be a maximum of 60 ft (18 m) in diameter. The distances were calculated following a 30-minute period from the start of the release. This is why the ERG cautions that the distances are valid only for the 30-minute period following a spill.

(8) Identify the circumstances under which the following distances are used at a hazardous materials/WMD incidents:
  (a) Table of Initial Isolation and Protective Action Distances

These distances are used only for products whose vapors present an inhalation hazard, where the release does not involve a fire, and where no more than 30 minutes have elapsed between the spill and the response.

  (b) Isolation distances in the numbered guides

The isolation distances in the ERG are to be used when a hazardous material or its container is exposed to fire or when the product's vapors have potentially poisonous effects.

(9) Describe the difference(s) between the isolation distances on the orange-bordered guidebook pages and the protective action distances on the green-bordered ERG pages

The orange-bordered pages in the emergency action section of the ERG provide isolation distances for selected materials that are involved in a fire. The distances found in this table are the recommended downwind protective action distances for materials whose poisonous vapors are inhalation hazards.

For example, ethylene oxide has an isolation distance (as found in the orange-bordered pages) of 1 mi (1600 m) when involved in a fire. When ethylene oxide is not involved in a fire, this same material has a recommended isolation distance of 100 ft (30 m) for a small spill and 300 ft (90 m) for a large spill, according to the ERG.

The competency in 4.4.1(7) points out how important it is that personnel understand how to use the ERG or similar guidebooks.

(10) Identify the techniques used to isolate the hazard area and deny entry to unauthorized persons at hazardous materials/WMD incidents

At this level, personnel do not have many resources available to them. However, several steps can be taken to isolate a hazard area. A vehicle could be used to block a road or driveway, or a rope or other type of barricade could be placed across the entrance to the area to block access. Awareness level personnel can also notify law enforcement officials to begin diverting traffic from the scene. In a fixed facility, personnel can close a door or gate, use the public address system to announce the problem to the facility's occupants or notify security.

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Awareness level personnel are urged to approach with caution whenever an incident is suspected to involve criminal or terrorist activity. The possibility exists that biological or chemical weapons could have contaminated an area, and secondary devices could be present.

4.4.2 Initiating the Notification Process. Given a hazardous materials/WMD incident, policies and procedures, and approved communications equipment, awareness level personnel shall initiate notifications at a hazardous materials/WMD incident, completing the following requirements:

(1) Identify policies and procedures for notification, reporting, and communications
(2) Identify types of approved communications equipment
(3) Describe how to operate approved communications equipment

Awareness level personnel must be familiar with the notification process they must follow to begin an effective response to a hazardous materials/WMD incident. This might only involve notifying the local fire or police department. In some fixed facilities, internal notification procedures can be used to initiate the response of private sector specialists, the plant fire brigade, or security personnel. Whatever the procedures, the proper notification process must be set in motion immediately.

4.5* Competencies — Evaluating Progress. (Reserved)

A.4.5 No competencies are currently required at this level.

4.6* Competencies — Terminating the Incident. (Reserved)

A.4.6 No competencies are currently required at this level.

References Cited in Commentary

1. *Emergency Response Guidebook* (ERG). Office of Hazardous Materials Initiatives and Training, PHH-50, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, 1200 New Jersey Avenue, SE East Building, 2nd Floor, Washington, DC 20590, http://phmsa.dot.gov/hazmat/library/erg, 2016.
2. *European Agreement Concerning the International Carriage of Dangerous Goods by Road* (ADR), United Nations, New York, NY, 2007.
3. *International Regulations Concerning the Carriage of Dangerous Goods by Rail* (RID), Intergovernmental Organization for International Carriage by Rail (OTIF), United Nations Economic Commission for Europe, Geneva, Switzerland.
4. Colonna, G., ed., *Fire Protection Guide to Hazardous Materials,* 14th ed., National Fire Protection Association, Quincy, MA, 2010.
5. NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, National Fire Protection Association, Quincy, MA, 2012.
6. ANSI Standard Z400.1, *Hazardous Industrial Chemicals — Material Safety Data Sheets — Preparation,* American National Standards Institute, Inc., New York, NY.
7. Title 29, Code of Federal Regulations, Part 1910.1200, "Hazard Communication," U.S. Government Publishing Office, Washington, DC, July 1, 2001.

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8. Title 18, Code of Federal Regulations, Chapter 113, Section 2331, "Crimes and Criminal Procedure," U.S. Government Publishing Office, Washington, DC.

9. NRT-1, *Hazardous Materials Emergency Planning Guide*, U.S. National Response Team, Washington, DC 20592, 2001.

Additional References

Cote, A., ed., *Fire Protection Handbook*®, 20th ed., National Fire Protection Association, Quincy, MA, 2008.

U.S. Air Force Manual, 91-201, *Explosives Safety Standards*, Figure 2.2, released October 18, 2001.

Responder, Fire Engineering, New York, 1989.

Title 28, Code of Federal Regulations, Part 0.85, U.S. Government Publishing Office, Washington, DC.

Title 29, Code of Federal Regulations, Part 1910, U.S. Government Publishing Office, Washington, DC.

Title 40, Code of Federal Regulations, Part 261, U.S. Government Publishing Office, Washington, DC.

Title 49, Code of Federal Regulations, Part 173, U.S. Government Publishing Office, Washington, DC.

Title 49, Code of Federal Regulations, Part 178, U.S. Government Publishing Office, Washington, DC.

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5 Competencies for Operations Level Responders

Competencies for operations level responders build on those for awareness level personnel. In the 2017 edition of NFPA 472, competencies for operations level personnel are addressed in Chapter 5, and additional mission-specific competencies are addressed in Chapter 6. When a training entity designs courses for operations level responders, it is up to the authority having jurisdiction (AHJ) to choose the appropriate mission-specific competencies of Chapter 6 to include in that training. For example, many jurisdictions will certainly be interested in personal protective equipment (PPE) and decontamination as additional operations level competencies, but they might not be as concerned with evidence preservation or sampling because those duties can be assigned to other personnel.

5.1 General.

5.1.1 Introduction.

5.1.1.1* The operations level responder shall be that person who responds to hazardous materials/weapons of mass destruction (WMD) incidents for the purpose of protecting nearby persons, the environment, or property from the effects of the release.

Δ **A.5.1.1.1** Operations level responders need only be trained to meet the competencies in Chapter 5. The competencies listed in Chapter 6 (mission-specific competencies) are not required and should be viewed as optional at the discretion of the AHJ based on an assessment of local risks. The purpose of Chapter 6 is to provide a more effective and efficient process so that the AHJ can match the expected tasks and duties of its personnel with the required competencies to perform those tasks. Table A.5.1.1.1 is a sample operations level responder matrix.

Table A.5.1.1.1 is designed to help users of this standard determine which competencies in Chapters 5 and 6 can be utilized to ensure that operations level responders have the appropriate knowledge and skills to perform their expected tasks. These competencies are above the competencies contained in Chapter 5 and are optional. This matrix is provided only as a sample. The selection of competencies should always be based on the expected mission and tasks, as assigned by the AHJ.

5.1.1.2 The operations level responder shall be trained to meet all competencies at the awareness level *(see Chapter 4)* and the competencies defined in Sections 5.2 through 5.5 of this chapter.

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TABLE A.5.1.1.1 *NFPA 472 Operations Level Responder Matrix*

	Competencies						
Responders	***Use PPE***	***Perform Technical or Mass Decontamination****	***Perform Product Control***	***Perform Air Monitoring***	***Perform Victim Rescue and Removal***	***Preserve Evidence and Perform Sampling***	***Respond to Illicit Lab Incident***
Fire fighters expected to perform basic defensive product control measures	X	X	X	—	—	—	—
Emergency responders assigned to a decontamination company or decontamination strike force	X	X	—	—	—	—	—
Emergency responders assigned to a unit tasked with providing rapid rescue and extraction from a contaminated environment	X	X	—	X	X	—	—
Emergency responders assigned to provide staffing or support to a hazardous materials response team	X	X	X	X	X	—	—
Law enforcement personnel involved in investigation of criminal events where hazardous materials are present	X	X	—	X	—	X	X
Law enforcement personnel involved in investigation of incidents involving illicit laboratories	X	X	—	X	—	X	X
Public health personnel involved in the investigation of public health emergencies	X	X	—	—	—	X	—
Environmental health and safety professionals who provide air monitoring support	X	X	—	X	—	—	—

* The scope of the decontamination competencies would be based on whether the mission involves the responder being the "customer" of the decontamination services being provided or is part of those responders who are responsible for the set-up and implementation of the decontamination operation.

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5.1.1.3* The operations level responder shall receive additional training to meet applicable governmental occupational health and safety regulations.

Some examples of additional training would include programs from the U.S. Department of Transportation (DOT), U.S. Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA) regulatory courses, and any local or state standard operating procedures.

A.5.1.1.3 Operations level responders who are expected to perform additional missions should work under the direction of a hazardous materials technician, a written emergency response plan or standard operating procedures, or an allied professional.

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5.1.2 Goal.

Δ **5.1.2.1** The goal of the competencies in this chapter shall be to provide operations level responders with the knowledge and skills to perform the competencies in 5.1.2.2 in a safe manner.

Safety, which is the goal of 5.1.2, must be considered in every action taken at an incident scene because risks are always present. By demonstrating the knowledge and skills that follow, a responder should be able to reduce the risk inherent in a hazardous materials incident. A risk-based response process should be put in place by operations level responders to ensure the safety of personnel. This is a systematic process by which responders analyze a problem involving hazardous materials/weapons of mass destruction (WMD), assess the hazards, evaluate the potential consequences, and determine appropriate response actions based on facts, science, and the circumstances of the incident.

5.1.2.2 When responding to hazardous materials/WMD incidents, operations level responders shall be able to perform the following tasks:

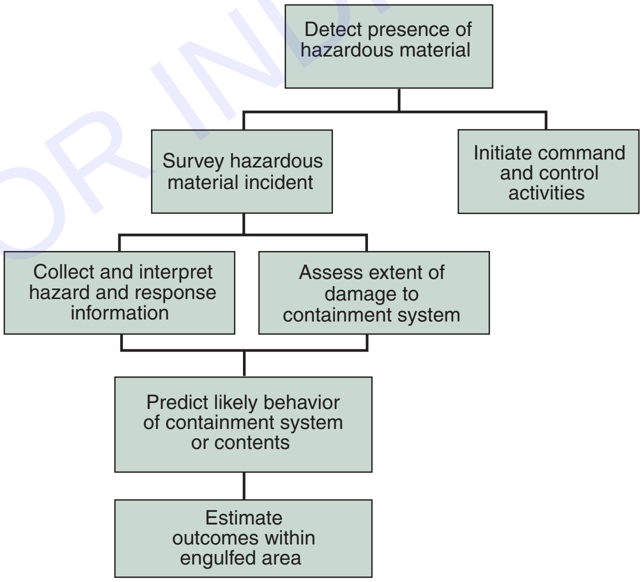
(1) Identify the scope of the problem and potential hazards, harm, and outcomes by completing the following tasks:

Charles Wright notes the following in the *Fire Protection Handbook*®:

> "The analysis process begins when a responder receives notification of a problem and continues throughout the incident, typically at the scene threatened by any hazardous materials involved." [1] p. 13–121

Outcomes are the direct and indirect results or consequences associated with an emergency. Direct outcomes are considered in terms of people, property, and/or the environment as shown in Exhibit I.5.1.

EXHIBIT I.5.1



This flow diagram displays the tasks associated with analyzing a hazardous material problem.

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(a) Survey a hazardous materials/WMD incident to identify the containers and materials involved and to identify the surrounding conditions

According to Charles Wright, the incident survey should be done from a safe distance so that the responder is not exposed to any released materials [1]. The following steps should be completed during the survey of a hazardous material incident:

1. Identify each containment system by type, identifier, and size. Containment systems (see Commentary Table I.5.1) fit into one of the following three types:

- Nonbulk
- Bulk
- Facility containment systems

COMMENTARY TABLE I.5.1 *Types of Nonbulk, Bulk, and Facility Containment Systems*

Transportation		
Nonbulk	***Bulk***	***Facility Containment Systems***
Bags	Bulk bags	Buildings
Bottles	Bulk boxes	Machinery
Boxes	Cargo tanks	Open piles (outdoors and indoors)
Carboys	Covered hopper cars	Piping
Cylinders	Freight containers	Reactors (chemical and nuclear)
Drums	Gondolas	Storage bins, cabinets, or shelves
Jerricans	Intermediate bulk	
Multicell		
Tanks and storage vessels packages	Pneumatic hopper trailers	
Wooden barrels	Portable tanks and bins	
	Protective overpacks for radioactive materials	
	Tank cars	
	Ton containers	
	Van trailers	

Source: *Fire Protection Handbook*, 20th edition, Table 13.8.4.

The containment system identifier (i.e., facility or carrier name and number) is used to differentiate one containment system from another and to allow tracking of that container throughout the incident. The quantity within (or capacity of) the containment system can be obtained from markings on the container or entries on the shipping papers or facility documents. The quantity information helps indicate the magnitude of the problem.

2. Identify the name, DOT identification number, or placard applied to each hazardous material containment system. This information provides a means of accessing various sources of hazard and response information. For facilities, sources for identifying the material include pre-emergency planning documents, markings and color, contact with the facility manager, and review of appropriate safety data sheets (SDSs).

In transportation, the identity of the hazardous material can be determined from the DOT identification number, commodity stencil, type of placard or label applied, shipping paper entries, and manufacturer, shipper, or consignee contacts using the 24-hour emergency phone number on the shipping papers. Pipeline markers provide the name of the commodity or at least the name and phone number of the pipeline company.

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3. Identify leaking containment systems. Clues indicating leakage include material on the outside of the containment system, taste or smell, presence of vapor clouds, or the operation of a safety relief valve. If possible during the survey, the form of the released material (solid, liquid, or gas) and the location of the release should be noted. See Exhibit I.5.2.
4. Identify the surrounding conditions. Surrounding conditions should be noted when surveying hazardous material incidents. These conditions include topography, land use (including utilities and fiber-optic cables), accessibility, weather conditions, bodies of water (including recharging ponds), public exposure potential, and the nature and extent of injuries.

EXHIBIT I.5.2

Damaged containers, which result in leaking chemicals, help a responder to establish whether a release has occurred. Other indicators include errant smells, the presence of vapor clouds, or unusually high-pitched sounds indicating a pressure release. (Source: Marvin Nauman/FEMA photo)

If a facility is involved, information about floor drains, ventilation ducts, air returns, and so forth should be gathered as appropriate.

The information collected in the incident survey should be reviewed to verify its accuracy. For example, if the shipping paper identifies the material as a gas and a solid is being released, some of the information obtained might not be correct.

An understanding of the characteristics of various containment systems helps to verify information about the contents.

(b) Collect hazard and response information from the ERG; SDS; CHEMTREC/CANUTEC/SETIQ; governmental authorities; and shipper/manufacturer/carrier documents, including shipping papers with emergency response information and shipper/manufacturer/carrier contacts

It is very important for the responder to know what resources are available for providing technical assistance during hazardous materials emergencies and to know how to use those resources. Exhibit I.5.3 shows an incident analysis worksheet, which is a means of collecting hazard and response data.

(c) Predict the likely behavior of a hazardous material/WMD and its container, including hazards associated with that behavior

The responder is required to be able to assess the potential behavior of a hazardous material/WMD and its container. Some questions the responder should ask include: Is it likely to explode? Is it nonflammable? Is it corrosive? Will the container rupture violently?

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EXHIBIT I.5.3

Commonwealth of Virginia Hazardous Materials
Incident Analysis Worksheet - Chemical Hazard Profile

PRODUCT ID

UN NUMBER ______ STCC NUMBER ______ CAS NUMBER ______

CHEMICAL NAME ______ HAZARD CLASS ______

NFPA 704 HEALTH ______ FIRE ______ REACTIVITY ______ SPECIAL ______

HIGH ENERGY EVALUATION

HAZARD	**ACTION**	**NO**	**YES**	**PROFILE**
EXPLOSIVE		______	______	**EXPLOSIVE**
REACTIVE	IN CONTACT WITH OTHER CHEMICALS	______	______	**REACTIVE**
	REACTIVE WITH OTHER CHEMICALS	______	______	
	WATER REACTIVE	______	______	
	AIR REACTIVE	______	______	
	VIOLENT POLYMERIZATION	______	______	
	CHEMICAL UNSTABLE	______	______	
RADIOACTIVE		______	______	**RADIOACTIVE**

PHYSICAL STATE

AMBIENT TEMP ______ BOILING POINT ______ MELTING POINT ______

EVALUATION	**YES**	**PROFILE**
BOILING POINT **BELOW** AMBIENT TEMPERATURE	______	**GAS**
BOILING POINT **BELOW** 300°F BUT ABOVE AMBIENT TEMPERATURE	______	**LIQUID / GAS**
BOILING POINT **ABOVE** AMBIENT TEMPERATURE AND ABOVE 300°F	______	**LIQUID**
MELTING POINT **ABOVE** AMBIENT TEMPERATURE	______	**SOLID**

EVALUATE GAS HAZARDS

					PROFILE
FLASH POINT	______	BELOW 100°F			**FLAMMABLE**
		ABOVE 100°F			**COMBUSTIBLE**
IGN. TEMP	______	LEL	______	UEL ______	
VAPOR DENSITY	______	BELOW 1			**RISE**
		ABOVE 1			**SINK**
CARCINOGEN		NO	______	YES ______	**CARCINOGEN**

			INHALATION HAZARD
LC_{50}		LESS THAN 100 PPM (0.01% v/v)	**HIGH**
PEL	______	101 to 1,000 PPM (0.01% to 0.1% v/v)	**MODERATE**
STEL	______	1,000 to 10,000 PPM (0.1% to 1.0% v/v)	**LOW**
IDLH	______		
pH	______	0 – 3 or 12 – 14	**CORROSIVE**

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This worksheet is a sample hazardous materials incident survey form. (Source: Virginia Department of Emergency Management)

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EXHIBIT I.5.3 Continued

Commonwealth of Virginia Hazardous Materials
Incident Analysis Worksheet - Chemical Hazard Profile

EVALUATE LIQUID HAZARDS

					PROFILE
SOLUBLE IN WATER		NO	______	YES ______	**SOLUBLE**
SPECIFIC GRAVITY	______	BELOW 1			**FLOATS**
		ABOVE 1			**SINK**
CARCINOGEN		NO	______	YES ______	**CARCINOGEN**

			INHALATION HAZARD
LC_{50}		LESS THAN 50 mg/Kg	**EXTREME**
PEL	______	50 mg/Kg to 500 mg/Kg	**HIGH**
STEL	______	500 mg/Kg to 5 g/Kg	**MODERATE**
IDLH	______	5 g/Kg to 15 g/Kg	**LOW**
pH	______	0 – 3 or 12 – 14	**CORROSIVE**

EVALUATE SOLID HAZARDS

				PROFILE
SUBLIME	NO	______	YES ______	EVALUATE GAS
COMBUSTIBLE	NO	______	YES ______	COMBUSTIBLE
CARCINOGEN	NO	______	YES ______	CARCINOGEN

			INHALATION HAZARD
LD_{50}		LESS THAN 50 mg/Kg	**EXTREME**
PEL	______	50 mg/Kg to 500 mg/Kg	**HIGH**
STEL	______	500 mg/Kg to 5 g/Kg	**MODERATE**
IDLH	______	5 g/Kg to 15 g/Kg	**LOW**
pH	______	0 – 3 or 12 – 14	**CORROSIVE**

OTHER INFORMATION

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

As the responder collects the information necessary to predict the behavior of the material and its container, he or she can begin to estimate the potential harm it presents, which is required in 5.1.2.2(1)(d). Generally, initial assessments should be very conservative and should look at the worst possible event that could occur. As more information becomes available, these predictions can be modified.

(2) Plan an initial response to a hazardous materials/WMD incident within the capabilities and competencies of available personnel and personal protective equipment (PPE) by completing the following tasks:

In 5.1.2.2(2), a plan of action is required to be developed using the information gathered and the estimates of potential harm. This plan establishes the responders' objectives in controlling the incident. Any plan of action must be formulated based on the resources that can be brought to bear on the mitigation process. Operations level responders would perform to the extent their training and equipment allowed and would be required to summon appropriate help.

(a) Describe the response objectives for the hazardous materials/WMD incident

The response objectives for a hazardous materials/WMD incident focus on controlling events as they occur.

(b) Describe the response options available for each objective

Response options are the actions the responders can take safely without coming in direct contact with the hazardous materials/WMD involved in the incident. These actions can be done safely with the protective clothing and equipment available to the responder at this level, providing they have received applicable training. See 6.1.1.1 in Chapter 6.

(c) Determine whether the PPE provided is suitable for implementing each option

Individuals involved in emergency response must understand their limitations, particularly concerning PPE and equipment. Responders must also understand that clothing and equipment requirements vary depending on the material involved in an incident.

Fire fighters responding to structural fires generally use the same type of protective clothing each time. In hazardous materials incidents, however, what is appropriate for one material could be totally unacceptable for another. Responders using air-purifying respirators at one incident might require self-contained breathing apparatus (SCBAs) at another incident.

(d) Describe emergency decontamination procedures

Emergency decontamination might be necessary if a life-threatening exposure has occurred and the individual needs immediate medical attention that is delayed due to contamination. Technical decontamination is not available until trained and equipped responders arrive on the incident scene.

(e) Develop a plan of action, including safety considerations

A site safety plan or incident action plan (IAP) with safety issues identified must be developed by the incident commander (IC) or unified command for incidents involving the release of hazardous materials.

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(3) Implement the planned response for a hazardous materials/WMD incident to favorably change the outcomes consistent with the emergency response plan and/or standard operating procedures by completing the following tasks:

Once responders have analyzed the incident and planned the initial response, they must implement that response in accordance with 5.1.2.2(3). Although some might expect that this process is lengthy, it frequently takes only a few minutes.

For example, a responder might be able to analyze, plan, and implement the response to a small spill of home heating fuel in a nonthreatening location within minutes. However, if the incident involved an 8000 gal (30,280 L) gasoline tank truck overturned on a congested highway, the process would take longer. No matter how severe the incident, the responder should go through the same planning process to ensure that nothing was overlooked.

(a) Establish and enforce scene control procedures, including control zones, emergency decontamination, and communications

Scene control is critical in keeping both responders and the public safe, so it should be established immediately. Responders can do this by establishing control zones and an exclusion perimeter to keep the public away from the working areas of the emergency responders.

(b) Where criminal or terrorist acts are suspected, establish a means of evidence preservation
(c) Initiate an incident command system (ICS) for hazardous materials/WMD incidents

When arriving on the scene, operations level responders must begin implementing the incident command system (ICS) in the local emergency response plan (ERP). An ICS identifies the roles and responsibilities that help personnel control the incident safely and effectively.

(d) Perform tasks assigned as identified in the incident action plan

Operations level responders must be familiar with the ICS and incident management system (IMS) and work from the IAPs developed by the planning section. These plans will address the mission objectives, and the safety issues raised by them.

(e) Perform emergency decontamination

Operations level responders must be able to demonstrate the agency's standard operating procedures for emergency decontamination to both civilians and responders. This process is critical to the health of civilians and responders who may be accidentally contaminated and suffer serious effects.

(4) Evaluate and report the progress of the assigned tasks taken at a hazardous materials/WMD incident to ensure that the response objectives are met in a safe, effective, and efficient manner by completing the following tasks:

Part of an effective response is the ongoing evaluation of the actions that have been undertaken and their effectiveness. Operations level responders must not base their actions solely on their initial assessment of conditions at the site because these conditions can, and do, change. For example, the wind could shift, rain could begin to fall, or resources could become unavailable.

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(a) Evaluate the status of the actions taken in accomplishing the response objectives

Some questions responders should ask include the following: Are the actions having the desired results? Is the incident stabilizing, or is it intensifying? Responders might find that the actions they chose initially are no longer correct because they no longer suit the circumstances. The weather could have changed, for example, or the arrival of additional personnel could have been delayed.

(b) Communicate the status of the planned response

The incident commander must be kept informed of the effectiveness of the actions. An effective response cannot be carried out without frequent status reports, which are required in 5.1.2.2(4)(b). Everyone must be aware of this and provide the necessary information through the appropriate channels.

5.2 Competencies — Analyzing the Incident.

Δ **5.2.1* Surveying Hazardous Materials/WMD Incidents.** Given scenarios involving hazardous materials/WMD incidents, the operations level responder shall collect information about the incident to identify the containers, the materials involved, leaking containers, and the surrounding conditions released by completing the requirements of 5.2.1.1 through 5.2.1.6.

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.

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.

Charles Wright notes the following in *Fire Protection Handbook*:

> After detecting the presence of hazardous materials in an emergency, and while initiating command and control activities, the next task is to survey or inventory the hazardous materials incident. Completion of this task provides an inventory of the containment systems and materials involved, materials released, and surrounding conditions. This incident survey should be conducted from a safe distance, using aided vision, without exposure to the released materials. [1] p. 13–126

Recognition of the shapes of various containers and knowledge of what each normally holds, which are requirements of 5.2.1, helps the responder verify the presence of hazardous materials and could help in the identification of the particular materials involved in an incident. See Exhibit I.5.4 for an example of containers that hold a specific product and Exhibit I.5.5 for an illustration of the parts of a typical tank car.

Δ **5.2.1.1*** Given examples of the following pressure containers, the operations level responder shall identify each container by type, as follows:

(1) Bulk fixed facility pressure containers
(2) Pressure tank cars
(3) High-pressure cargo tanks

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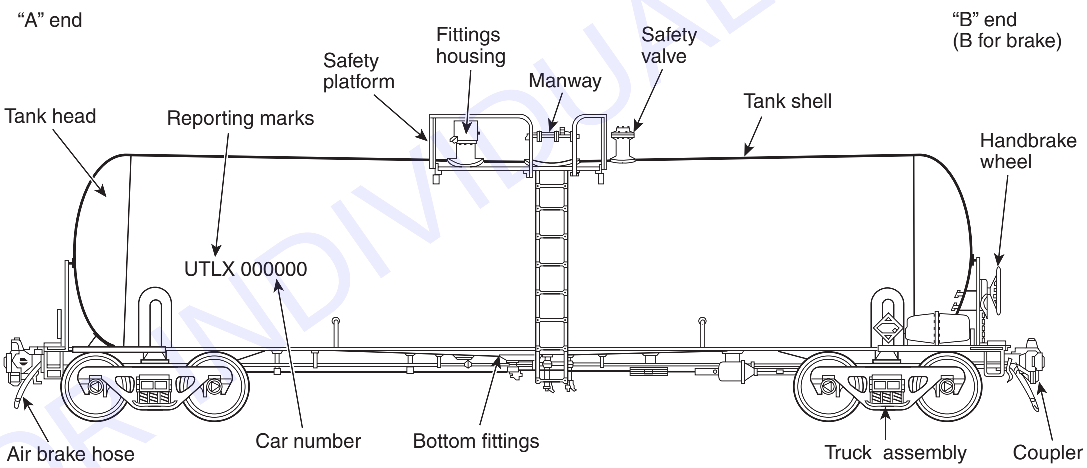
EXHIBIT I.5.4

The containers shown hold a liquefied gas product maintained under cryogenic conditions. (Source: FroggyFrogg/iStock/Thinkstock)

EXHIBIT I.5.5



The diagram shows a tank car with basic features identified. (Source: Union Tank Car Company)

High pressure is considered to be more than 100 psi (689 kPa). The tank with capacities of 2500 gal to 11,500 gal (9.46 m^3 to 43.5 m^3) has a circular cross-section and rounded ends. The construction is single shell and noninsulated. The upper two-thirds of the tank is painted white or with reflective color to reduce potential heating from the sun. A common product carried in this tank is propane.

(4) Compressed gas tube trailers
(5) High-pressure intermodal tanks
(6) Ton containers

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(7) Y-cylinders
(8) Compressed gas cylinders

Metal cylinders hold a variety of chemical products under pressure. The cylinders can vary in size from a few pounds to several thousand. A 20 lb (9.1 kg) propane cylinder is common for home barbecues, and larger cylinders up to 250 lb (113.4 kg) are used as a home fuel source. A relief valve or frangible disk provides protection in case of fire or overpressure.

(9) Portable and horizontal propane cylinders
(10) Vehicle-mounted pressure containers

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.

The packaging, storage, and transport containers in 5.2.1.1 vary greatly, depending on the type of material (solid, liquid, or gas), the quantity, and the associated hazards. Liquids can be contained in drums ranging in size from 1 gal up to 85 gal overpack drums, encasing, for example, corrosive liquids (Class 8). Drums can be made from plastic-lined and unlined fiberboard to plastic (poly) steel, stainless steel, and aluminum. There are also carboys for acids and caustics, combination packaging for etiological agents (Class 6), multicell packaging, and plastic and glass bottles that hold, for example, organic peroxides (Class 5).

Cylinders can be used for pressurized, liquefied, and dissolved gases, such as aerosol containers with propane (Class 2.1), uninsulated containers with chlorine (Class 2.3), and cryogenic insulated cylinders with cryogenic liquid (Class 2.2).

Many household products, such as poisonous pesticides, insecticides, caustic powders, and fertilizers (Class 5), are contained in cloth, burlap, or plastic bags; jugs or jars; or cardboard boxes. Totes, bulk bags, and drums can hold flammable solids, such as calcium carbide and water treatment chemicals (Classes 2, 3, and 4), or combustible (Class 4), toxic (Class 6), and corrosive materials (Class 8).

5.2.1.1.1 Given examples of the following cryogenic containers, the operations level responder shall identify each container by type, as follows:

Charles Wright notes the following in the *Fire Protection Handbook*'s section on Rail Transportation Systems: "Tank cars are classed according to their construction, features, and fittings. The tank's specification determines the product it may transport."

(1) Bulk fixed facility cryogenic containers
(2) Cryogenic liquid tank cars
(3) Cryogenic liquid cargo tanks

Cryogenic liquid tanks, such as the one shown in Exhibit I.5.6, are insulated double shell with pressure-relief protection. The product carried is a gas that is cooled to at least –130°F (–90°C) until it becomes a liquid. The space between the shells is placed under a vacuum as part of the cooling process. The tank ends are flat. The piping is usually at the end, contained in a box with double doors. The material is kept in liquid form through refrigeration. Heat from the sun can increase the pressure on the material, and discharging vapors from top rear relief valves is normal.

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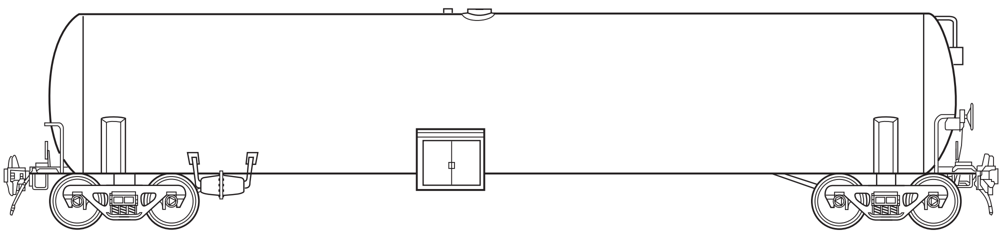

EXHIBIT I.5.6

The diagram shows a typical cryogenic liquid tank car. (Source: Union Pacific Railroad)

Cryogenic liquid tanks are heavily insulated with a vacuum in the space between the outer and inner shells. The nonpressure tanks are designed to carry refrigerated commodities such as carbon dioxide, nitrogen, argon, hydrogen, and oxygen.

(4) Intermodal cryogenic containers
(5) Cryogenic cylinders
(6) Dewar flasks

Dewar flasks are containers within a container. Insulating material and the use of a vacuum space keep the cryogenic material cooled and in a liquid state.

5.2.1.1.2 Given examples of the following liquids-holding containers, the operations level responder shall identify each container by type, as follows:

(1) Bulk fixed facility tanks

Dry bulk cargo tanks are large uninsulated containers with bottom hoppers for unloading. The tanks are used for hauling dry product or sometimes a slurrylike concrete in bulk. Common products carried include fertilizer, grain, and other food products but can include toxic materials.

(2) Low-pressure tank cars
(3) Nonpressure liquid cargo tanks

Nonpressure tanks, also called atmospheric tanks, are designed for pressures of 0 psi to 0.5 psi (4 kPa).

(4) Low-pressure chemical cargo tanks

Pressure tanks are divided into low-pressure storage tanks with pressures of 0.5 psi to 15 psi (4 kPa to 103 kPa) and pressure vessels, with pressures above 15 psi (103 kPa). Exhibit I.5.7 shows some examples of low-pressure tanks.

Low pressure is considered to be less than 40 psi (275.8 kPa). The most common construction is doubleshell with insulation, featuring one or two compartments with overturn protection. The tank cross-section is circular, except for some insulated tanks. Uninsulated tanks have a single compartment and stiffening rings around the tank. The contents can include a variety of chemicals, and the capacity is between 2000 gal and 7000 gal (7.57 m^3 and 26.5 m^3).

(5) 101 and 102 intermodal tanks
(6) Flexible intermediate bulk containers/rigid intermediate bulk containers (FIBCs/RIBCs)

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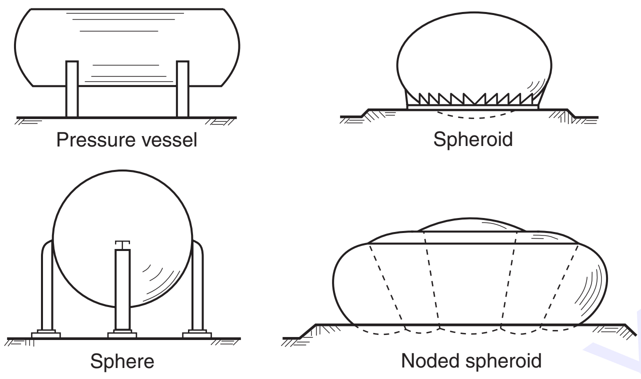
EXHIBIT I.5.7

The drawing illustrates common types of low-pressure tanks or pressure vessels.



(7) Flexible bladders
(8) Drums
(9) Bottles, flasks, carboys

A carboy is a glass bottle with a protective cover to keep the bottle from breaking during transportation or if the container is dropped. A common size is 1 gal (3.78 L).

Cryogenic liquid tank cars carry low-pressure [25 psi (172 kPa) or lower] liquids refrigerated to −130°F (−90°C) and below. The liquids typically include argon, ethylene, hydrogen, nitrogen, and oxygen. A cryogenic liquid tank car is actually a tank within a tank, and the inner tank is made of stainless steel or nickel. The space between the inner and outer tanks is filled with insulation and is under a vacuum. [1]

Wright notes the following in the Rail Transportation Systems section of *Fire Protection Handbook*:

> Nonpressure tank cars, also known as general-service tank cars or acid-service tank cars, transport a wide variety of hazardous and nonhazardous materials at low pressures.
>
> Nonpressure tank cars transport hazardous materials such as flammable and combustible liquids, flammable solids, oxidizers, organic peroxides and poison, corrosive materials, and molten solids. They also transport nonhazardous materials, such as tallow, clay slurry, corn syrup, and other food products.
>
> Tank test pressures for nonpressure tank cars range from 430 kPa to 689 kPa (60 psi to 100 psi). Capacities range from 15 m^3 to 181 m^3 (4000 to 45,000 gal).
>
> Nonpressure tank cars are cylindrical with rounded heads. [1] p. 21–126.

These tanks are shown in Exhibits I.5.8 and I.5.9.

Wright notes the following in the Rail Transportation Systems section of the *Fire Protection Handbook*:

> Pressure tank cars typically transport hazardous materials, including flammable, nonflammable, or poisonous gases at higher pressures. However, pressure tank cars can transport other commodities, depending on the characteristics of the product or the process for loading and unloading the tank.
>
> Other products transported in pressure tank cars are ethylene oxide, pyrophoric liquids, sodium metal, motor fuel antiknock compounds, bromine, anhydrous hydrofluoric acid, and acrolein.
>
> Tank test pressures for these tank cars range from 100 psi to 600 psi (689 kPa to 4137 kPa). Pressure tank cars range in capacity from 4000 gal to 45,000 gal (15 m^3 to 170 m^3).
>
> Pressure tank cars are cylindrical, noncompartmented steel or aluminum tanks with rounded heads. They are top-loading, with fittings for loading and unloading, pressure relief, and gauging located inside protective housing mounted on a single manway.

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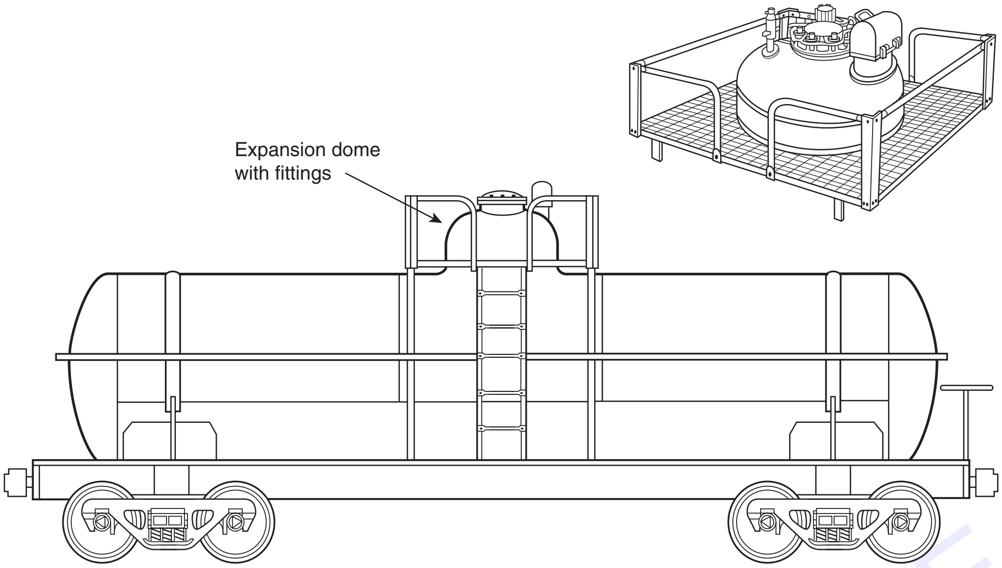
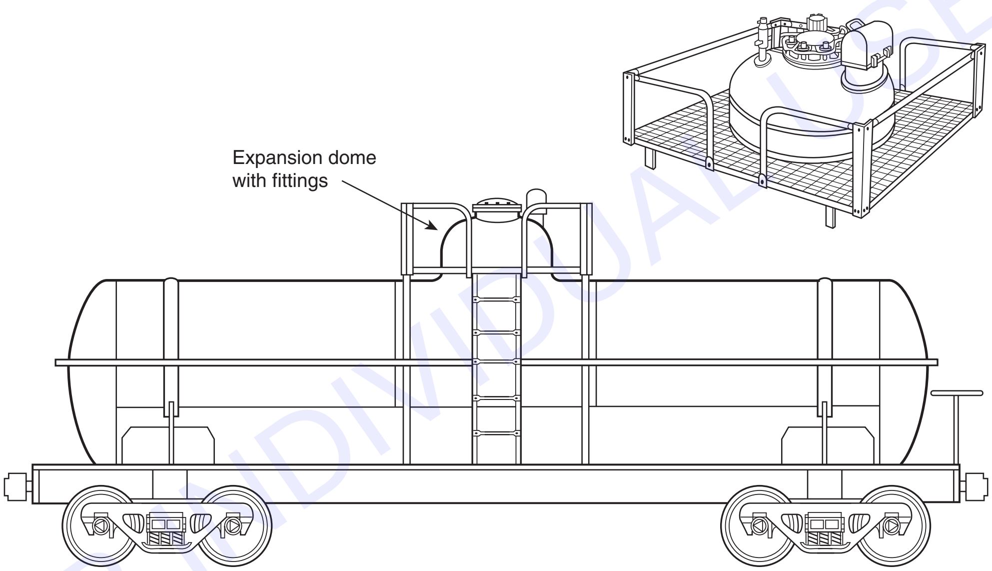
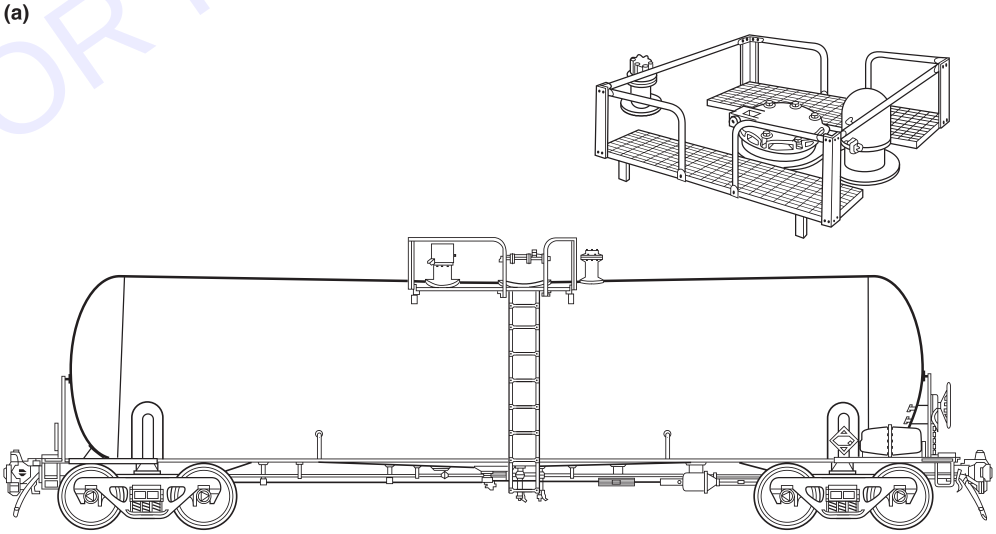


EXHIBIT I.5.8

The diagram shows a typical nonpressure tank car with an expansion dome. Older models, such as the one shown here, have the dome. (Source: Union Pacific Railroad)



(a)



(b)

EXHIBIT I.5.9

a) A typical old-style nonpressure tank car is shown here with an expansion dome, and b) the diagram shows a typical nonpressure tank car without an expansion dome, which is generally true of newer cars. (Source: Union Pacific Railroad)

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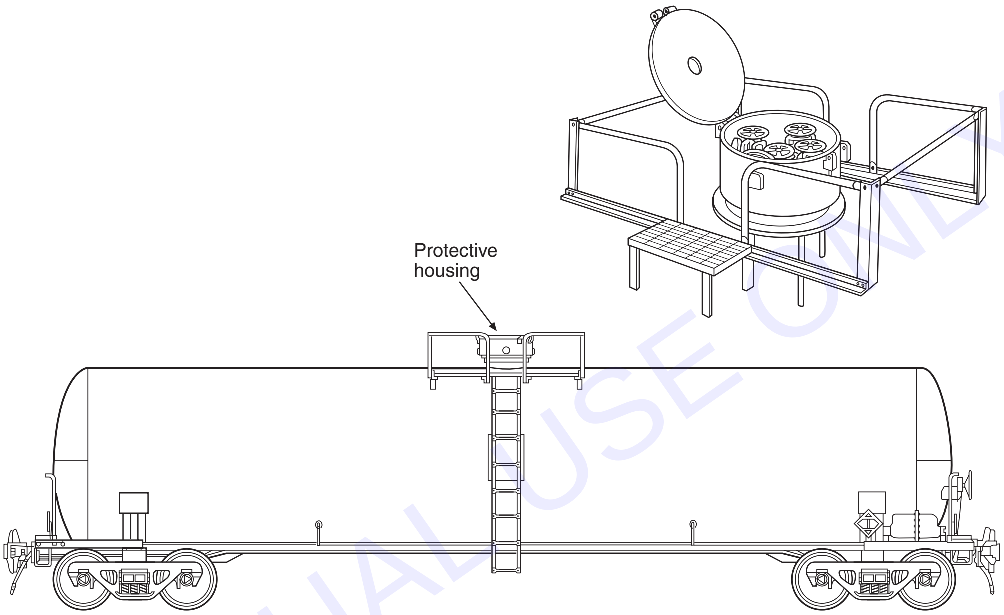
> Pressure tank cars may be insulated and/or thermally protected. The top two-thirds of pressure tank cars without insulation and without jacketed thermal protection will be painted white or another reflective color. [1] p. 21–128, 21–129.

See Exhibit I.5.10.

EXHIBIT I.5.10



The diagram shows a typical pressure tank car. (Source: Union Pacific Railroad)

An operations level responder is required to be able to identify intermodal (IM) tank containers, which are used more and more frequently in North America to transport a range of commodities, including an increasing number of hazardous materials. Among the factors that account for this increased use are the containers' improved safety, portability, and lower transportation costs. Tank containers also offer the benefits of a multimodal transport system. Because the containers consist of a single metal tank mounted inside a sturdy metal supporting structure, they can be used interchangeably on several modes of transport, such as railroad cars, tank trucks, and ships. [1]

Nonpressure tank containers, as shown in Exhibit I.5.11, are referred to as IM portable tanks. These containers are usually used to transport liquid or solid materials at pressures of up to 100 psi (689 kPa). [1]

Since 2003, construction and certification under DOT Specification IM 101, DOT Specification IM 102, and DOT Specification 51 tanks are no longer authorized by DOT, but tank containers built to these specifications may continue to transport hazardous materials provided they conform to current DOT regulations for specifications for UN portable tanks. They will continue to display the old specification markings, just like the international IMO 1, IMO 2, IMO 5, and IMO 7 specification markings for tank containers built to previous international standards.

Wright notes the following in the *Fire Protection Handbook*:

> Pressure tank containers are designed to accommodate internal pressures of 100 to 500 psi (690 to 3450 kPa) and are generally used to transport gases liquefied under pressure, such as LP-gas and anhydrous ammonia. Pressure tank containers may also carry liquids such as motor fuel antiknock compounds and aluminum alkyls. [1] pp. 21–132, 21–133

See Exhibit I.5.12 for an example of this type of container.

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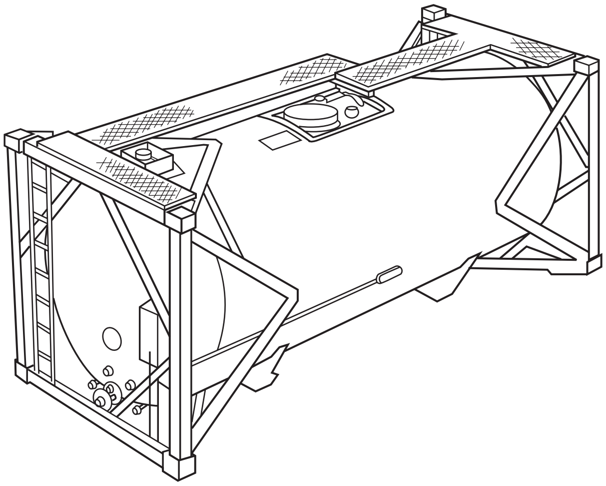
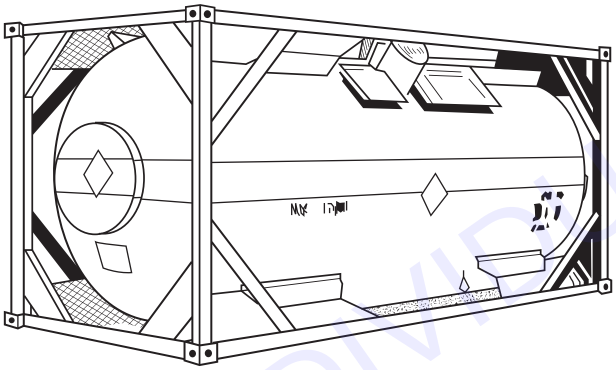
EXHIBIT I.5.11



The diagram illustrates a nonpressure tank container. (Source: Union Pacific Railroad)

EXHIBIT I.5.12



The diagram shows a typical pressure tank container. (Source: Union Pacific Railroad)

Cryogenic IM tanks, such as the one shown in Exhibit I.5.13, carry refrigerated liquid gases. Internationally they are called IMO Type 7 tank containers.

Tube modules, such as the one in Exhibit I.5.14, transport gases in high-pressure cylinders permanently mounted within an International Standards Organization (ISO) frame.

5.2.1.1.3 Given examples of the following solids-holding containers, the operations level responder shall identify each container by type, as follows:

(1) Bulk fixed facilities
(2) Railway gondolas, coal cars
(3) Dry bulk cargo trailers
(4) Intermodal tanks (reactive solids)
(5) FIBCs/RIBCs
(6) Drums

Drums are often metal cylinders holding 55 gal (208 L) of liquid, but they can be constructed of plastic or fiberboard to hold other products. A common size in use is the 55 gal (208 L) drum.

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EXHIBIT I.5.13

This is an example of a cryogenic IM tank. (Source: Union Pacific Railroad)

EXHIBIT I.5.14

This is an example of a tube module. (Source: Union Pacific Railroad)

(7) Bags, bottles, boxes

Nonpressurized cargo tanks are the most common on the road and have an elliptical cross-section. Construction is usually of aluminum. The tanks are often used for gasoline and diesel fuel but may contain any liquid.

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Bags can be many sizes and contain many types of products, from food to poisons. The construction material can be paper and fiber to plastic and plastic lined. Reinforced sacks can hold very large quantities.

NFPA 1072 changed terminology of "packaging" to "container."

◆ NFPA 1072 NOTE

5.2.1.1.4 Given examples of the following mixed-load containers, the operations level responder shall identify each container by type, as follows:

(1) Box cars
(2) Mixed cargo trailers
(3) Freight containers

In the *Fire Protection Handbook* section Storage of Flammable and Combustible Liquids, Anthony M. Ordile notes the following:

> Tanks can be installed aboveground, underground, or, under certain conditions, inside buildings. [1] p. 7–15

It is important that the responder be able to identify the difference between pressure and non-pressure tanks.

Δ **5.2.1.1.5** Given examples of the following containers, the operations level responder shall identify the characteristics of each container by type as follows:

(1) Intermediate bulk container (IBC)
(2) Ton container

Δ **5.2.1.1.6*** Given examples of the following radioactive material containers, the operations level responder shall identify the characteristics of each container by type, as follows:

(1) Excepted (package)

Excepted packages are for materials with extremely low levels of radioactivity. Due to the very limited hazard of the contents, packaging requirements include ease of handling as well as reasonable strength for transportation. Packaging can range from a fiberboard box to a more sturdy wooden or steel crate. Packages are not identified as such by package markings or on shipping papers. Excepted packages, such as the one shown in Exhibit I.5.15, are used for transporting limited quantities of radioactive material that would pose very low hazard if released in an accident.

(2) Industrial (package)

Industrial packages, such as the ones shown in Exhibit I.5.16, are intended for materials with a low concentration of radioactivity that pose a limited hazard to the public and the environment. The radioactive material can be liquid or solidified in materials such as concrete or glass. Industrial packages are not identified as such by package markings or on shipping papers. The following three categories are based on strength:

1. IP-l packages must meet the same design requirements as excepted packaging.
2. IP-2 packages must pass the same tests as Type A for free-drop and stacking.
3. IP-3 packages must pass IP-2 tests and the water spray and penetration tests for Type A shipment of solid contents.

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EXHIBIT I.5.15

This package is a shipment of low specific activity material en route to a disposal facility. (Source: Department of Energy Transportation Emergency Preparedness Program)

EXHIBIT I.5.16

These industrial packages contain low activity material and contaminated objects that are categorized as radioactive waste. (Source: Department of Energy Transportation Emergency Preparedness Program)

(3) Type A (package)

Type A packages, such as the one shown in Exhibit I.5.17, are used to transport radioactive material with higher concentrations of radioactivity than those allowed in excepted and industrial packages. They often have an inner containment vessel made of glass, plastic, or metal surrounded by packaging material of polyethylene, rubber, vermiculite, or wood. The packaging might be an absorbent in a fiberboard, wood, or metal outer container. This packaging must be able to withstand heavy rain equivalent to 2 in. (5.1 cm) per hour, free-dropping from 4 ft (1.22 m), stacking (compression equal to the weight of the package for at least 24 hours), vibration [1 hour, strong enough to raise the package 0.063 in. (1.6 cm)], and penetration by a dropped weight [1.25 in. (3.18 cm) in diameter and 13.2 lb (5.99 kg) dropped from 40 in. (1.02 m)].

(4) Type B (package)

Type B protects materials with higher radioactivity levels, including spent nuclear fuel, so it is substantially constructed to retain the contents under normal transport conditions and under severe accident conditions (see Exhibit I.5.18). Sizes range from small handheld radiography cameras to small drums [55 gal (208 L)] to heavily shielded steel casks that can weigh more than 100 tons (101.6 kilotons). This packaging must be strong enough to withstand tests for dropping 30 ft (9.1 m) so that the package's weakest point is hit; puncture, dropped 40 in. (1.02 m) onto a 6 in. (15.2 cm) diameter steel rod 8 in. (20.3 cm) high,

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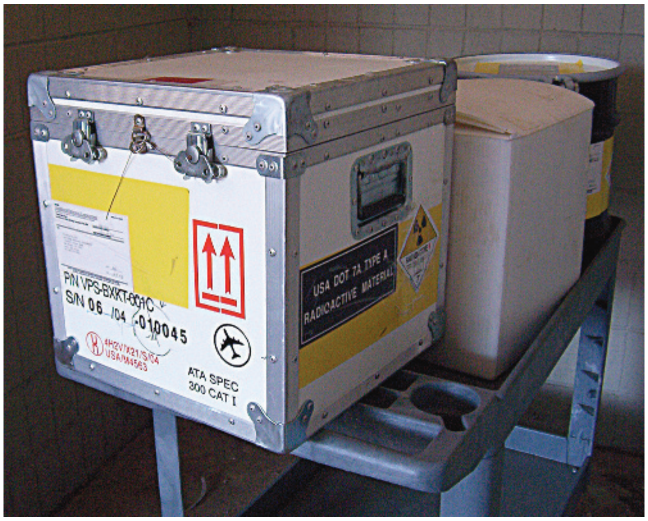

EXHIBIT I.5.17

This Type A package is designed to be a reusable container. (Source: Department of Energy Transportation Emergency Preparedness Program)

again hitting the package's weakest point; heat, 1475°F (802°C) for 30 min; crush, for some lightweight packages, a drop of 1,100 lb (499 kg) mass 30 ft (9.1 m) onto the package, and immersion under 50 ft (15.2 m) of water. Packages are identified as Type B by markings on the package and shipping papers.

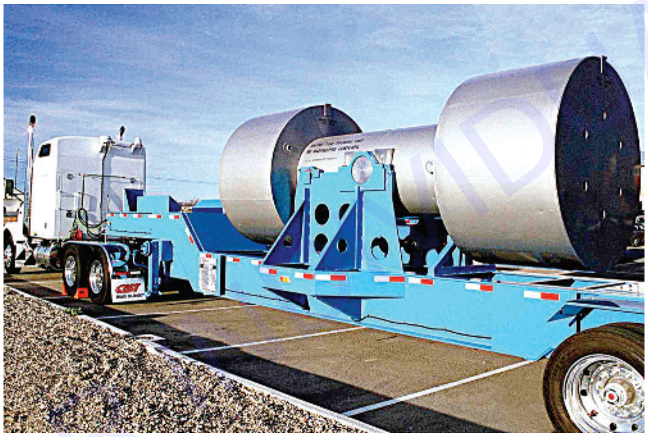

EXHIBIT I.5.18

This RH-72B Type B shipping cask provides double containment for shipment of transuranic waste material. (Source: Department of Energy Transportation Emergency Preparedness Program)

(5) Type C (package)

Type C packaging is used for consignments, transported by aircraft, of high-activity radioactive materials. They are designed to withstand severe accident conditions associated with air transport without loss of containment or significant increase in external radiation levels. Type C packaging performance requirements are significantly more stringent than those for Type B packaging. Type C packaging is not authorized for domestic use but can be authorized for international shipments of these high-activity radioactive material consignments.

A.5.2.1.1.6 See A.3.3.44.3.

5.2.1.2 Given examples of containers, the operations level responder shall identify the markings that differentiate one container from another.

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Containers at fixed facilities can be marked according to NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, and transportation vehicles can be marked with DOT placards or identification numbers [2]. Responders are required to know how to differentiate both markings. Particular tanks or storage areas at fixed facilities can also be identified by labeling and pre-incident planning documents, as can the products they contain.

5.2.1.2.1 Given examples of the following marked transport vehicles and their corresponding shipping papers, the operations level responder shall identify marking used for identifying the specific transport vehicle:

The identification marking on each transport vehicle is included on the shipping papers. This system allows the responders to ensure that the shipping papers and vehicles match. The identification number also provides a way to contact the shipper for information about a specific vehicle.

(1) Highway transport vehicles, including cargo tanks

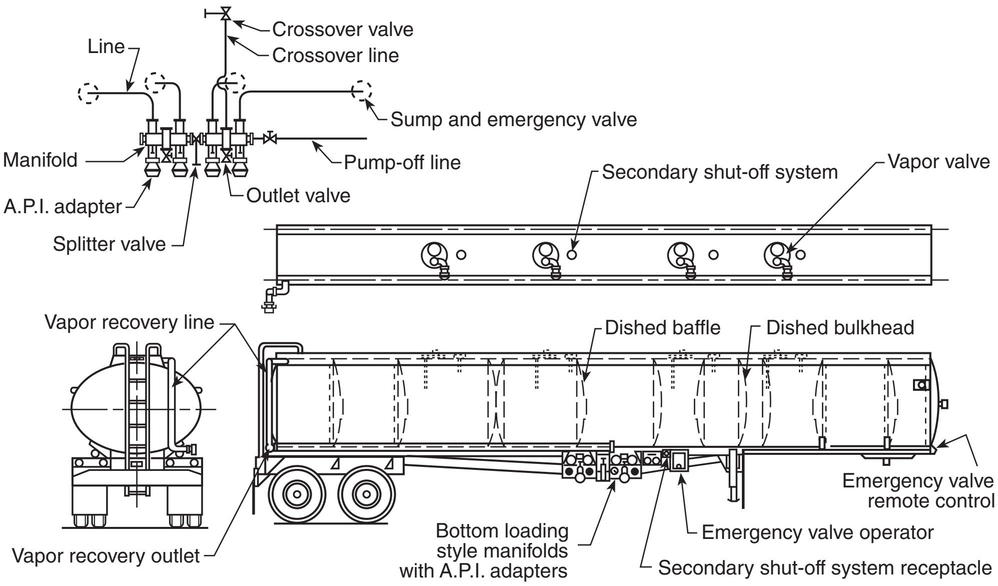
In highway transportation, shipping papers can also be called bills of lading. Visible markings include company names and logos, vehicle identification numbers, the manufacturer's specification plate, and tank color for specific tanks.

The identification marking on each transport vehicle is noted on the shipping papers, which allows the responders to contact the shipper for information about a specific vehicle. Identification numbers, which are assigned to each proper hazardous material shipping name, are required on or near bulk transport container placards and on shipping papers. The numbers begin with the prefix UN for United Nations or NA for North America. NA is used only between the United States and Canada for those not covered by the UN system.

Sometimes referred to as tank motor vehicles or tank trucks, cargo tanks are the most common vehicles used to transport combustible, flammable, and corrosive materials as well as flammable and nonflammable compressed gases. Exhibit I.5.19 through Exhibit I.5.24 illustrate the types of cargo tanks with which the operations level responder must be familiar. As discussed in the commentary to A.5.2.1, the operations level responder should be able to look at a particular type of cargo tank and know something about the nature of the material inside.

EXHIBIT I.5.19

The diagram illustrates a typical MC-306 cargo tank and its components.



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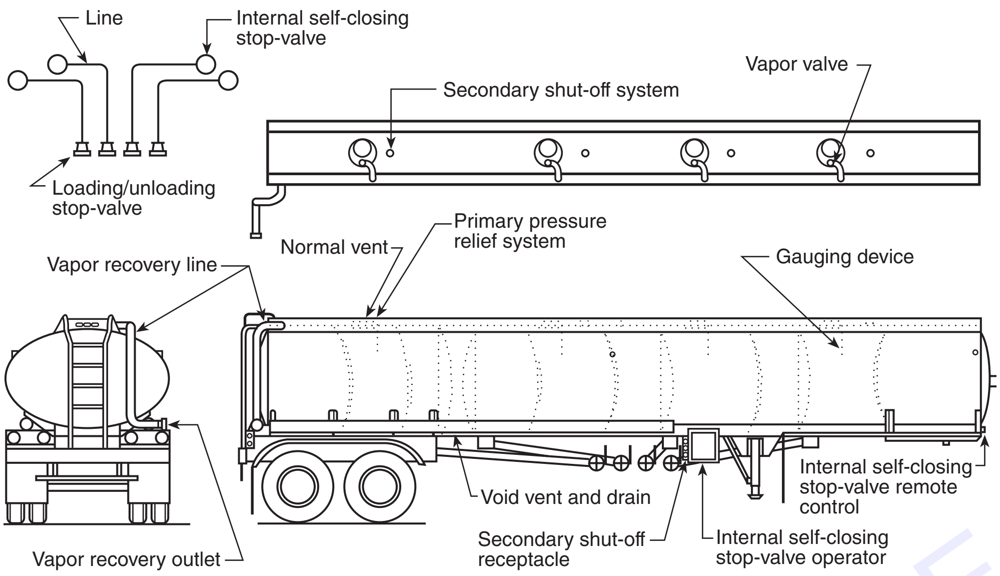

EXHIBIT I.5.20

The diagram illustrates a typical DOT-406 cargo tank and its components.

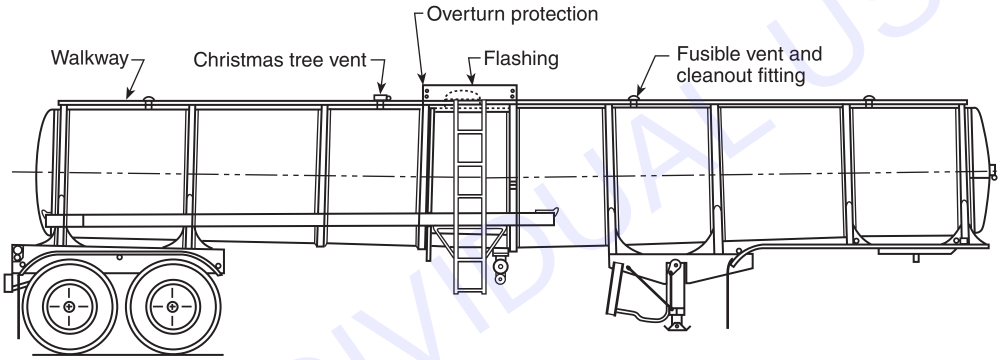

EXHIBIT I.5.21

The diagram illustrates a typical MC-307 cargo tank and its components.

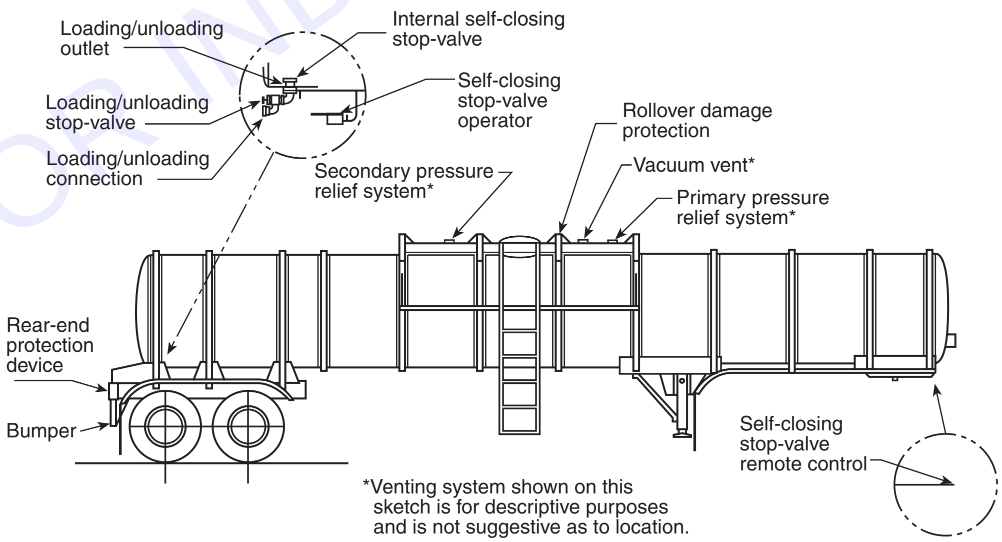

EXHIBIT I.5.22

The diagram illustrates a typical DOT-407 cargo tank and its components.

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EXHIBIT I.5.23

The diagram illustrates a typical MC-312 cargo tank and its components.

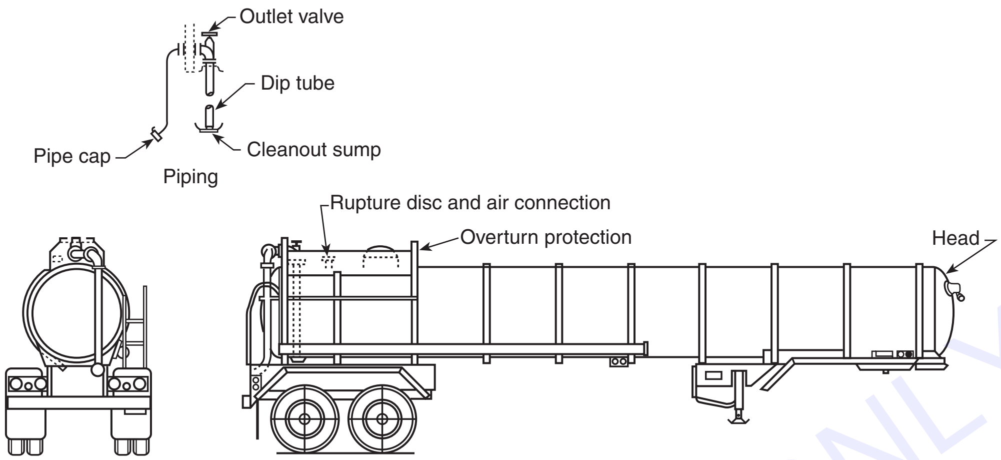
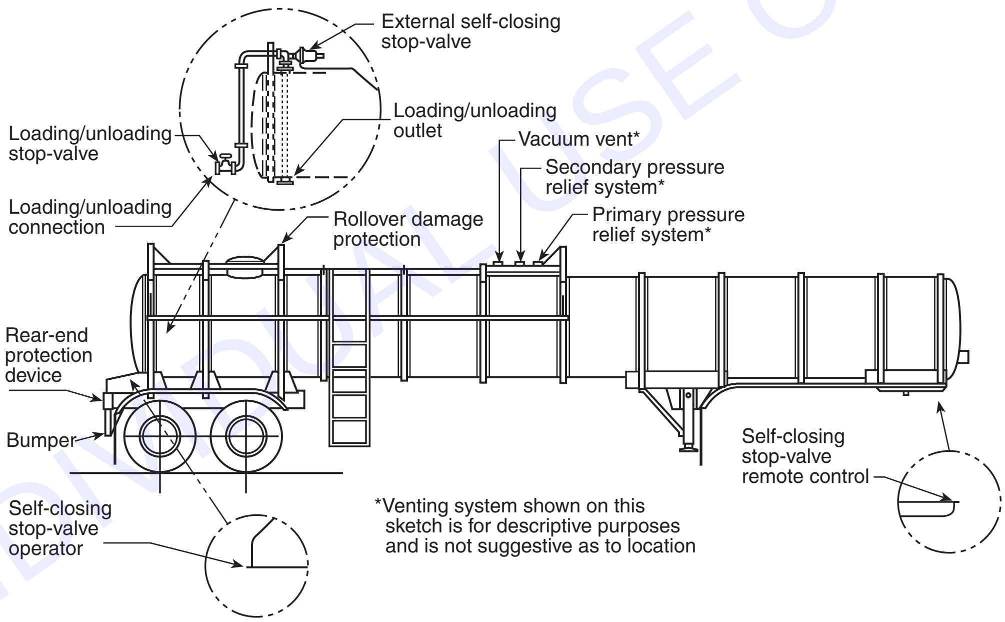


EXHIBIT I.5.24

The diagram illustrates a typical DOT-412 cargo tank and its components.



On compressed gas tube trailers, multiple cylinders are stacked and manifolded together with controls at the rear. Pressures range up to 5000 psi (34,470 kPa). These trailers are often at construction and industrial sites where a driver drops off a full trailer and later picks up the empty trailer for refilling.

The corrosive liquid tank cross-section is circular, except for some insulated tanks, with a single compartment. The capacity of a corrosive liquid tank can be up to 7000 gal (76.5 m^3), and reinforcing ribs are often visible. Overturn and splash protection is at the dome cover and valve locations, which are more often at the rear. The access housing area is often coated with a black, tarlike material to protect the surface from the contents.

(2) Intermodal equipment, including tank containers

Reporting marks and the tank number on IM portable tanks are registered with the International Container Bureau in France. These markings detail the ownership of the tank by the initials and the specific tank by the tank number. The standards to which a portable tank was built are shown by the specification

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markings. Other markings include DOT exemption markings, Association of American Railroads (AAR) 600 markings for interchange purposes, the permanently attached data plate, and the size, type, and country codes.

(3) Rail transport vehicles, including tank cars

For rail transport, shipping papers for a train are called the train consist or train list. Individual waybills for a specific rail car can be generated if requested. A seven-digit number, starting with either a 48 or a 49, indicates that the material is hazardous, as per the Standard Transportation Commodity Code (STCC) or stick number. A 48 indicates hazardous waste, while a 49 refers to an uncontaminated product. Railroad hopper cars can display the four-digit identification numbers. Other markings include a commodity stencil for specific tank cars, reporting marks and numbers, capacity stencil for volume, and specification markings. Rail industry standards previously recommended a vertical red stripe painted the length of an entirely white railroad tank car and a vertical red stripe 4 ft (1.2 m) from each end to identify hydrogen cyanide rail tank cars. This is being phased out over time as each tank car receives maintenance.

5.2.1.2.2 Given examples of facility storage tanks, the operations level responder shall identify the markings indicating container size, product contained, and/or site identification numbers.

Containers at fixed facilities are often stenciled with a product name or a type of identification number that refers to a site plan or an emergency operations plan that identifies the product and the quantity stored. Containers at fixed facilities can be marked with the NFPA 704 marking system.

5.2.1.3 Given examples of hazardous materials incidents, the operations level responder shall identify the name(s) of the hazardous material(s) in 5.2.1.3.1 through 5.2.1.3.3.

To develop appropriate action options, the operations level responder is required to gather whatever information is necessary to identify the hazardous materials at an incident. When the responder can ascertain the material involved, he or she can identify the hazards of the material and the routes of exposure. When they know the routes of exposure, they can determine if the PPE they have will protect them from the hazards of the material.

5.2.1.3.1 Given a pipeline marker, the operations level responder shall identify the emergency telephone number, owner, and product as applicable.

Pipelines that carry hazardous materials must be identified, and the information is routinely provided on the pipeline marker, such as the one shown in Exhibit I.5.25. The term *product* refers to product class (petroleum), not a specific product identification (gasoline). The responder should be aware that markers are not always exact indicators of pipeline location and that pipelines do not always follow a straight line between markers. The responder should look for a pipeline marker where it intersects a street or railroad.

5.2.1.3.2 Given a pesticide label, the operations level responder shall identify the active ingredient, hazard statement, name of pesticide, and pest control product (CPC) number (in Canada).

According to William J. Keffer and Matthew Woody's section, Pesticides, in the *Fire Protection Handbook*, 19th edition, pesticides are classified according to their primary or specific control purposes or to reflect the manner in which they are used. Among the pesticides classified by control purposes are

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EXHIBIT I.5.25

This pipeline marker displays typical markings. (Courtesy of photosbyjim/iStock/Thinkstock)

insecticides, fungicides, herbicides, nematocides, and rodenticides. Among those pesticides classified by the manner in which they are used are fumigants. [3]

Each active ingredient in the pesticide is identified and the percentage is indicated. Inert ingredients are also shown but only by percentage. A hazard statement typically indicates that the product poses an environmental hazard and advises against contaminating water supplies. The label contains the manufacturer's name for the pesticide, which the responder is required to identify.

In Canada, labels carry a pest control product number to acquire additional information regarding a specific product. In the United States, labels carry an EPA registration number.

Labels also carry a precautionary statement indicating the care that must be taken when using the product. Such statements include "Keep Out of Reach of Children," "Restricted Use Pesticide," or "Hazard to Humans and Domestic Animals."

Pesticide labels must have a signal word that indicates the relative hazard of the product. Commentary Table I.5.2 lists the current warnings the EPA requires, based on the hazard of the active ingredient. It should be noted that EPA "signal word" and GHS "signal word" have different meanings and are used for different purposes.

COMMENTARY TABLE I.5.2 *EPA Toxicity Categories*

Category	*Description*
Category 1: Poison/Danger	All pesticide products meeting the following criteria: • Oral LD_{50} up to and including 50 mg/kg • Inhalation LD_{50} up to and including 0.2 mg/liter • Dermal LD_{50} up to and including 200 mg/kg • Eye effects — corneal opacity not reversible within 7 days, and skin effects corrosive

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COMMENTARY TABLE I.5.2 *Continued*

Category	*Description*
	Must bear on the front panel the signal word "Danger." In addition, if the product was assigned to Category 1 on the basis of its oral, inhalation, or dermal toxicity (as distinct from skin and eye local effects), the word "Poison" must appear in red on a background of distinctly contrasting color, and the skull and crossbones must appear in immediate proximity to the word "Poison."
Category 2: Warning	All pesticides meeting the following criteria: • Oral LD_{50} from 50 through 500 mg/kg • Inhalation LD_{50} from 0.2 through 2.0 mg/liter • Dermal LD_{50} from 200 through 2000 mg/kg • Eye effects — corneal opacity reversible within 7 days (irritation persisting for 7 days) • Skin effects — severe irritation at 72 hr Must bear on the front panel the signal word "Warning."
Categories 3 and 4: Caution	All pesticide products meeting the following criteria: • Oral LD_{50} greater than 500 mg/kg • Inhalation LD_{50} greater than 2.0 mg/liter • Dermal LD_{50} greater than 2000 mg/kg • Eye effects — no corneal opacity • Skin effects — moderate irritation at 72 hr Must bear on the front panel the signal word "Caution"

Source: Adapted from *Fire Protection Handbook*®, 19th edition, Table 8.11.2.

5.2.1.3.3 Given a label for a radioactive material, the operations level responder shall identify the type or category of label, contents, activity, transport index, and criticality safety index as applicable.

Each label mentioned in 5.2.1.3.3 has from one to three red vertical bars used to identify the label category. Each label provides a space where the shipper notes the contents of the package and the activity level of the radioactive material inside the package. Additionally, the Radioactive Yellow-II and Radioactive Yellow-III labels provide a space for the transport index. The following radioactive labels are applied to a package based on external radiation levels:

- Radioactive White-I label indicates low external radiation levels.
- Radioactive Yellow-II label indicates medium levels of radiation on the external surface of the package.
- Radioactive Yellow-III label indicates the highest levels of radiation on the external surface of the package.

The criticality safety index for each package will be noted on the label. The criticality safety index is displayed on the label to assist the shipper in controlling how many fissile packages can be grouped together on a conveyance.

Most radioactive materials emit one or more forms of ionizing radiation. The four types of ionizing radiation are alpha radiation, beta radiation, gamma radiation, and neutron radiation. All types differ in their penetrating power and the manner in which they affect human tissue.

Alpha radiation consists of high-energy particles that are relatively large, heavy, and travel only a short distance. Alpha particles lose their energy very rapidly and have a low penetrating ability and short range of travel — only a few inches in air. Because of their short range and limited penetrating ability, alpha particles do not require external shielding. A few inches of air, a sheet of paper, or the

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dead (outer) layer of skin that surrounds our bodies easily stops alpha particles. Alpha radiation poses minimal biological hazard outside the body. The greatest hazard from alpha-emitting material occurs when the material is inhaled or ingested. Once inside the body, the alpha radiation can cause harm to individual cells or organs. Alpha particles are 7000 times larger than beta particles.

Beta radiation consists of particles that are smaller, lighter, and travel farther than alpha radiation. Because the particles are smaller and lighter, beta radiation results in greater penetration than alpha radiation. The range of penetration in human tissue is less than ¼ in. In air, beta radiation can travel several feet. Beta radiation may be blocked or shielded by plastic (SCBA faceshield), aluminum, thick cardboard, several layers of clothing (bunker gear), or the walls of a building. Outside the body, beta radiation constitutes only a slight hazard; it penetrates only a fraction of an inch into living skin tissue. It does not reach the major organs of the body. However, exposure to high levels of beta radiation can cause damage to the skin and eyes. Internally, beta radiation is less hazardous than alpha radiation because beta particles travel farther than alpha particles and, as a result, the energy deposited by the beta radiation is spread out over a larger area. This causes less harm to individual cells or organs.

Gamma radiation, like x-rays, is electromagnetic radiation consisting not of particles but waves of energy with no mass and no electrical charge. Gamma rays are similar to x-rays and are weightless packets of energy called photons. They may accompany the emission of alpha or beta particles from a decaying nucleus, but they travel at the speed of light. Gamma rays are able to travel great distances and require dense material as shielding. Gamma radiation poses a hazard to the entire body because it can easily penetrate human tissue. Lead, steel, and concrete are commonly used to shield gamma radiation.

Neutron radiation consists of neutron particles that are ejected from an atom's nucleus. Neutrons are a basic part of an atom. Neutron radiation is best shielded with high hydrogen content material (i.e., water, plastic). In transportation situations, neutron radiation is not commonly encountered. Neutron radiation is usually associated with operating nuclear power plants. Neutrons are neutrally charged. As a consequence, they can travel great distances.

Δ **5.2.1.4*** The operations level responder shall identify and list the surrounding conditions that should be noted when surveying a hazardous materials/WMD incident.

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 where appropriate.

Surrounding conditions are important to the responder because they influence the choice of available options. The responder should think very broadly when considering the surrounding conditions.

5.2.1.5 The operations level responder shall describe ways to verify information obtained from the survey of a hazardous materials/WMD incident.

Responders should collect information continuously about an incident so that they can validate the information collected earlier. This information can be verified by, among other things, contacting CHEMTREC/CANUTEC/SETIQ or any of the many online websites that store chemical data sheets to verify the hazard information found in emergency response guides; contacting the shipper to verify the products listed on shipping papers; and using additional references to confirm the emergency handling procedures.

◆ **NFPA 1072 NOTE**

NFPA 1072 does not specify that "operations responders shall describe ways to verify information obtained from the survey," but this is implied as part of the process of collecting information.

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

A.5.2.1.6 The following are examples of such 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

N **5.2.1.6.1** Identify at least four types of locations that could be targets for criminal or terrorist activity using hazardous materials/WMD.

The word *terrorism* is defined in 18 CFR Part 1, Chapter 113B: [8]

(1) The term *international terrorism* means activities that
- **(A)** Involve violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or of any State, or that would be a criminal violation if committed within the jurisdiction of the United States or of any State;
- **(B)** Appear to be intended
  - **(i)** To intimidate or coerce a civilian population;
  - **(ii)** To influence the policy of a government by intimidation or coercion; or
  - **(iii)** To affect the conduct of a government by mass destruction, assassination, or kidnapping; and
- **(C)** Occur primarily outside the territorial jurisdiction of the United States, or transcend national boundaries in terms of the means by which they are accomplished, the persons they appear intended to intimidate or coerce, or the locale in which their perpetrators operate or seek asylum;

(5) The term *domestic terrorism* means activities that
- **(A)** Involve acts dangerous to human life that are a violation of the criminal laws of the United States or of any State;
- **(B)** Appear to be intended
  - **(i)** To intimidate or coerce a civilian population;
  - **(ii)** To influence the policy of a government by intimidation or coercion, or
  - **(iii)** To affect the conduct of a government by mass destruction, assassination, or kidnapping; and
- **(C)** Occur primarily within the territorial jurisdiction of the United States.

Terrorists are arrested and convicted under existing criminal statutes, which is why criminal and terrorist activities are grouped together. Terrorist activities are currently receiving more attention than criminal activities because of the demonstrated willingness of terrorists to go to more extensive measures than domestic criminals to achieve their objectives.

Regarding the example of places of historical interest or symbolic significance, different locations could be targeted for domestic or international terrorists, and planning must consider all of the possibilities. For example, a domestic terrorist might target a women's health clinic where abortions are performed, but an international terrorist might target historical sites. Whether domestic or international, any terrorist incident could involve hazardous materials/WMD.

Public assembly targets might be selected by terrorists because of the opportunity to harm or intimidate large numbers of people in a single incident. Enclosed structures with a high concentration of people can be attacked in a dramatic way with a bomb, or the supply of food and water can be contaminated so that the harm is not immediately known.

Public buildings present a target of perhaps high occupant density but low occupant awareness of hazards, exits, and places of shelter.

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A mass transportation system provides a confined location where large numbers gather, especially at intersection points where different systems meet or where subway lines intersect.

Places with high economic impact might include major banking centers, but a domestic terrorist might target an area's largest employer.

Terrorists might want to disrupt telecommunications facilities because they are important as a means both for maintaining normal lifestyles and for responding to a terrorist incident in progress and in the recovery time afterward.

Military installations might be targeted by domestic or international terrorists. These installations are normally high-risk targets for attack, but when a terrorist finds a weakness, attacking a military installation can have a strong psychological impact.

Airports can be a target in the same way as other facilities where large numbers of people gather but also can be an entry point for hijacking a plane, as occurred on September 11, 2001.

Targeting an industrial facility can have twice the terrorism impact. An incident involving a significant industrial facility can cause serious long-term damage, not only economically from lost production or laid-off workers, but also immediate damage from intentional release of hazardous materials/WMD into the environment to injure workers, residents, and emergency personnel.

◆ NFPA 1072 NOTE NFPA 1072 does not include a specific reference to the limitations of using the senses to determine the presence of hazardous materials/WMD, but this should be included for safety reasons.

N **5.2.1.6.2** Describe the difference between a chemical and a biological incident.

N **5.2.1.6.3** Identify at least four indicators of possible criminal or terrorist activity involving chemical agents.

N **5.2.1.6.4** Identify at least four indicators of possible criminal or terrorist activity involving biological agents.

N **5.2.1.6.5** Identify at least four indicators of possible criminal or terrorist activity involving radiological agents.

N **5.2.1.6.6** Identify at least four indicators of possible criminal or terrorist activity involving illicit laboratories (e.g., clandestine laboratories, weapons lab, explosive lab, or biological lab).

The examples of illicit labs listed in NFPA 1072 and NFPA 472 are not the same. Responders should be able to recognize clandestine, weapons, explosive, and biological labs.

Exhibit I.5.26 shows a hazmat team member responding to an illicit laboratory incident.

EXHIBIT I.5.26

This is an example of an illicit laboratory.

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N **5.2.1.6.7** Identify at least four indicators of possible criminal or terrorist activity involving explosives.

Explosive/incendiary attack indicators include the following:

- Warning or threat of an attack; received intelligence
- Reports of an explosion
- Accelerant odors
- Multiple fires or explosions
- Incendiary device or bomb components
- Unexpected, heavy burning or high temperatures
- Unusual, fast-burning fires
- Unusual colored smoke or flames
- Cylinders of propane or other flammable gas in unusual locations
- Unattended packages/backpacks/objects left in high traffic/public areas
- Fragmentation damage/injury
- Damage that exceeds that usually seen during gas explosions including shattered reinforced concrete or bent structural steel
- Crater(s)
- Scattered metal objects such as nuts, bolts, nails possibly used as shrapnel

Exhibit I.5.27 shows a hazmat team investigating an explosive/incendiary attack.

EXHIBIT I.5.27

Incidents involving explosions are investigated as possible criminal or terrorist activity. (Courtesy of Prathaan/iStock/Thinkstock)

N **5.2.1.6.8** Identify at least four indicators of secondary devices.

N **5.2.1.6.9** Identify at least four specific actions necessary when an incident is suspected to involve criminal or terrorist activity.

N **5.2.1.7** The operations level responder shall describe ways in which emergency responders are exposed to toxic products of combustion.

Δ **5.2.2 Collecting Hazard and Response Information.** Given scenarios involving known hazardous materials/WMD, the operations level responder shall collect hazard and response

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information from SDS, CHEMTREC/CANUTEC/SETIQ, governmental authorities, and manufacturers, shippers, and carriers by completing the following requirements:

In the *Fire Protection Handbook*, Charles Wright notes the following:

> Once a hazardous material is identified, information about the material's hazards, behavior characteristics, and suggested response options is collected. This information, which may be collected simultaneously with determining the extent of containment system damage, is used to predict the behavior of that material. The information to be collected is divided into six basic groups:
>
> 1. Material identification information
> 2. Physical properties
> 3. Chemical properties
> 4. Physical hazards
> 5. Health hazards
> 6. Response information
>
> The task of obtaining, recording, and interpreting hazardous material information can be lengthy and rigorous. Various forms are being used to record hazard and response information. [1] p. 13–127

The information the operations level responder is required to collect by 5.2.2 allows the responder to determine the defensive options that can be performed safely, given the personnel and equipment available. At the technician level, this process continues and the responder uses the information collected to determine whether conducting offensive operations is feasible.

◆ NFPA 1072 NOTE

NFPA 1072 specifically requires responders to communicate with carrier representatives (particularly pipeline representatives) to reduce the impact of the release. The committee wanted to emphasize the need to work with pipeline owners to mitigate incidents.

(1) Match the definitions associated with the hazard classes and divisions of hazardous materials/WMD with the designated class or division.

The responder is required to match the hazard class or division of a hazardous material with the appropriate definition of that material. For example, the responder should be able to match the definition of a flammable gas with a Class 2, Division 1 material.

(2) Identify two ways to obtain an SDS in an emergency.

SDSs are available at fixed facilities and can be found in transporting vehicles as well. A responder can obtain SDSs from CHEMTREC or from the shipper, who can e-mail or fax them to field personnel. Many web sites are also available to access SDSs, including many of the shippers' and manufacturers' sites.

(3) Using an SDS for a specified material, identify the following hazard and response information:

In the United States, SDSs are required by OSHA. Although OSHA provides a standard form, manufacturers can use similar forms of their own design that are approved by OSHA. Certain basic information specified by OSHA must appear on all forms. Responders should be familiar with this information and know how to locate it on an SDS, which is a valuable source of product information.

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(a) Identification, including supplier identifier and emergency telephone number

An SDS contains the following 16 sections, and more information is located here: https://www.osha.gov/Publications/HazComm_QuickCard_SafetyData.html

- **Section 1, Identification:** includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.
- **Section 2, Hazard(s) identification:** includes all hazards regarding the chemical; required label elements.
- **Section 3, Composition/information on ingredients:** includes information on chemical ingredients; trade secret claims.
- **Section 4, First-aid measures:** includes important symptoms/effects, acute, delayed; required treatment.
- **Section 5, Fire-fighting measures:** lists suitable extinguishing techniques, equipment; chemical hazards from fire.
- **Section 6, Accidental release measures:** lists emergency procedures; protective equipment; proper methods of containment and cleanup.
- **Section 7, Handling and storage:** lists precautions for safe handling and storage, including incompatibilities.
- **Section 8, Exposure controls/personal protection:** lists OSHA's permissible exposure limits (PELs); American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLVs); and any exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the SDS where available, as well as appropriate engineering controls; PPE.
- **Section 9, Physical and chemical properties:** lists the chemical's characteristics.
- **Section 10, Stability and reactivity:** lists chemical stability and possibility of hazardous reactions.
- **Section 11, Toxicological information:** includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.
- **Section 12, Ecological information**
- **Section 13, Disposal considerations**
- **Section 14, Transport information**
- **Section 15, Regulatory information**
- **Section 16, Other information:** includes the date of preparation or last revision.

The SDS information in 5.2.2(3)(a) provides the responder with information about physical characteristics of the hazardous material such as vapor density, boiling point, specific gravity, water solubility, pH, and physical appearance. For example, a substance might be described as "white to pale yellow sticks," "granules," or "powder, no odor."

(b) Hazard identification

The SDSs holds information about a material's fire and explosion hazards, including its flash point, autoignition temperature, and flammability limits as well as information about the extinguishing agents that might be used on the material. This section might also provide information about hazards associated with fire control operations.

For example, an entry might read, "A water stream directed at molten material can scatter the material, increasing the flammability of any combustible material it contacts." This section might also recommend appropriate personal protective clothing and respiratory protection.

A separate reactivity section generally provides information about the material's stability and indicates how it could react with other substances. For instance, an entry might read, "Is a strong oxidizing agent that will increase the flammability of all combustible materials it contacts."

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(c) Composition/information on ingredients
(d) First aid measures
(e) Fire-fighting measures
(f) Accident release measures

Information on PELs is generally contained in the health hazard section, which provides the responder with important data on the health hazards a material presents, including the TLV, the routes of exposure, and the material's effects. Also provided in 5.2.2(3)(f) is information about emergency first-aid measures.

(g) Handling and storage

Information about the material's manufacturer and possibly the names of its distributors is also provided, as are the phone numbers for emergency contacts.

(h) Exposure controls/personal protection

The SDS also tells the responder what steps should be taken in the event of a spill or leak and how to dispose of such spilled or leaked material. For example, this SDS section might instruct the responder to remove ignition sources or to suppress the material's vapors with foam.

(i) Physical and chemical properties

This SDS information helps the responder choose the appropriate respiratory protection, eye protection, protective gloves, and so forth for working with the hazardous material. The information might also indicate how the material should be stored and how to recognize improperly stored materials.

(j) Stability and reactivity

Information about emergency and first-aid procedures is often found with other health-related data. This SDS section details the actions that should be taken immediately if an individual is exposed to a hazardous material and recommends when to seek additional medical attention.

(k) Toxicological information
(l) Ecological information (nonmandatory)
(m) Disposal considerations (nonmandatory)
(n) Transport information (nonmandatory)
(o) Regulatory information (nonmandatory)
(p) Other information

(4) Identify the types of assistance provided by, procedure for contacting, and information to be provided to CHEMTREC/CANUTEC/SETIQ and governmental authorities.

CHEMTREC is a public service of the American Chemical Council. It provides the on-scene commander with immediate advice by phone and contacts the involved shipper for detailed assistance and response follow-up. The organization can also notify the National Response Center (NRC) of significant incidents and bridge a caller to the NRC to report a spill. CHEMTREC operates 24 hours a day and can be contacted throughout the United States and Canada.

CHEMTREC can usually provide hazard information warnings and guidance when given a material's four-digit identification number, the name of the product, and the nature of the problem. If the product is unknown or more detailed information and assistance is needed, the caller should provide as much of the following information as possible:

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- Caller's name and a call-back number
- Guide number being used
- Rail car or truck number
- Carrier's name
- Consignee
- Local conditions

At an incident, the caller should keep a phone line open to CHEMTREC to receive guidance and assistance. CHEMTREC can also provide teleconferencing to connect technical experts to the caller's line as necessary.

CANUTEC is the Canadian Transport Emergency Center, which is operated by the Transport Dangerous Goods Directorate of Transport Canada. Similar to CHEMTREC, the organization provides technical assistance to emergency responders about physical, chemical, toxicological, and other properties of products involved in an incident; recommends remedial actions for fires, spills, or leaks; provides advice on protective clothing and emergency first aid; and contacts the shipper, manufacturer, or others who are deemed necessary.

SETIQ is the Emergency Transportation System for the Chemical Industry in Mexico and provides the same services as CHEMTREC and CANUTEC.

Local and state authorities might have specific roles in receiving incident information or providing assistance. These roles should be designated in the local ERP, which should be consulted as needed for the agencies and phone numbers involved. Federal authorities might also provide information and other assistance. The responder might be required to notify federal authorities according to the emergency at hand.

The responder should collect as much of the following information as can be obtained safely and provide it to the chain of command and specialists listed in the *Emergency Response Guidebook* (ERG) who might be contacted for technical guidance [4]:

- Responder's name, call-back phone number, and fax number
- Location and nature of the problem
- Name and ID number of the material involved
- Shipper, consignee, and point of origin
- Carrier name, railcar number, or truck number
- Container type and size
- Quantity of material transported and released
- Local conditions of weather and terrain, and proximity to schools, hospitals, and waterways
- Injuries and exposures
- Local emergency services that have been notified

The ERG lists emergency response phone numbers for CHEMTREC, CANUTEC, military shipments, and the NRC. The NRC receives reports required when dangerous goods and hazardous substances are spilled. After receiving notification of an incident, the NRC will immediately notify the appropriate federal on-scene coordinator and concerned federal agencies. Federal law requires that anyone who releases a reportable quantity of a hazardous substance into the environment must notify the NRC immediately. Calling other agencies does not constitute compliance with the requirement to call the NRC.

(5) Identify two methods of contacting manufacturers, shippers, and carriers (highway, rail, marine, air, and pipeline) to obtain hazard and response information.

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The two methods that the responder can use to contact the manufacturer or shipper are through CHEMTREC/CANUTEC/SETIQ, as described in the commentary to 5.2.2(4), or by using information provided on the shipping papers or on the SDS.

(6) Identify the type of assistance provided by governmental authorities with respect to criminal or terrorist activities involving the release or potential release of hazardous materials/WMD.

Criminal or terrorist activities can involve a variety of hazardous materials, and all such incidents involve law enforcement response. Notifying the local law enforcement agency initiates the needed state and federal agency notification and response. This assistance support includes scene security, crime scene preservation, evidence collection, and other law enforcement missions.

The key to accomplishing this requirement is to become familiar with the local ERP or organization's standard operating procedures and to make detailed preparations before the emergency. Planning documents have specified the authorities who need to be contacted and under what circumstances. From that list the relevant phone numbers are available or can be compiled.

The methods for keeping the list of contacts and phone numbers updated needs to be well thought out. When contacted, the government authorities need as much accurate information as can be provided. At that time differentiating between known facts and other reported information that cannot be verified is very important.

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Δ **5.2.3* Predicting the Likely Behavior of a Material and Its Container.** Given scenarios involving hazardous materials/WMD incidents, each with a single hazardous material/WMD, the operations level responder shall describe the likely behavior of the material or agent and its container by completing the following requirements:

•

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 National Fire Academy program, *Hazardous Materials Incident Analysis*, or the *Fire Protection Handbook* chapter titled "Managing the Response to Hazardous Material Incidents."

In *A Textbook for Use in the Study of Hazardous Materials Emergencies*, Ludwig Benner, Jr., describes the process of predicting hazardous materials behavior:

> . . . visualization of an event's sequences in a 'mental movie' framework. . . . The responder needs to think in terms of events and then relate them to the prediction of the emergency events. The responder . . . needs to focus on what the hazardous material is going to do . . . to influence the sequence of events. [5]

(1) Use the hazard and response information obtained from the current edition of the ERG, SDS, CHEMTREC/CANUTEC/SETIQ, governmental authorities, and manufacturer, shipper, and carrier contacts, as follows:

Not only must the responder know where to find response information, but he or she must also be able to interpret that information to decide what actions are appropriate. The responder must also recognize that different emergency response guides might present conflicting information or emphasize one area more than another. The information that is most appropriate for a given situation must be gathered, interpreted, and chosen.

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(a)* Match the following chemical and physical properties with their significance and impact on the behavior of the container and its contents:

i. Boiling point

The boiling point is the temperature of a substance when the vapor pressure exceeds atmospheric pressure and the liquid turns into a gas at the surface.

ii. Chemical reactivity

Chemical reactivity is the ability of a material to undergo a chemical change. The catalyst for the chemical reaction could be exposure to light, heat, shock, or contact with other chemicals. Undesirable effects such as pressure buildup and increasing temperature can result in catastrophic failure of the container or the formation of other hazardous materials.

iii. Corrosivity (pH)

Corrosivity is defined as visible destruction or irreversible alterations in human skin tissue at the site of contact or that causes steel to corrode at a severely accelerated rate [17]. The EPA defines corrosivity as the property that makes a substance capable of dissolving material with which it comes in contact. The degree of corrosiveness is measured by pH, which ranges from 1 to 14. A pH of 7 is neutral, while a pH below 7 is acidic and a pH above 7 represents a base.

iv. Flammable (explosive) range [lower explosive limit (LEL) and upper explosive limit (UEL)]

A material's flammable, or explosive, range is the difference between its upper and lower explosive limits. The lower explosive limit (LEL) is the minimum concentration of vapor to air below which a flame does not propagate in the presence of an ignition source. The upper explosive limit (UEL) is the maximum vapor-to-air concentration above which a flame does not propagate. If a vapor-to-air mixture is below the LEL, the mixture is described as being "too lean" to burn; if it is above the UEL, it is "too rich" to burn. When the vapor-to-air ratio is somewhere between the LEL and the UEL, fires and explosions can occur, and the mixture is said to be in the flammable range. The flammable range for gasoline is 1.4 percent to 7.6 percent, and the flammable range for carbon monoxide is 12.5 percent to 74 percent. Awareness of the range as well as the upper and lower flammable limits is important for the responder. If the responder suspects or knows that flammable vapors are present, he or she must determine the concentration of vapor in air. Combustible gas detection instruments are used for this purpose.

v. Flash point

The flash point of a liquid is the minimum temperature at which the liquid gives off vapor in sufficient concentration to form an ignitable mixture with air. A liquid's flash point is the primary property or characteristic used to determine its relative degree of flammability. Since the vapors of flammable liquids are what burn, vapor generation is a primary factor in determining the liquid's fire hazard.

vi. Ignition (autoignition) temperature

The terms *ignition temperature* and *autoignition temperature* are interchangeable. The ignition temperature of a substance, whether solid, liquid, or gaseous, is the minimum temperature required to cause self-sustained combustion in the absence of any source of ignition. The responder should look on assigned ignition temperatures as approximations.

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Ignition temperatures can be quite high, especially in relation to a liquid's flash point. For example, the flash point of gasoline is −45°F (−43°C), while its ignition temperature is well over 500°F (260°C).

vii. Particle size

Particle size refers to solids, and it is expressed in microns or percent passing through a meshed screen.

vii. Persistence

The term *persistence* refers to a material's ability to stay within the area of release for long periods of time. This is generally considered to be more than 24 hours and is intended to prevent personnel from re-entering the area due to concentrations that remain high.

ix. Physical state (solid, liquid, gas)

Hazardous materials are either solids, liquids, or gases, and the responder should understand the difference physical form makes on the hazards a material presents. For example, gases present significantly different hazards than solids.

x. Radiation (ionizing and nonionizing)

Radiation can be grouped into two categories: ionizing radiation (i.e., alpha, beta, gamma, neutron) and nonionizing radiation (i.e., microwaves, radio waves, visible light).

Ionizing radiation consists of high-energy rays (gamma rays, x-rays) or particles (alpha particles, beta particles). The term *ionizing* is used because of the radiation's ability to create ions by removing orbital electrons. This ability to create ions is what makes ionizing radiation hazardous. With very high radiation doses, the damage can be immediate and physical and lead to genetic mutations. Ionizing radiation's ability to cause a physical change in atoms does not have an effect on the container or its contents. However, as the hazard level of the radioactive material increases so does the strength of the package.

Nonionizing radiation consists of ultraviolet and visible light, sound waves, microwaves, and magnetic fields. Ultraviolet radiation exposure causes familiar sunburn. Nonionizing radiation from the sun can cause genetic damage to skin cells and result in skin cancer. This radiation does not have the energy required to impact an atom enough to eject an orbital electron (ionization). Nonionizing radiation is generally beyond the control of hazardous materials responders.

xi. Specific gravity

Specific gravity is the ratio of the weight of a volume of liquid or solid to the weight of an equal volume of water, with the gravity of water being 1. A substance with a specific gravity of less than 1 will float on water, and a substance with a specific gravity greater than 1 will sink.

xii. Toxic products of combustion

All products of combustion should be considered toxic. The combustion process represents fairly complex chemical reactions in the sense that fire conditions often play a role in the types of materials generated during the process. The burning of materials alters the original chemical and physical hazards of the material and can dramatically increase the risk of exposure to toxic or carcinogenic materials (particles and aerosols). The responder should consider the materials that are burning and

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the fire conditions to accurately address the need for specialized protective equipment and decontamination procedures.

However, there are instances when burning hazardous materials, such as pesticides, can destroy the hazardous materials during the combustion process. Fire fighters must be aware that this is as true for outside fires as it is for structural fires.

xiii. Vapor density

Vapor density measures the weight of a given vapor as compared with an equal volume of air, with air having a value of 1.0. A vapor density greater than 1.0 indicates it is heavier than air, and a value less than 1.0 indicates it is lighter. Vapor density can be important to the responder because it determines the behavior of free vapor at the scene of a liquid spill or gas release.

xiv. Vapor pressure

Vapor pressure is the pressure at any given temperature at which the vapor and liquid phases of the substance are in equilibrium in a closed container. A change in temperature or atmospheric pressure can increase the pressure inside the container, increasing the stress on the container. If the container breaches, the material will spread quickly. For example, the vapor pressure of diesel fuel increases with elevation due to reduced barometric pressure (lower atmospheric pressure).

xv. Water solubility

Water solubility, or the degree to which a substance is soluble in water, can be useful in determining the effectiveness of water as an extinguishing agent in dilution and in a decontamination process.

xvi. Polymerization
xvii. Expansion ratio
xviii. Biological agents and toxins

N **A.5.2.3(1)(a)** Bioterrorism Agent Categories. The following material applies to 5.2.3(1)(a) xviii., Biological agents and toxins: The CDC has separated biological threat agents into three categories, depending on how easily they can be spread and the severity of illness or death they cause. Category A agents are considered the highest risk and Category C agents are those that are considered emerging threats for disease.

Category A These high-priority agents include organisms or toxins that pose the highest risk to the public and national security for the following reasons:

(1) They can be easily spread or transmitted from person to person.
(2) They result in high death rates and have the potential for major public health impact.
(3) They might cause public panic and social disruption.
(4) They require special action for public health preparedness.

Category B These agents are the second highest priority for the following reasons:

(1) They are moderately easy to spread.
(2) They result in moderate illness rates and low death rates.
(3) They require specific enhancements of CDC's laboratory capacity and enhanced disease monitoring.

Category C These third highest priority agents include emerging pathogens that could be engineered for mass spread in the future for the following reasons:

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(1) They are easily available.
(2) They are easily produced and spread.
(3) They have potential for high morbidity and mortality rates and major health impact.

Examples of Category A priority pathogens are as follows:

(1) *Bacillus anthracis* (anthrax)
(2) *Clostridium botulinum toxin* (botulism)
(3) *Yersinia pestis* (plague)
(4) Variola major (smallpox) and other related pox viruses
(5) *Francisella tularensis* (tularemia)
(6) Viral hemorrhagic fevers (Arenaviruses, Junin, Machupo, Guanarito, Chapare Lassa, Lujo)
(7) Bunyaviruses (Hantaviruses causing Hanta Pulmonary syndrome, Rift Valley Fever, Crimean Congo Hemorrhagic Fever)
(8) Flaviviruses (Dengue)
(9) Filoviruses (Ebola, Marburg)

Examples of Category B priority pathogens are as follows:

(1) *Burkholderia pseudomallei* (melioidosis)
(2) *Coxiella burnetii* (Q fever)
(3) *Brucella species* (brucellosis)
(4) *Burkholderia mallei* (glanders)
(5) *Chlamydia psittaci* (Psittacosis)
(6) Ricin toxin (Ricinus communis)
(7) Epsilon toxin (Clostridium perfringens)
(8) Staphylococcus enterotoxin B (SEB)
(9) Typhus fever (Rickettsia prowazekii)
(10) Food- and waterborne pathogens
(11) Bacteria (Diarrheagenic E.coli, Pathogenic Vibrios, Shigella species, Salmonella, Listeria monocytogenes, Campylobacter jejuni, Yersinia enterocolitica)
(12) Viruses (Caliciviruses, Hepatitis A)
(13) Protozoa (*Cryptosporidium parvum, Cyclospora cayatanensis, Giardia lamblia, Entamoeba histolytica, Toxoplasma gondii, Naegleria fowleri, Balamuthia mandrillaris*)
(14) Fungi (Microsporidia)
(15) Mosquito-borne encephalitis viruses [West Nile virus (WNV), LaCrosse encephalitis (LACV), California encephalitis, Venezuelan equine encephalitis (VEE), Eastern equine encephalitis (EEE), Western equine encephalitis (WEE), Japanese encephalitis virus (JE), St. Louis encephalitis virus (SLEV)]

Examples of Category C priority pathogens are as follows:

(1) Nipah and Hendra viruses
(2) Additional hantaviruses
(3) Tickborne hemorrhagic fever viruses
    (a) Bunyaviruses [Severe Fever with Thrombocytopenia Syndrome virus (SFTSV), Heartland virus]
    (b) Flaviviruses (Omsk Hemorrhagic Fever virus, Alkhurma virus, Kyasanur Forest virus)
(4) Tickborne encephalitis complex flaviviruses
    (a) Tickborne encephalitis viruses
    (b) European subtype
    (c) Far Eastern subtype
    (d) Siberian subtype
    (e) Powassan/Deer Tick virus

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(5) Yellow fever virus
(6) Tuberculosis, including drug-resistant TB
(7) Influenza virus
(8) Other Rickettsias
(9) Rabies virus
(10) Prions
(11) Chikungunya virus
(12) Coccidioides spp.
(13) Severe acute respiratory syndrome associated coronavirus (SARS-CoV), MERS-CoV, and other highly pathogenic human coronaviruses
(14) Antimicrobial resistance, excluding research on sexually transmitted organisms, unless the resistance is newly emerging
  (a) Research on mechanisms of antimicrobial resistance
  (b) Studies of the emergence and/or spread of antimicrobial resistance genes within pathogen populations
  (c) Studies of the emergence and/or spread of antimicrobial-resistant pathogens in human populations
  (d) Research on therapeutic approaches that target resistance mechanisms
  (e) Modification of existing antimicrobials to overcome emergent resistance
(15) Antimicrobial research, as related to engineered threats and naturally occurring drug-resistant pathogens, focused on development of broad-spectrum antimicrobials

More information on bioterrorism agents can be located at https://emergency.cdc.gov/bioterrorism/overview.asp.

The example listing of agents is referenced from http://www.niaid.nih.gov/topics/biodefenserelated/biodefense/pages/cata.aspx.

(b) Identify the differences between the following terms:

◆ NFPA 1072 NOTE

NFPA 1072 does not list the contrasting terms from NFPA 472 5.2.3(1)(b); however, responders are expected to understand these terms and how they differ.

i. *Contamination* and *secondary contamination*

Contamination is a direct transfer of a hazardous material, as described in the commentary to 5.2.3(1)(b)ii. Secondary contamination is an indirect transfer when, for example, contaminated personnel or equipment carries a contaminant away from a hot zone and transfers it to another person. Responders working in the hot zone may become contaminated during control operations. If the responders carry that contamination outside the hot zone on their equipment clothing, skin, or hair in sufficient quantities and are not adequately decontaminated, they could contaminate others.

ii. *Exposure* and *contamination*

Exposure occurs when a material comes directly in contact with or is taken into a person's body through a route of exposure. It might or might not result in contamination. An example of this is when carbon monoxide that is breathed in causes an exposure but does not lead to contamination of the person.

A person can be exposed to radiation and not become contaminated. On the other hand, radioactive contamination emits radiation. If a person is contaminated with radioactive material, the person continues to be exposed to radiation until the contamination is removed. Radioactive

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materials exist in nature or can be man-made. Natural sources of low-level radioactive material can include soil or air, and through these sources radioactive material can enter food. Man-made radiation might be intentionally directed at us from cell phones or in the form of medical procedures such as x-rays, which constitutes a normal exposure. Any of these exposures can go from external to internal if the material emitting the radiation is inhaled or ingested. The term *exposure* means being exposed to ionizing radiation or to radioactive material. The risk from short duration, low levels of radiation exposure is small. Management of any risk from radiation exposure includes attention to the following three radiation protection principles:

1. Minimize your time in a field of radiation.
2. Maintain as much distance between you and the source of radiation.
3. Use available shielding whenever possible. This could involve standing behind a vehicle, building, or any other object you can place between you and the source of radiation.

Personnel and equipment can become contaminated if they come in contact with radioactive material that has been released from its containment or package. When individuals (accident victims or response personnel), PPE, or equipment become contaminated, the contamination can be spread easily by secondary contamination to other persons, equipment, or surfaces. Care should be taken to avoid secondary contamination.

Radioactive contamination can be determined by direct or indirect measurement. Direct measurement is possible with portable detection instruments for fixed and removable contamination when background radiation levels are negligible and the detector has sufficient sensitivity. Indirect measurement only detects removable contamination by wipe tests.

iii. *Exposure* and *hazard*

A hazard is something capable of posing an unreasonable risk to health and safety, while an exposure is the process by which people, animals, and equipment come in contact with a hazardous material. An exposure is affected by duration and concentration of the hazardous material. A person might be exposed to large quantities of a hazardous material in concentrations that do not present a hazard or to small amounts of a hazardous material that present a very high hazard.

iv. *Infectious* and *contagious*

Contagious means a substance is capable of being transmitted from one individual (animal or human) to another through contact, typically by bodily fluids or secretions. Infectious means disease is caused by exposure to harmful microorganisms. Microorganisms multiply and typically attack other organs or cells in the body. Not all infectious diseases are contagious.

v. *Acute effects* and *chronic effects*

Acute effects present symptoms immediately while chronic effects manifest at a later time, which can even be years later.

vi. *Acute exposures* and *chronic exposures*

Acute exposures are generally considered to be large concentrations over a short period of time. An acute exposure can have effects that are both immediate and/or long term. Chronic exposures are over long periods of time, over several days or longer with repeated periods of contact at relatively low levels of concentrations.

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(2)* Identify types of stress that can cause a container system to release its contents (thermal, mechanical, and chemical).

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.

(3)* Identify ways containers can breach (disintegration, runaway cracking, closures open up, punctures, and splits or tears).

Δ **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/ WMD 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.

When a hazardous materials container loses its integrity, the incident often escalates. The timing of such a release cannot always be predicted, and the release will vary with the duration, intensity, and type of stress to which the container is subjected.

The responder must understand that a container or its contents might be stressed and that a difference exists between the two phenomena. A container can degrade under stress. The material inside a container can either degrade the container or breach a container that has not been degraded [5].

According to Charles Wright in *Fire Prevention Handbook*, factors that affect the intensity of the breach include the following:

> Type and duration of the stress being applied, behavior of the containment system under the stresses applied, behavior of the contents, location of the applied stresses, force of opening of the containment system, size of breach, and speed of breach event. [1] p. 13–132

(4)* Identify ways containers can release their contents (detonation, violent rupture, rapid relief, spill, or leak).

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.

The types of release include detonation, disintegration of the container, and/or detonation of the contents; violent massive failure behavior, the runaway cracking of the container, and rapid-acceleration polymerization or oxidizing hazardous materials reactions that burst the container abruptly; rapid relief behavior, including pressure ruptures or safety valve operation; and spill or leak behavior, including gradual flow through openings, tears or splits, and punctures [5].

(5)* Identify dispersion patterns that can be created upon release of a hazardous material (hemispherical, cloud, plume, cone, stream, pool, and irregular).

A.5.2.3(5) Seven dispersion patterns can be created upon release of agents: hemisphere, cloud, plume, cone, stream, pool, and irregular.

Knowing how hazardous materials behave when they are released is important in identifying dispersion patterns to determine potential hazard to people and environment. Dispersion patterns

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are influenced by the way the material is released, physical behavior of the material, and weather conditions.

(6)* Identify the time frames for estimating the duration that hazardous materials/WMD will present an exposure risk (short-term, medium-term, and long-term).

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/WMD in an endangered area are short-term (minutes and hours), medium-term (days, weeks, and months), and long-term (years and generations).

Factors that influence the length of time an exposure might last in an endangered area include the quantity of the material released, the method of dispersion, and the speed at which it is released. For example, did the container leak or did it detonate? The presence of secondary reactions also influences the length of an exposure.

(7)* Identify the health and physical hazards that could cause harm.

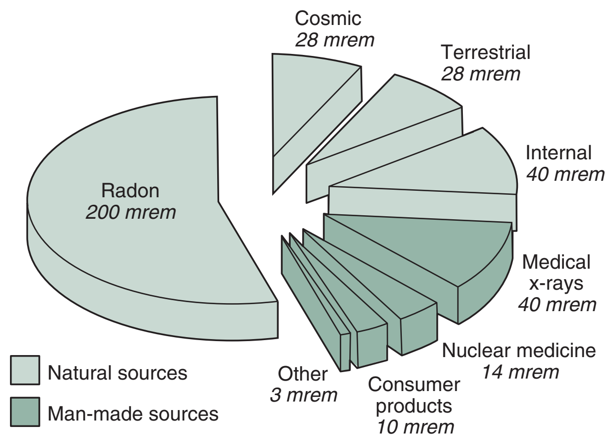
The fact sheet "Potential Health Hazards of Radiation" from the U.S. Department of Energy explains the following:

> Radiation is energy emitted by unstable (radioactive) atoms. Unstable atoms contain extra energy that is released as invisible particles or waves as the atoms change, or decay, into more stable forms. Particles and waves are referred to as radiation and their emission is called radioactivity. People are exposed to radiation from natural and man-made sources. [6]

Exhibit I.5.28 illustrates sources of radiation.

EXHIBIT I.5.28

This diagram illustrates that there are various sources of radiation and those sources can be natural or man-made. (Source: Potential Health Hazards of Radiation, U.S. Department of Energy)



Although alpha particles travel only a few inches (centimeters) through air and are not strong enough to penetrate the outer layer of skin, if radioactive material emitting alpha particles is inhaled or ingested, the alpha particles pose a much greater hazard in close proximity to internal tissue.

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Low levels of exposure to beta particles pose only a slight hazard outside the body, but they are capable of penetrating the skin and can travel longer distances [mean range of 7 ft (2.1 m)] than alpha particles. Exposure to high levels of beta particles can cause damage to the skin and eyes. If material emitting beta particles is inhaled or ingested, the beta particles can cause more internal damage than from external exposure.

Both gamma and neutron radiation pose a hazard to the entire body because they penetrate human tissue. Gamma rays are more penetrating than alpha or beta particles and can pass through the human body or be absorbed by tissue. Shielding requires several feet (meters) of concrete or a few inches (centimeters) of lead.

Depending on the level of exposure, radiation can be a health risk. The damage can be acute or late. A high dose, for even a short period of time, is acute and can cause tissue damage or even death. Late damage effects are not seen until years after exposure. Late effects can result from a previous high acute dose or a low but chronic dose. Late effects can include genetic consequences.

Acute effects occur at the cell function level of skin, blood, gastrointestinal tissue, reproductive tissue, and brain tissue. At a high dose the cell membrane might be ruptured, killing the cell, interrupting the cell's energy supply, or changing its function in a harmful way. The most radiosensitive cells are those that have a high division rate, have a high metabolic rate, are of a nonspecialized type, and are well nourished.

Symptoms of radiation sickness include gastrointestinal disorders, bacterial infections, hemorrhaging, anemia, loss of body fluids, and electrolyte imbalance.

Late effects include cancer, genetic effects, and life shortening. If a cell survives an acute dose that causes damaged DNA, the cell can become cancerous and multiply uncontrollably. A cell exposed to high radiation might survive with altered DNA, which might be passed to offspring. Problems in this case can be caused from missing essential parts of DNA, the addition of harmful extra DNA, or rearrangement of the strands of DNA.

Life-shortening effects of radiation, in addition to cancer, can include an acceleration of the aging process.

Neutron radiation is most commonly seen in conjunction with nuclear power generation and medical treatment. A relatively new medical procedure is the use of higher-energy neutron radiotherapy. This use is spreading because of the effectiveness of neutrons. With neutrons, the required tumor dose is about one-third the dose required with other radiation therapy. This medical use is intended for highly controlled circumstances, but accidents can occur. One commonly used and transported neutron source is a density gauge. These gauges often have an americium/beryllium source (AmBe) that emits neutron radiation. The gauges are commonly used in the construction industry to check the moisture content of soil. The health hazard of neutron radiation is similar to that of other forms of radiation.

An asphyxiant is a substance that can cause unconsciousness or death by suffocation. Asphyxiation is an extreme hazard when working in enclosed spaces. Asphyxiants are usually classified as either simple or chemical. A simple asphyxiant will displace available oxygen in air while a chemical asphyxiant will prevent oxygen in the breathed air from being used by the body during the respiratory process.

A carcinogen is a chemical or material that is known or suspected to cause cancer and that falls within any of the following categories:

1. It has been evaluated by the International Agency for Research on Cancer (IARC) and found to be a carcinogen or potential carcinogen.
2. It is listed as a carcinogen or potential carcinogen in the latest edition of the "Annual Report on Carcinogens" published by the National Toxicology Program (NTP).
3. It is federally regulated by OSHA as a carcinogen (can be regulated additionally by states).

A convulsant is a drug or chemical that causes convulsions. Convulsions are a violent shaking of the body or limbs caused by uncontrollable muscle contractions, which can be a symptom of brain disorders and other conditions such as exposure to a hazardous material. A person having

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convulsions can receive additional injury from falling and striking an object or the ground. The convulsion can also cause the exposure to the substance to be lengthened if the person cannot escape from a hazardous area.

A corrosive is a chemical that causes visible destruction or irreversible alterations to living tissue by chemical action at the site of contact. A highly toxic chemical is one that falls within any of the following categories:

1. A chemical that has a median lethal dose (LD_{50}) of 50 mg or less per kg of body weight when administered orally to albino rats weighing between 200 g and 300 g each
2. A chemical that has an LD_{50} of 200 mg or less per kg of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 kg and 3 kg each
3. A chemical that has a median lethal concentration (also LD_{50}) in air of 200 parts per million by volume or less of gas or vapor, or 2 mg/L or less of mist, fume, or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within one hour) to albino rats weighing between 200 g and 300 g each

An irritant is a chemical that is not corrosive but one that causes a reversible inflammatory effect on living tissue by chemical action at the site of contact.

Allergens are substances that, in some people, the immune system recognizes and attacks as "foreign" or "dangerous" but for most people cause no response. Allergic reactions vary. Reactions can be mild or serious and can be confined to a small area of the body or affect the entire body. Most occur within seconds or minutes after exposure to the allergen, but some can occur after days or weeks. Anaphylaxis is a sudden and severe allergic reaction that occurs within minutes of exposure.

Common allergens include certain contactants (e.g., chemicals, plants), drugs (e.g., antibiotics, serums), foods (e.g., milk, chocolate, strawberries, wheat), infectious agents (e.g., bacteria, viruses, animal parasites), inhalants (e.g., dust, pollen, perfumes, smoke), and physical agents (e.g., heat, light, friction, radiation).

A sensitizer is defined by OSHA as the following:

> 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 chemical. [16]

Target organ effects are signs and symptoms from chemical exposure that affect specific organs. The following examples are not intended to be all-inclusive but do illustrate the range and diversity of effects and hazards that can be encountered:

1. Hepatotoxins. Chemicals that produce liver damage (signs and symptoms: jaundice, liver enlargement; chemicals: carbon tetrachloride, nitrosamines)
2. Nephrotoxins. Chemicals that produce kidney damage (signs and symptoms: edema, protein urea; chemicals: halogenated hydrocarbons, uranium)
3. Neurotoxins. Chemicals that produce their primary toxic effects on the nervous system. Both the central nervous system (CNS) and the peripheral nervous system (PNS) can be affected. The following are the symptoms associated with CNS and PNS exposure to neurotoxins:
   - CNS hazards are chemicals that cause depression or stimulation of consciousness or otherwise injure the brain (signs and symptoms: drooping of upper eyelids, respiratory difficulty, seizures, unconsciousness)
   - PNS hazards are chemicals that damage the nerves that transmit messages to and from the brain and the rest of the body (signs and symptoms: numbness, tingling, decreased sensation, change in reflexes, decreased motor strength; examples: arsenic, lead, toluene, styrene)
4. Agents that decrease the function of hemoglobin in the blood deprive the hematopoietic body tissues of oxygen (signs and symptoms: cyanosis, loss of consciousness; chemicals: carbon monoxide, benzene)

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5. Agents that irritate the lung or damage the pulmonary tissue (signs and symptoms: cough, tightness in chest, shortness of breath; chemicals: silica, asbestos, HCl)
6. Reproductive Toxins. Chemicals that affect the reproductive capabilities including chromosomal damage (mutations) and affect fetuses (teratogenesis) (signs and symptoms: birth defects, sterility; chemicals: lead, DBCP)
7. Cutaneous Hazards. Chemicals that affect the dermal layer of the body (signs and symptoms: defatting of the skin, rashes, irritation; chemicals: ketones, chlorinated compounds)
8. Eye Hazards. Chemicals that affect the eye or visual capacity (signs and symptoms: conjunctivitis, corneal damage; chemicals: organic solvents, acids)

A toxic chemical is one that falls within any of the following categories:

1. Has a median lethal dose (LD_{50}) or more than 50 mg per kg but not more than 500 mg per kg of body weight when administered orally to albino rats weighing between 200 g and 300 g each
2. Has an 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
3. Has an LD_{50} concentration 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/L but not more than 200 mg/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

A.5.2.3(7) The health and physical hazards that could cause harm in a hazardous materials/WMD incident are thermal, mechanical, poisonous, corrosive, asphyxiating, radiological, and etiologic.

Harm is the injury or damage caused by exposure to the hazards of the released contents. The hazards associated with the released contents are directly proportional to the concentrations of released materials and to the duration of contact.

5.2.4* Estimating Potential Harm. Given scenarios involving hazardous materials/WMD incidents, the operations level responder shall describe the potential harm within the endangered area at each incident by completing the following requirements:

• **A.5.2.4** The process for estimating the potential outcomes within an endangered area at a hazardous materials/WMD 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.

The operational level responder must be able to estimate the area of potential harm. Responders at this level are not expected to engage in intricate calculations or even to use sophisticated computer modeling, but they should be able to make general estimates based on the hazard information collected so that they can begin evacuations and safely implement defensive operations. As an incident becomes more complex, technician level responders would probably become involved, and they would be able to make more definitive predictions about the endangered area.

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(1)*Identify a resource for determining the size of an endangered area of a hazardous materials/WMD incident

A.5.2.4(1) Resources for determining the size of an endangered area of a hazardous materials/WMD incident are the current edition of the DOT *Emergency Response Guidebook* and plume dispersion modeling results from facility pre-incident plans.

The ERG recommends isolation and evacuation distances for some hazardous materials. CHEMTREC, CANUTEC, or SETIQ can provide additional information. Plume modeling data is now available for many areas and real-time monitoring and detection information are also valuable resources.

(2) Given the dimensions of the endangered area and the surrounding conditions at a hazardous materials/WMD incident, describe the number and type of exposures within that endangered area

Exposures include people, the environment, and property. Once the responder has estimated the size and location of the endangered area, he or she can determine what is inside the perimeter. Factors influencing the decision include the time of day, the type of occupancies involved, and the type of area involved. Is it rush hour, for example? Is the occupancy a petrochemical plant? Is the area congested, or is it rural?

(3) Identify resources available for determining the concentrations of a released hazardous materials/WMD within an endangered area

Various types of monitoring equipment and dispersion modeling programs are available for determining the concentrations of a released hazardous material. In most cases, however, operations level responders would not have this type of equipment. Nonetheless, they are required to understand what can be used, how to acquire it, and the technical assistance needed to operate it. For example, responders should be aware of any company in their area that handles hazardous materials and know whether the company has personnel and equipment available to monitor hazardous conditions.

Responders should also know whether they can ask a regional hazardous materials response team to assist them. State or county environmental agencies or health departments can often provide monitoring equipment and personnel. However, responders should plan ahead and make these arrangements before an incident occurs, not at 3 a.m. on a rainy night when an overturned cargo tanker begins leaking hazardous materials all over the highway.

(4)* Given the concentrations of the released material, describe the factors for determining the extent of physical, health, and safety hazards within the endangered area of a hazardous materials/WMD incident

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/WMD incident are surrounding conditions, an indication of the behavior of the hazardous materials/WMD and its container, and the degree of hazard.

Responders must determine the extent of physical harm that can be expected in an endangered area and compare the gains they could receive from intervening, or not intervening, before they can determine the actions they should or should not take. The factors that influence this decision are the quantity and concentration of the hazardous materials released, the number of exposures in the

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endangered area, and the manner in which the exposures are subjected to the hazardous material. Is the material a liquid or a gas, for example? How far away from the source are the exposures? How fast is the material being released?

(5) Describe the impact that time, distance, and shielding have on exposure to radioactive materials specific to the expected dose rate

The three basic principles in 5.2.4(5) that affect an exposure to external radiation are time, distance, and shielding. Increased protection occurs when you decrease the time of the exposure, increase the distance from the radiation source, and increase shielding between you and the source.

Spend as little *time* as possible near the radiation source. Reducing the time of exposure reduces the amount of radiation energy absorbed under any conditions. Except for someone trapped, this variable can be controlled in an emergency response incident.

Maintain *distance* from the radiation source. Increasing the distance from the radiation source is an effective way of minimizing exposure. Gamma and x-ray radiation intensity varies inversely with the square of the distance, which means that when a 4000 milliroentgen per hour (mR/hour) exposure rate is present at 2 ft (0.61 m) from a source, the exposure rate at 4 ft (1.22 m) would be 1000 mR/hour. Doubling the distance reduces the exposure by a factor of 4. A practical application of this would be the use of forceps, tongs, and other tools to extend an individual's reach to pick up or move a radiation source if necessary. Decreasing time and increasing distance are often enough to ensure safe operations with radiation.

Use available *shielding*. For large radiation sources, controlling time and distance might not be enough. In other situations, time and distance might be safe but not efficient, such as when closer work may be required for rescue. Then shielding can be more of a factor.

Shielding is a barrier between the source radiation and other objects that might be affected. The shield absorbs the radiation energy. Different materials are used to shield different types of radiation. Many objects, including vehicles, a mound of dirt, or a piece of heavy equipment, can be used to diminish the exposure level if they are located between the responder and the radiation source.

Shielding is not always practical during emergency field operations, and administering emergency care should never be delayed in the interest of seeking shielding material. In emergency care situations, the responder can still reduce radiation exposure through the factors of time and distance.

(6) Describe the potential for secondary threats and devices at criminal or terrorist events

5.3 Competencies — Planning the Response.

5.3.1 Describing Response Objectives. Given at least two scenarios involving hazardous materials/WMD incidents, the operations level responder shall describe the response objectives for each example by completing the following requirements:

Up to this point, NFPA 472 has addressed the competencies that allow the responder to gather the information necessary to make appropriate decisions when determining response objectives. Section 5.1 outlines the competencies necessary for using this information to develop defensive options that can be safely implemented to influence the outcomes of the incident. Responders need to remember that actions are limited by the resources available. Responders should not take any action until they have a clear idea of what they are trying to accomplish. In *Fire Prevention Handbook*, Wright notes the following:

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> The planning process begins as part of the pre-emergency response planning efforts prior to the incident and continues on the scene of the incident, again from a safe location. Federal, state, and local agencies, industry, and carrier personnel may be called on to help. The process of response planning is based on the following tasks:
>
> - Determine the response objectives.
> - Determine the available response options that could favorably change the outcomes.
> - Identify the PPE for the response options.
> - Identify an appropriate decontamination process for each response option.
> - Select the response options within the response community's capabilities that will most favorably change the outcomes.
> - Develop a plan of action including safety considerations. [1] p. 13–137

(1) Given an analysis of a hazardous materials/WMD incident and the exposures, describe the number of exposures that could be saved with the resources provided by the AHJ

The key component of determining the exposures that could be saved lies within the *hazard risk assessment* of the situation. This assessment should include the hazardous materials involved, the chemical and physical properties of those materials, the population at risk for exposure, and the resources available to either mitigate the release of the material or isolate the population.

As an example, a breach of a DOT-105 chlorine rail tank car upwind of a school presents a greater exposure risk than a ricin biological toxin release in an isolated office. Each situation must be assessed for its potential risk to the population, and resources should be ordered to meet the threat. Incidents involving high-risk materials, such as chemicals toxic by inhalation, can quickly involve local, state, and federal assets.

(2) Given an analysis of a hazardous materials/WMD incident, describe the steps for determining response objectives

Wright also notes the following:

> Response objectives, based on the stage of the incident, are the strategic goals for stopping the event now occurring or keeping future events from occurring. . . . Decisions should focus on changing the actions of the stressors, the containment system, and the hazardous material. [1] p. 13–137

As part of the planning process during the development of the IAP, the development of objectives is one of the first actions that should be taken by the IC/unified command. Every facet of resolving the incident must stem from the objectives that are developed. Specifically, initial objectives should address the incident priorities of life safety, incident stabilization, and preservation of property. Incident objectives should be specific, measurable, and realistic based on the resources available.

◆ NFPA 1072 NOTE

Although NFPA 1072 does not specifically require the student to describe the prioritization of emergency care and removal of victims from the hazard area relative to exposure and contamination, this is necessary information for rescues at hazardous material/WMD incidents. Rescue is an important response objective.

(3) Describe how to assess the risk to a responder for each hazard class in rescuing injured persons at a hazardous materials/WMD incident

The risk of harm to a responder from hazardous materials was defined by Ludwig Benner as part of his "General Behavior Model of Hazardous Materials." He coined the acronym TRACEM, which stands

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for thermal, radioactive, asphyxia, chemical, etiological, and mechanical. The specific risks listed in the nine DOT hazard classes that follow are all represented in Benner's model [7]:

- **Class 1 Risk.** Explosives that may involve thermal injury due to the heat generated by the detonation, mechanical injury from the shock, blast overpressure, fragmentation, shrapnel or structural damage, and secondary and tertiary contact with objects. Chemical injuries may result from associated contamination. During a rescue, contact with the blood or other bodily fluids from the victim can result in etiological harm. Because burning depletes oxygen, asphyxiation should always be a consideration.
- **Class 2 Risk.** Gases that are stored in containers that might be under pressure can rupture violently and, depending on their contents, could create a thermal, asphyxiant, chemical, or mechanical hazard. Cryogenic materials (Class 2.2) such as liquid oxygen can cause thermal harm because of their extremely cold temperatures. Asphyxiation is always a concern with chemical vapors in a confined space because chemical reactions can deplete oxygen, affect the body's ability to use oxygen, or create gases that displace oxygen, such as carbon dioxide.
- **Class 3 Risk.** Flammable liquids can burn freely, disseminate heat and shrapnel caused by a forceful explosion, all of which results in thermal hazards from heat and fire as well as associated chemical and mechanical injuries.
- **Class 4 Risk.** Flammable solids, spontaneously combustible materials, and materials that are dangerous when wet could cause thermal harm from heat and flammability. Many of these materials burn at extremely high temperatures. Mechanical harm could occur as some materials react spontaneously and create slip, trip, and fall hazards, while other water-reactive, toxic, and/or corrosive materials can cause chemical harm.
- **Class 5 Risk.** Oxidizers and organic peroxides can create thermal, chemical, and mechanical harm because they supply oxygen to support combustion and are sensitive to heat shock, friction, and contamination.
- **Class 6 Risk.** Toxic/poisonous materials and infectious substances that cause chemical harm due to toxicity by inhalation, ingestion, and skin and eye contact, and in rare circumstances injection. Etiological harm can come from biological agents such as bacteria and viruses or toxins derived from living organisms. Because these products may be flammable, thermal injuries are a hazard.
- **Class 7 Risk.** Radioactive material can cause radiological harm from alpha, beta, gamma, and neutron radiation. The hazard to humans is relative to the radiation dose rate being received over time. Limiting the time of exposure, the distance to the material, and placing shielding between the material and the responder reduces the harm. Radiological substances can also be associated with chemical hazards, for example uranium hexafluoride, which is both radioactive and corrosive.
- **Class 8 Risk.** Corrosive materials that have chemical and thermal hazards associated with damage to contacted tissues and the recognition that chemical reactions create heat especially if the material is fuming and/or water reactive. Acids tend to cause direct immediate damage to tissue, and alkalis can emulsify human tissue. Corrosive chemicals such as strong acids can weaken structural elements, causing the potential for mechanical harm.
- **Class 9 Risk.** Miscellaneous materials present unspecified danger from harm due to the variety of materials that fall within the hazard class, including hazardous wastes, hot materials, and other materials. Responders should anticipate that these materials could cause harm under any of the TRACEM components.

◆ **NFPA 1072 NOTE**

TRACEM is just one model used to describe the harm caused by hazardous materials. Other models are equally valid as long as the responder is able to identify the risks present at the incident. In fact, NFPA 1072 takes this a step further and expects responders to understand basic risk analysis concepts.

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5.3.2 Identifying Action Options. Given examples of hazardous materials/WMD incidents (facility and transportation), the operations level responder shall identify the action options for each response objective and shall meet the following requirements:

After responders have determined what or whom to protect, they must determine how to protect them. Operational level responders must remember that their actions are expected to be defensive in nature.

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

The available defensive options of 5.3.2(1) fall into the following two categories:

1. Evacuation
2. Recognition, identification, notification, and isolation

(2) Describe the prioritization of emergency medical care and removal of victims from the hazard area relative to exposure and contamination concerns

Prioritization of emergency medical care and victim removal will depend on local medical procedures and standard operating procedures. The prioritization of emergency medical care and victim removal from an incident's hazard zones is a distinct and separate process from medical triage. Victim prioritization includes incident conditions, considerations of victim proximity to the hot zone, overall viability, and resources needed for victim removal. Medical triage focuses on the order in which removed victims receive medical care and resources.

5.3.3 Determining Suitability of Personal Protective Equipment (PPE). Given examples of hazardous materials/WMD incidents, including the names of the hazardous materials/WMD involved and the anticipated type of exposure, the operations level responder shall determine whether available PPE is applicable to performing assigned tasks by completing the following requirements:

Responders at this level are not expected to use specialized chemical-protective clothing. Rather, they are expected to use the type of protective clothing they normally wear in their working environment. For example, fire fighters would wear structural fire-fighting protective clothing, while the employee of an industrial facility might use liquid splash-protective clothing.

Responders are required in 5.3.3 to understand the differences among the types of protective clothing and the levels of protection they supply. The level of protective clothing available to operational level responders is a significant factor when considering what type of defensive operations they can undertake safely and when they should request additional expertise and specialized equipment.

◆ **NFPA 1072 NOTE**

Section 5.4 of NFPA 1072 has some requirements that differ from NFPA 472 in regard to PPE. For example, 5.4.1(B) requires responders to inspect, don, doff, work in, and go through decontamination while wearing and doffing approved PPE. This performance requirement goes beyond NFPA 472, which lacks a corresponding "demonstrate" competency for PPE.

(1)*Identify the respiratory protection required for a given response option and the following:

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A.5.3.3(1) The minimum requirement for respiratory protection at hazardous materials/WMD incidents (emergency operations until concentrations have been determined) is positive pressure self-contained breathing apparatus (SCBA).

The respiratory hazards presented by the hazardous materials to which the first responder at the operational level might be exposed can vary widely. A risk-based method of selecting respiratory protection is therefore needed.

For most materials, positive pressure SCBA is appropriate and readily available. However, lower-risk incidents such as a powder spilled from an envelope might warrant downgrading respiratory protection to air-purifying respirators, in accordance with protocols set out by the AHJ.

Similarly, long-duration reduced-risk activities such as mass decontamination might warrant downgrading respiratory protection to powered air-purifying respirators or supplied-air respirators. Choices in respiratory protection are many and must be matched to the risk faced by the responder.

In all cases, the respiratory protective device should be approved under the applicable respiratory protection program legislation such as 29 CFR 1910.134 or local equivalent. Where exposure to chemical, biological, or radiological warfare agents is possible, the respiratory protective device should have CBRN certification under NIOSH or under a local equivalent agency in jurisdictions where NIOSH does not apply.

Referenced in A.5.3.3(1), OSHA 1910.120, Subpart L, 4iiiD requires the following:

> Employees engaged in emergency response and exposed to hazardous substances shall wear positive pressure self-contained breathing apparatus while engaged in emergency response until such time that the individual in charge of the incident command system (ICS), the incident commander, determines through the use of air monitoring that a decreased level of respiratory protection will not result in hazardous exposure to employees. [9]

This requirement does not mean that the responder at the operational level cannot use other types of respiratory protection. Once the material is identified and an appropriate type of protection is determined, the protection can be worn for the emergency. The incident commander should make this decision only after consulting with the hazardous materials safety officer.

(a) Describe the advantages, limitations, uses, and operational components of the following types of respiratory protection at hazardous materials/WMD incidents:

The six types of respiratory protection are the air-purifying respirator (APR), supplied-air respirator (SAR), SCBA, powered air-purifying respirator (PAPR), particulate respirator, and closed circuit breathing respirator. See Commentary Table I.5.3 for the advantages and disadvantages of emergency response respirators.

The use of SCBA has specific advantages and user limitations (see Commentary Table I.5.4). Positive pressure SCBA can place a strain on the wearer's cardiovascular system because of the additional weight and air flow resistance to breathing created by the SCBA and the physical fitness of the user. In general, the better the aerobic capacity of the wearer, the longer a person can breathe/operate before egressing or escaping from a workplace or running out of air. This physiological capacity can be substantially different between users/wearers. In addition, some individuals are claustrophobic or have facial dimensions that prohibit safe use or wear of a full-face, tight-fitting, man-packed SCBA and simply cannot wear one. OSHA regulations require that an individual be medically certified to wear respiratory protective devices safely.

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***COMMENTARY TABLE I.5.3** Advantages and Disadvantages of Emergency Response Respirators*

Type	*Advantages*	*Limitations*
Open-Circuit, Pressure-Demand, Positive Pressure SCBA	**Movement:** Allows free walking movement of the protected user over a specific work area. **Protection:** Provides highest level of respiratory protection against airborne contaminants and oxygen deficiency when properly fitted and maintained. **CBRN Protections:** CBRN certification offers novel verification of new designs available to emergency responders, which would not otherwise be available. **Live Agent Testing (LAT) and Laboratory Respirator Protection Level (LRPL):** CBRN SCBA are laboratory evaluated and determined certified against CASARM grade CWA (GB and HD) and quantitatively evaluated for manufacturer specified face-to-facepiece fit factors and sizing using corn-oil particulate on human test subjects in LRPL testing. **Breathing Air:** SCBA is a man-packed portable source of breathable CGA specification G-7.1 Grade D air. **PASS:** Integrated and stand alone [personal alert safety system (PASS)] devices alert fellow users of downed responder(s). Certain passive tactile or silent alarms allow users to maintain noise discipline when mission dictates. **End-of-Service-Time Indicators (EOSTI):** Heads-up-display and redundant EOSTI indicate breathing air cylinder consumption rates over time via visual or audio codes to user. **Full Facepiece:** Tight-fitting, full facepiece protects the entire frontal facial dimensions of a user, has an integrated impact-resistant visor, and is available in multiple sizes. **Rules of Air Management (ROAM):** SCBA can be donned and user seal checked while user is standing by to respond. Breathing air can be conserved through use of available SCBA technologies and application of local rules of air management. **Fit Evaluation/Testing:** Annual facepiece seal-to-face fit evaluation/testing using recognized quantitative methods increases user confidence in respirator protective qualities and validates that the issued SCBA provides the highest level of respiratory protection afforded from a CBRN SCBA or a non-CBRN SCBA. **Ease of Use:** Hologram sights are recommended for tactical operators who wear SCBA and have to sight a weapon while conducting criminal apprehensions under CBRN or hazardous materials incident response. Ballistic protection of cylinder and high-pressure hose lines is best accomplished by use of stealth and concealment measures. Integration of ballistic protection plates adds weight.	**Complicated:** One of the most complicated respirators used by trained emergency responders. Extensive special technical training and maintenance is required. **Ergonomics:** User has to adapt to the weight and backframe designs of SCBA to ensure adequate proficiency of use. Some SCBA may be considered bulky, awkward, or heavy to untrained users. **Air Requirement:** A finite air supply requires refilling or replacement. **Duration:** Available air cylinder and resupply defines work duration cycles. **Profile:** SCBA hardware may impair movement in confined spaces, structural collapse, or low visibility conditions. **Non-CBRN:** Use of Non-CBRN–compliant SCBA may obstruct respiratory protection of a user in CBRN incidents. **Cylinder Valve:** Cylinder and neck valve assemblies require special emphasis compliance to specified manufacturer maintenance instructions regarding torque, use, and cleanliness. Pressure ranges of 4500, 3000, and 2216 psig exist and require like pressure-rated hardware for compatibility. **Dermal Protection:** SCBA must be integrated and worn with appropriate dermal protection ensembles to attain recognized level of total user protection per hazard type. **CBRN Respirator In-Use Life (CRUL):** CBRN SCBA have a maximum use life of 6 hours when contaminated with chemical warfare agents (CWAs). Non-CBRN SCBA have been shown to fail catastrophically or allow levels of CWA contamination in the SCBA breathing zone within minutes of contamination. Decontamination is difficult. **Head Harness:** SCBA head harness assembly that holds the facepiece to the user's head can become entangled, torn or fail during use and cause facepiece seal breakage, slippage, or dumping of air. **User Seal Checks:** User must be trained and remember to conduct facepiece user seal check and regulator check before "going on air." **Survival Skills:** Use of SCBA requires repetitive, ingrained training for effective use. Communications is hindered. MAYDAY messages require realistic training and the creation of unique survival skills. **Donning Time:** Routine and nonroutine donning time standards for SCBA are required to be defined, validated, and trained to. **Variation of Models:** Multiple types and styles of SCBA are fielded and must be maintained to applicable user instructions and edition-specific performance standards. **Sight Picture:** Facepiece design may challenge a user's ability to attain a consistent sight picture using chin-to-stock.

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***COMMENTARY TABLE I.5.3** Continued*

Type	*Advantages*	*Limitations*
Positive pressure SAR	**Duration:** Longer work periods than with SCBA. **Ergonomics:** Less bulky and lighter than most SCBA. **Protections:** Protects against airborne industrial contaminants. **Like Parts:** Similar in operation to the demand and pressure-demand SCBA regulators. **Comfort:** Select models of SAR provide vortex tubes that cool or heat the respirable air for user comfort or physiological support. **Types of Masks:** Full face and half masks air line respirators are available. **Construction Specific:** Abrasive-blasting air line respirators are available for structural collapse work. **Ensembles:** Full-suit air line respirators may be available. **Air Supply:** Requires same quality of breathing air as SCBA. **Escape Trait:** SAR with escape bottle can be disengaged from air line source and user can egress while on escape bottle air.	**Approval:** Not approved for structural fire or CBRN incident work. Use in a CBRN warm zone requires strict delineation of use and incident commander risk assessment. **Air Supply:** SAR require an air supply hose that will restrict or impair mobility. **Maximum Use Distance:** Mine Safety and Health Administration (MSHA)/National Institute for Occupational Safety and Health (NIOSH) hose length is a maximum of 300 ft (91 m) to ensure proper air flow. **Air Flow:** As length of hose is increased, supply of minimum approved air flow may require adjustment to maintain proper airflow at the facepiece. **Decontamination and Damage:** Air line is vulnerable to damage, chemical contamination, and degradation; decontamination of hoses may be difficult. **Air Pressure Range:** Air pressure is limited to 125 psig; there is only a single stage reduction. **Restriction on Movement:** Worker must retrace steps to leave work area. **Air Line Protection:** Requires protection of the air line and supervision/monitoring of the air supply status and line condition. **IDLH:** Select models are not approved for use in atmospheres immediately dangerous to life or health (IDLH) or in oxygen-deficient atmospheres unless equipped with an emergency egress-only SCBA that can provide immediate emergency respiratory protection in case of air line failure. **Demand Mode:** Air line respirators that are demand mode have negative pressure in the facepiece.
Air-purifying respirators (APRs), including powered air-purifying respirators (PAPRs), air-purifying escape respirators (APERs), and elastomeric half-masks	**CBRN:** Select models of APR, PAPR, and APER are compliant to NIOSH-certified CBRN protection standards. **TRA:** CBRN Cap 1 rating signifies NIOSH approval of the canister at 15 minute laboratory test times at known concentration gradients of 11 test representative agents covering 139 toxic industrial chemicals or toxic industrial materials (TIC/TIM). **Live Agent Training (LAT):** CBRN rating equates to 8 hours of respirator protection against a known concentration of aerosolized GB (sarin) and HD (blister) and 2 hours of protection against liquid HD droplets. **Ease of Use:** Overall, easy to use because the threat is defined and toxicity is known. **Canister Life:** Each canister is vacuum packaged to maintain integrity of performance in storage and reaction with contaminants or air starts as soon as canister is exposed to atmosphere. **Fewer Parts:** Fewer moving/pressurized parts. **Movement:** Unlimited movement of user. **Hydration:** Hydration device may be integral. **Protection:** Combination P100 and carbon filtration canisters and cartridges are primary mechanisms for filtering characterized contaminated air.	**APF:** Lowest assigned protection factors and levels. **Incident Use:** Per response, a new canister must be taken out of vacuum package and correctly applied to the facepiece or powered air source to gain maximum protection afforded by the APR or PAPR. Canisters left on facepieces while in storage lose approved efficiency of carbon bed but retain particulate protection efficiency if they are not destructively probed or damaged. **IDLH:** Filtration media is subject to saturation when respirator is inappropriately or distinctly used in unknown, greater than IDLH, or IDLH respiratory hazardous conditions. **Ensembles:** Requires dermal protection appropriate to the hazard. **Hybrids:** SCBA-PAPR/APR combination-hybrid respirators are not NIOSH-approved as a system configuration. NIOSH standards are under development. **Detection:** Sampling and monitoring/characterization of workplace required before authorization to use APR or PAPR is recommended.

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COMMENTARY TABLE I.5.3 *Continued*

Type	Advantages	Limitations
	Air: Breathable air concentrations of oxygen at 19.5% are required for use. **Particulate Media:** P100 particulate media retains longer service life than adsorbent or absorbent carbon media, when used to protect against respiratory hazards consisting of only particulate in less than IDLH conditions (riot control agent/CS/CN/OC are examples). **Weight:** Exceedingly lighter in weight than SCBA. **Integration:** PAPR can be integrated with SCBA to create a design unique to the respirator manufacturer. **Eye and Face:** Eye and face protection attained is contingent on the type of respirator used and the compliance of the respirator to current ANSI and equivalent performance standards. **Fit Testing:** Loose-fitting PAPR and APER do not require annual fit testing.	**Logistics:** Requires a single or dual filtration media and replacement supplies that attach or are integral to the full facepiece, half mask, or hooded respirator. **Break-through:** Requires filtration media change-out schedule for mandatory removal and replacement of approved filtration media prior to contaminant breakthrough. **Air:** Cartridge filtration media cannot be used in IDLH or oxygen-deficient atmosphere (less than 19.5 percent oxygen at sea level). **Escape Use:** Canister filtration media cannot be used to enter IDLH, but when used in less than IDLH conditions and a secondary device creates IDLH conditions, canister media can be used to escape from IDLH conditions in a single use. **Duration:** Limited duration of protection. May be hard to gauge safe operating time in field conditions. **Limits:** Only protects against specific chemicals and up to specific concentrations. **CBRN Use:** In CBRN/WMD incidents, use requires continuous sampling and monitoring of contaminants and oxygen levels. **Restrictions:** Can only be used when/for: 1. Workplace respiratory hazards are characterized and appropriate respiratory protection is available. 2. Specific gases, vapors, dusts, fumes, or mists — provided that the service life is known via a change-out schedule that is validated and enforced by use of a calculated formula or an integrated end-of-service-life indicator (EOSLI).

COMMENTARY TABLE I.5.4 *Advantages and Disadvantages of SCBA*

Type	Description	Advantages	Disadvantages	Comments
Entry-and-Escape SCBA or Open-Circuit SCBA, Pressure-Demand, Positive Pressure Respirator	**Air:** Supplies breathable air to wearer from cylinder. **Exhalation and Indicators:** Wearer exhales air directly to atmosphere while monitoring all visual and manual indicators of the respirator.	**Alarms:** Primary and redundant warning alarms and gauges signal when 20% to 25% of air supply remains. **Use:** Allows full walking range of movement for user within restrictions of workplace and duration of cylinder. **Air:** Grade D air supply.	**Industrial:** Industrial models are not approved for structural fire or CBRN incident response. **Duration:** Shorter operating time (30, 45, 60 minutes), heavier weight [up to 35 lb (15.9 kg)] than closed-circuit SCBA. **Fit:** Fit testing required. **Maintenance:** Extensive technician trained logistics support program required.	Operating time may vary depending on size of air tank, physical fitness, and work rate of individual.

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COMMENTARY TABLE I.5.4 *Continued*

Type	*Description*	*Advantages*	*Disadvantages*	*Comments*
		CBRN: CBRN protection compliance is for the entire SCBA respirator system, independent of the protection afforded by any protective ensemble rated for CBRN incident response or proximity fire fighting. **Respirator of Choice:** A CBRN SCBA protected by an encapsulating ensemble will assume the protective qualities of the ensemble until the suit is compromised. The CBRN SCBA is then the respirator of choice when the respiratory route is the most likely route of entry for a CBRN agent due to the penetration or failure of protective ensembles and the possible variations in protective equipment ensemble interfaces, types, models, and breakthrough times.	**Cylinder:** Compliance review every 5 years. **Service:** Annual service flow checks. **Checks:** Monthly and weekly maintenance checks. **Shared Hardware:** Facepieces are issued individually, but certain responders may not have an individual regulator and thus may share regulators and SCBA hardware. **Sanitization:** Regulator sanitization process per UI. **Adapters:** Select facepieces require adaptor configuration to convert SCBA facepiece to a negative-pressure facepiece. **Exhalation Valves:** Select SCBA have unique exhalation valves that prevent the facepiece from being converted to negative pressure use. **Cylinder:** Compressed air vessel regulated by separate agency that regulates respirator breathing zone performance. **Use in Fire:** Proximity fire fighting requires SCBA to be protected by fire-hardened ensemble. APR integrated in SCBA is not fire resistant.	
Closed-Circuit SCBA (Rebreather), Pressure-Demand, Positive Pressure Respirator	**Air:** Supplies regenerated dry breathing air from man-packed device. **Recycle:** Recycles exhaled gases (CO_2, O_2, nitrogen) by removing CO_2 with alkaline scrubber and replenishing consumed oxygen with oxygen from liquid or gaseous source.	**Air-Supplied Respirator (ASR):** With future CBRN protections compliance, it is expected to be one of the respirator ASR types that provides a higher respiratory protection level and type to the user. **Duration:** Longer operating time (up to 4 hours), lighter weight [21 lb to 30 lb (9.5 kg to 13.6 kg)] than open-circuit apparatus	**Dry Air:** Hot dry air is generated for the user over the entire duration of use. **Approvals:** Not approved for structural fire or CBRN incident response. **Mouthpiece:** User may have to use teeth to bite mouthpiece to keep mouthpiece sealed to lips.	**Types:** Positive pressure units offer more protection than negative pressure closed-circuit SCBA, which are not recommended on hazardous waste sites.

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COMMENTARY TABLE I.5.4 Continued

Type	*Description*	*Advantages*	*Disadvantages*	*Comments*
	Facepiece: Self-contained backpacked respirator capable of interfacing with compatible or different facepieces of like origin — at the risk of voiding NIOSH approval. **Duration:** 4 hours is normal service life for one closed circuit SCBA. **Use:** If user can withstand quality of breathing air generated, closed circuit SCBA are ideal for underground hazardous materials incidents where fire hazard is minimal to none and longest duration of use is required.	**Alarms:** Warning alarm signals when 20% to 25% of oxygen supply remains. **Air:** Oxygen supply is depleted before CO_2 sorbent scrubber supply, protecting wearer from CO_2 breakthrough.	**Cold Temp:** At very cold temperatures, scrubber efficiency may be reduced; CO_2 breakthrough may occur. **Heat Stress:** Units retain heat exchanged in exhalation, generate heat in CO_2 scrubbing operations, adding to danger of heat stress. Auxiliary cooling devices may be required. **Permeation:** When worn outside encapsulating suit, breathing bag may be permeated by industrial chemicals, contaminating breathing apparatus and air. **Breathing Bag:** Decontamination of breathing bag may be difficult. **Size:** Ergonomic features may seem more bulky compared to open-circuit SCBA. **Vision:** Dual hose assembly interface with facepiece inhibits downward vision. **Hydration and Communication:** Hydration devices and communication devices required.	**Design:** While these devices may be certified as closed-circuit SCBAs, manufacturers do not design closed-circuit SCBA as positive pressure devices due to limitations in design and performance standards. **Mil-Spec:** Variations of closed-circuit SCBA used in special military operations exist, and all variations are based on the same traditional technology.
Escape-Only SCBA/ Self-Contained Escape Respirator (SCER)	**Air:** Supplies clean air from an air cylinder or from oxygen-generating chemical reaction vessel. **Approval:** Approved for escape-only uses.	**Ergonomics:** Lightweight [10 lb (4.5 kg) or less], low bulk, easy to carry, one-time use. **Styles:** Available in pressure-demand, continuous flow modes with industrial protections. **CBRN:** CBRN protections available for NIOSH-approval holders that can meet existing technical performance standards.	**Use:** Cannot be used for entry. **Misuse:** Untrained or uninformed user may attempt to rely on an SCER for entry, or sustainment of the user or users in situations where escape is viewed as one of two or three user options.	**Duration:** Provides 5 to 15 minutes of respiratory protection, depending on model, wearer breathing rate, and other critical respiratory protection factors.

NFPA 1500, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*, requires that all responders using SCBA be medically certified annually [10]. The certifying physician should consult ANSI Z88.6, *Standard for Respiratory Protection — Respirator Use — Physical Qualifications for Personnel*, to determine which medical review is appropriate [11]. NFPA 1500 also requires that SCBA

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users be trained, tested, and certified regularly in the safe and proper use of the equipment. NFPA 1404, *Standard for Fire Service Respiratory Protection Training*, states the following:

> SCBA used in training evolutions simulating exposure to weapons of mass destruction (WMD) shall meet the appropriate sections of 42 CFR Part 84 and shall be marked with a chemical, biological, radiological and nuclear (CBRN) rating. [12, 13]

Additionally, NFPA 1404 requires the training program of the AHJ to evaluate the ability of members to determine whether a given SCBA has been tested and certified by NIOSH for use by emergency responders in CBRN environments.

i. Self-contained breathing apparatus (SCBA)

Positive pressure SCBA provides the highest level of respiratory protection available. The equipment can be used in oxygen-deficient atmospheres and does not restrict the distance the wearer can travel or the path the wearer can take. However, the positive pressure SCBA's limited air supply, which is 2 hours at the most, limits the length of time it can be used, thus controlling the distance the wearer can travel. This limitation is even greater for individuals who are not in good physical condition. In addition, the weight of the SCBA might cause the wearer to exert additional physical effort, which may also shorten the period of effectiveness. See Commentary Table I.5.4 for advantages and disadvantages of SCBA.

ii. Supplied air respirators

SARs are supplied with air by an external source, usually a compressor or compressed air cylinders located away from the actual work site. SARs can be used in oxygen-deficient atmospheres, can operate longer than SCBA, and are lighter to wear than SCBA. However, SAR hoses limit the distance the wearer can travel and can become tangled or twisted. In addition, the wearer must enter and leave the site at the same point.

iii. Powered air-purifying respirators
iv. Air-purifying respirators

PAPRs operate similarly to APRs in that they use filtration canisters to filter the air of contaminants. They cannot be used in an oxygen-deficient atmosphere and must only be worn in atmospheres in which the hazard has been identified and the concentrations are within allowable limits. They have battery-powered fans that pull the air through filtration canisters, minimizing the stress of the weight on the user.

APRs are lightweight, and they provide the user with more movement and travel distance than many of the other types of respiratory protection. However, APRs cannot be used in oxygen-deficient atmospheres and must be worn only in atmospheres in which the hazard has been identified and the concentrations are within allowable limits.

(b) Identify the required physical capabilities and limitations of personnel working in respiratory protection

The use of SCBA has certain limitations, as listed in Commentary Table I.5.4. Positive pressure SCBA places a strain on the wearer's cardiovascular system because of the additional weight. In general, the better the user's aerobic capacity, the longer the user can operate before running out of air. This difference can be substantial. In addition, some individuals are claustrophobic and simply cannot wear SCBA. OSHA regulations require that an individual be medically certified to wear respiratory protection safely.

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NFPA 1500 requires that all responders using SCBA be medically certified annually. The certifying physician should consult ANSI Z88.6 to determine which medical review is appropriate. NFPA 1500 also requires that SCBA users be trained, tested, and certified regularly in the safe and proper use of the equipment.

(2) Identify the personal protective clothing, required for a given action option and the following:

Given the name of the material involved in an incident and the type of exposure, the responder is required to be able to determine what type of PPE is required when implementing options.

(a) Identify skin contact hazards encountered at hazardous materials/WMD incidents

A number of skin contact hazards, including burns, rashes, and absorption of toxic substances, can occur, so protecting exposed skin is critical.

(b) Identify the purpose, advantages, and limitations of the following types of protective clothing at hazardous materials/WMD incidents:
  i. Chemical-protective clothing, including liquid splash–protective ensembles and vapor-protective ensembles
  ii. High temperature–protective clothing, including proximity suits and entry suits
  iii. Structural fire-fighting protective clothing

A responder needs to remember that no single type of protective clothing protects the wearer against all possible hazards, which is true even of chemical-protective clothing.

5.3.4* Identifying Emergency Decontamination Issues. Given scenarios involving hazardous materials/WMD incidents, the operations level responder shall identify when emergency decontamination is needed by completing the following requirements:

◆ **NFPA 1072 NOTE**

Section 5.3 is the section in NFPA 1072 where routes of exposure are listed as a knowledge component. Ideally, it will have been addressed at the awareness level instead.

(1) Identify ways that people, PPE, apparatus, tools, and equipment become contaminated.

Contamination occurs when responders come in contact with hazardous substances at an incident. If the responders are adequately protected, only the garments they are wearing or the equipment they are using in the hot zone will be contaminated. All contaminants must be removed from the responder's personal protective clothing before the responder removes the clothing.

◆ **NFPA 1072 NOTE**

NFPA 1072 Section 5.3 requires responders to identify sources and hazards of carcinogens at incident scenes (including, but not limited to, hazardous materials/WMD incidents). Responders should be aware that smoke is full of contaminants, and exposure to these contaminants is known to cause cancer.

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(2) Describe how the potential for secondary contamination determines the need for emergency decontamination.

Operations level personnel who inadvertently or in the performance of an emergency rescue enter the hot zone might carry contaminants out of the hot zone on their protective clothing or equipment. Emergency decontamination procedures must be implemented immediately to minimize the threat of secondary contamination.

(3) Explain the importance, differences, and limitations of emergency/field expedient, gross, technical, and mass decontamination procedures at hazardous materials incidents.

The purpose of following decontamination procedures is to limit exposure, prevent the spread of the hazardous materials/WMD, and protect the environment. The limitations of these procedures include knowing the material, weather conditions, equipment available, topography, etc.

(4) Identify the purpose of emergency decontamination procedures at hazardous materials incidents.

Emergency decontamination is the physical process of immediately reducing contamination of individuals in potentially life-threatening situations with or without the formal establishment of a decontamination corridor. Exhibit I.5.29 shows the process of emergency decontamination.

EXHIBIT I.5.29

A hazmat team conducts training in performing an emergency decontamination. (Courtesy of Hildebrand and Fish, LLC)

◆ NFPA 1072 NOTE

Operations level responders need to understand all types of decontamination. In NFPA 1072, mass and technical decon are listed as types of decontamination in addition to emergency decon. Responders don't need to be able to perform mass and technical decon, but they should be aware that emergency decon is not the only type of decon available. NFPA 472 does not mention mass and technical decon by name, but responders at this level should understand what they are.

Additionally, in Section 5.4, NFPA 1072 requires responders to understand the need for gross decontamination in the field (fireground incidents), and the procedures for performing gross decontamination. Section 5.4 includes performing gross decon as a skill requirement. NFPA 472 does not have a corresponding "demonstrate" competency for gross decon.

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A.5.3.4 Refer to *Hazardous Materials/Weapons of Mass Destruction Response Handbook*.

Decontamination or contamination reduction procedures are critical to health and safety at a hazardous materials incident. It protects responders from hazardous substances that can contaminate and eventually permeate their PPE and the other equipment they use at the incident. Decontamination also minimizes the transmission of harmful substances from one control zone to another and helps protect the environment. Decontamination procedures must be specific for the type of hazard encountered.

5.4 Competencies — Implementing the Planned Response.

5.4.1 Establishing Scene Control. Given two scenarios involving hazardous materials/WMD incidents, the operations level responder shall explain how to establish and maintain scene control, including control zones and emergency decontamination, and communications between responders and to the public by completing the following requirements:

(1) Identify the procedures for establishing scene control through control zones

Scene control must be put into place very quickly at each hazardous materials/WMD incident to maintain control of the scene. The size of the control zones is based on the degree of hazard present and/or any potential hazards that might occur.

(2) Identify the criteria for determining the locations of the control zones at hazardous materials/WMD incidents

Initially, the responder probably determines where to locate the control zones using recommendations from emergency response guides, such as the initial isolation and evacuation distances in the ERG, or the advice of such organizations as CHEMTREC or CANUTEC.

In addition, the responder relies on his or her own observations of the incident and on an assessment of related information. As the incident progresses, the responder can adjust the zones based on sampling and monitoring results, on evaluations of the extent of contamination and the path it might take in case of a leak, and on the space needed to support control operations.

◆ **NFPA 1072 NOTE**

While NFPA 1072 does not specify the criteria for determining control zone locations in 5.4.1(A) knowledge components, it is assumed this is a necessary component of scene control and scene control procedures.

(3) Identify the basic techniques for the following protective actions at hazardous materials/WMD incidents:

(a) Evacuation

Evacuation is defined by the ERG as the process of moving people at risk to safety from the area threatened. Opportunity and enough time must be available to warn the people in the affected area, and enough time is also needed for them to get ready and leave that area.

Evacuees should be sent upwind of the threatened area by a specific route to a place far enough away from the incident so that they will not have to be moved again if the conditions change. Contaminated evacuees must be kept in a safe refuge area until they can be decontaminated and receive medical treatment if necessary.

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(b) Shelter-in-place

Sheltering-in-place means that people should seek shelter inside a building and remain inside until the danger passes. Sheltering-in-place is used when evacuating the public would cause greater risk than staying in place, or when an evacuation cannot be performed.

(4)* Perform emergency decontamination while preventing spread of contamination and avoiding hazards while using PPE

Even though emergency decontamination is the immediate reduction of contamination on individuals in potentially life-threatening situations, the procedures must be specific for the type of hazard encountered. Decontamination procedures should be undertaken expeditiously without compromising the health and safety of those involved.

The victim(s) must be evacuated from the source of contamination. With copious amounts of water, the responder should immediately begin flushing all of the exposed body parts that might have been contaminated. As the victim's clothing is removed, the responder should ensure that the victim does not become secondarily contaminated by cross-contact with their contaminated clothing. Following this flushing, the victim should be transferred to a clean area for first aid and medical treatment. Before transport, the receiving hospital personnel should be informed of the contaminant involved.

A.5.4.1(4) Refer to *Hazardous Materials/Weapons of Mass Destruction Response Handbook*.

(5)* Identify the items to be considered in a safety briefing prior to allowing personnel to work at the following:

The following items should be presented during a safety briefing:

1. Preliminary evaluation
2. Hazard identification
3. Description of the site
4. Task(s) to be performed
5. Length of time for task(s)
6. Required personal protective clothing
7. Monitoring requirements
8. Notification of identified risks

The factors in this list are some of the most important factors to consider, but others may be included depending on the type of incident.

◆ **NFPA 1072 NOTE**

NFPA 1072 does not mention safety briefings, but safety briefings should be considered part of the safety precautions needed when working hazardous materials/WMD incidents.

(a) Hazardous material incidents
(b)* Hazardous materials/WMD incidents involving criminal activities

A.5.4.1(5)(b) The following are examples of such hazards:

(1) Secondary events intended to incapacitate or delay emergency responders
(2) Armed resistance
(3) Use of weapons

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(4) Booby traps
(5) Secondary contamination from handling patients

A.5.4.1(5) Refer to NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*.

(6) Identify the procedures for ensuring coordinated communication between responders and to the public

5.4.2* Preserving Evidence. Given two scenarios involving hazardous materials/WMD incidents, the operations level responder shall describe the process to preserve evidence as listed in the emergency response plan and/or standard operating procedures.

A.5.4.2 Preservation of evidence is essential to the integrity and credibility of an incident investigation. Preservation techniques must be acceptable to the law enforcement agency having jurisdiction; therefore, it is important to get their agreement ahead of time for the techniques that are set out in the local emergency response plan or the organization's standard operating procedures.

General procedures to follow for these types of incidents include the following:

(1) Secure and isolate any incident area where evidence is located. This can include discarded personal protection equipment, specialized packaging (shipping or workplace labels and placards), biohazard containers, glass or metal fragments, containers (e.g., plastic, pipes, cylinders, bottles, fuel containers), and other materials that appear relevant to the occurrence, such as roadway flares, electrical components, fluids, and chemicals.
(2) Leave fatalities and body parts in place and secure the area in which they are located.
(3) Isolate any apparent source location of the event (e.g., blast area, spill release point).
(4) Leave in place any explosive components or housing materials.
(5) Place light-colored tarpaulins on the ground of access and exit corridors, decontamination zones, treatment areas, and rehabilitation sectors to allow possible evidence that might drop during decontamination and doffing of clothes to be spotted and collected.
(6) Secure and isolate all food vending locations in the immediate area. Contaminated food products will qualify as primary or secondary evidence in the event of a chemical or biological incident.

The collection (as opposed to preservation) of evidence is usually conducted by law enforcement personnel, unless other protocols are in place. If law enforcement personnel are not equipped or trained to enter the hot zone, hazardous materials technicians should be trained to collect samples in such a manner as to maintain the integrity of the samples for evidentiary purposes and to document the chain of evidence.

5.4.3* Initiating the Incident Command System. Given scenarios involving hazardous materials/WMD incidents, the operations level responder shall implement the incident command system as required by the AHJ by completing the following requirements:

One of the key elements of conducting a safe and effective control operation at a hazardous materials incident is the implementation of an effective IMS. For an IMS to be effective, the system must be part of a pre-incident plan and be adopted as a standard operating procedure for emergency responders in a given area.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety*, provides guidance on what an effective IMS should provide to operate effectively [14]. The National Incident Management System (NIMS) lists the following components of its IMS:

- Common terminology
- Modular organizations
- Integrated communications

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- Unified command structure
- Consolidated action plans
- Manageable span of control

A.5.4.3 Jurisdictions that have not developed an emergency response plan can refer to the National Response Team document NRT-1, *Hazardous Materials Emergency Planning Guide*.

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.

(1) Identify the role of the operations level responder during hazardous materials/WMD incidents as specified in the emergency response plan and/or standard operating procedures

The local ERP should outline the role of emergency responders at the operational level. Primarily, that role includes responding to an emergency, assessing the nature of the incident, implementing initial actions, notifying other involved parties, and asking for additional assistance when needed.

(2) Identify the levels of hazardous materials/WMD incidents as defined in the emergency response plan

The book, *Hazardous Materials — Managing the Incident,* describes levels of hazardous materials incidents as the following:

- **Level I: Potential Emergency Condition.** An incident or threat of a release, which can be controlled by the first responder. It does not require evacuation beyond the involved structure or immediate outside area. The incident is confined to a small area and poses no immediate threat to life and property.
- **Level II: Limited Emergency Conditions.** An incident involving a greater hazard or larger area than Level I which poses a potential threat to life and property. It may require a limited protective action of the surrounding area.
- **Level III: Full Emergency Condition.** An incident involving a severe hazard or a large area which poses a significant threat to life and property and which may require a large-scale protective action [15].

While not required directly by NFPA 1072, responders should be familiar with their AHJ's policies and procedures regarding incident levels.

◆ **NFPA 1072 NOTE**

(3) Identify the purpose, need, benefits, and elements of the incident command system for hazardous materials/WMD incidents

The ICS is an organized structure of roles, responsibilities, and procedures for the command and control of emergency operations. Because the ICS is modular and can expand and contract based on the size and nature of the incident, it enables multiple disciplines and multiple jurisdictions to work together safely and effectively.

Three management concepts of ICS include unity of command, span of control, and functional positions. Unity of command stipulates that only one incident commander or a unified command is

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ultimately responsible for the entire incident. The command structure encompasses clearly defined lines of authority in which everyone is responsible to, and directed by, one position. Span of control establishes that only three to seven individuals report to one position so that no one position becomes overloaded, with the optimum span of control at five. Under the functional positions concept, all resources at the scene (command, planning, operations, logistics, and administration and finance) are assigned to one functional position in the ICS and should remain in that position until reassigned or released from the incident.

(4) Identify the duties and responsibilities of the following functions within the incident management system:

(a) Incident safety officer

The incident safety officer should be designated specifically at all hazardous material incidents per 29 CFR 1910.120 [16]. The incident safety officer has the following responsibilities:

1. Obtains a briefing from the incident commander (IC)
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

The position of incident safety officer is critical. The incident commander can be responsible for implementing tasks at an incident, but the safety officer has the authority to see that they are accomplished safely in the hot and warm zones. At most incidents, only one safety officer is present. At more complex incidents, however, additional assistants may be available.

(b) Hazardous materials branch or group

(5) Identify the considerations for determining the location of the incident command post for a hazardous materials/WMD incident

The initial command post could be the first-arriving unit at the incident. As more equipment and personnel arrive, however, the incident commander can use a designated command post, which might be a specially designed vehicle. The incident commander can also use radios or phones to disseminate information.

Each incident should have only one command post. That post should be clearly marked and access to the post should be controlled. The responder should consider locating the command post in an area where it will not have to be moved.

◆ NFPA 1072 NOTE

NFPA 1072 does not mention establishing the command post. However, this should be a consideration of overall incident management and scene control.

(6) Identify the procedures for requesting additional resources at a hazardous materials/WMD incident

Responders at every level are required to know what types of resources are available and understand how to request them.

◆ NFPA 1072 NOTE

NFPA 1072 addresses this under Section 4.4, Notification.

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(7) Describe the role and response objectives of other agencies that respond to hazardous materials/WMD incidents

5.4.4 Using Personal Protective Equipment (PPE). Given the PPE provided by the AHJ, the operations level responder shall describe considerations for the use of PPE provided by the AHJ by completing the following requirements:

Not only should responders know all about the protective clothing and equipment they are given, but they must also be able to use it.

(1) Identify the importance of the buddy system

OSHA has dictated that employees working in IDLH environments work in pairs or teams. No one involved in operations at an incident works alone. Everyone either is part of a team or has a partner, which is shown in Exhibit I.5.30.

EXHIBIT I.5.30

Nurses from a local hospital demonstrate the buddy system. (Courtesy of Ken deBolt, Geneva, NY, Fire Department)

(2) Identify the importance of the backup personnel

During emergency operations and even with the best of planning, responders often work in conditions that deteriorate rapidly and unexpectedly. Thus, it is vitally important that backup personnel are available, that they are equipped with the same level of PPE as the personnel they are backing up, and that they can be deployed immediately.

(3) Identify the safety precautions to be observed when approaching and working at hazardous materials/WMD incidents

An incident should be approached from upwind and uphill whenever possible, and the approach should be calculated and deliberate. Binoculars can help responders identify the material involved, and monitoring equipment can help them assess the hazard and determine what protective equipment they should use from a safe distance.

Responders working at an incident should be aware of what is happening around them. The following are some examples of what the responders should ask themselves while working at a hazardous materials incident:

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- Is there an increase in the rate of venting?
- Does the fire seem bigger than it was on arrival?
- Does the problem seem to be lessening?
- Is there a change in atmospheric conditions? Is it getting windier?
- Has the wind changed direction?

(4) Identify the signs and symptoms of heat and cold stress and procedures for their control

The two most serious heat problems for responders are heat exhaustion and heat stroke. Heat exhaustion is characterized by fatigue, headache, nausea, dizziness, and profuse sweating and usually occurs when a person is dehydrated from not having adequate liquid intake. Heat stroke is characterized by elevated temperature and altered mental status. This condition can occur quickly, and the victim will exhibit confusion and impaired judgment.

Cold stress can occur if responders are exposed to prolonged cold temperatures. Hypothermia is one of the more severe manifestations of cold stress. Victims exhibit shivering, apathy, listlessness, drowsiness, slow pulse, a low respiratory rate, and possible freezing of the extremities. If the

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Closer Look

OSHA 29 CFR 1910.120(q), also known as HAZWOPER, specifically requires a “buddy system in groups of two or more” and emergency medical services (EMS) on scene during hazardous materials entry operations. Based on the HAZWOPER definition of *buddy system*, a backup team must have a minimum of two responders.

Backup teams are required during entries into the hazardous materials incident hot zone that may or may involve a hazardous atmosphere. Backup teams can be identified using several terms, including rapid intervention crew (RIC), rapid intervention team (RIT), fire fighter assist and search team (FAST).

Hazardous materials response teams should develop internal processes for deploying backup teams and should practice backup team deployments as part of their training regimen. This may be as simple as the traditional two-person entry team and two-person backup team that responders are familiar with, but in other circumstances, it may be more involved.

Using a risk-based analysis process and assessing various incident factors, the operational needs of the incident should determine the exact size, configuration, and deployment of the backup team. Factors will include the size of the hot zone, distance from the warm zone to the operational area in the hot zone, number of personnel operating in the hot zone, the hazards and risks associated with the entry, time on SCBA air, hazard control tasks, weather, and time. Coordination and communications between the incident commander, entry team leader, and the hazmat safety officer will be critical.

If a backup team is deployed into the hot zone for any reason, an additional (new) backup team must be put into place to be available to those still operating in the hot zone. By regulation, the backup team is required to maintain continuous contact with the entry team. This may be difficult depending on building size, terrain, size, or complexity of the hot zone, and other limiting factors. In these situations, the primary backup team may need to be close to the entry team in the hot zone and require that the backup team be in appropriate chemical protective clothing (CPC) and on SCBA air. In these situations, it may be prudent to have a secondary backup team standing by outside the hot zone to respond.

RIT/RIC/FAST personnel, special equipment such as portable stretcher systems, tools, and extra SCBA bottles should be employed and positioned based on incident requirements to assist with removing a hazmat responder. Additional trained personnel beyond the common two-person team may need to be assembled before an emergency hot zone entry can be initiated.

Rescuing a hazmat responder during operations in CPC involves significant risks, difficulties, and operational challenges. Sending two members into the hot zone as the entry team with two members as the backup team may be insufficient to rescue and remove even one entry team member in CPC, even under relatively low-risk scenarios. Depending on incident conditions, a hazmat incident may require a more structured backup process and that additional resources be assigned.

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Closer Look *(Continued)*

Factors for determining the backup capability should include:

1. Number of entry team members versus the number of backup team members
2. The need for a secondary backup team
3. The location of the primary and secondary backup team
4. An identified location for and deployment of specialized equipment
5. Incorporating language in the IAP that includes backup team deployment and rescue considerations
6. Having a dedicated EMS capability on scene to support hazmat entry operations

(Courtesy of Grand Lakes & Fire Rescue)

In summary:

- Due to the nature of hazardous materials response tactics and the protective clothing and equipment involved, backup team operations that involve rescuing personnel in a hazardous environment can be complex and difficult.
- Backup team personnel must be protected and equipped to provide for safe operations for the identified hazards and risks within the hot zone.
- The incident commander, hazmat safety officer, and entry team leader must develop a plan for the immediate rescue and removal of operational personnel who are active in the hot zone.
- Incident size-up, planning, and IAP development should ensure that the backup team configuration, needs, and deployment plans are considered and communicated.

victim is exposed to water, either by sweating or if clothing becomes wet, the possibility of cold stress increases.

(5) Identify the capabilities and limitations of personnel working in the PPE provided by the AHJ

The physical and medical requirements for personnel wearing respiratory protection were discussed in the commentary to 5.3.3(1)(b). In addition to those requirements, responders must have the physical stamina required in 5.4.4(5) to wear the protective clothing and equipment provided and to work under strenuous conditions. These criteria are why conducting realistic training exercises that require responders to demonstrate their true abilities is so important.

A job-oriented physical fitness test should be given to new responders and administered annually to existing responders. This test is the only way to determine fitness for duty before placing personnel into physically strenuous situations.

(6) Identify the procedures for cleaning, disinfecting, and inspecting PPE provided by the AHJ
(7) Maintain and store PPE following the instructions provided by the manufacturer on the care, use, and maintenance of the protective ensemble elements

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5.5 Competencies — Evaluating Progress.

5.5.1 Evaluating the Status of Planned Response. Given two scenarios involving hazardous materials/WMD incidents, including the incident action plan, the operations level responder shall determine the effectiveness of the actions taken in accomplishing the response objectives and shall meet the following requirements:

All responders should understand why their efforts must be evaluated. If they are not making progress, the plan must be re-evaluated to determine why progress is not being made.

(1) Identify the factors to be evaluated to determine if actions taken were effective in accomplishing the objectives

To decide whether the actions being taken at an incident are effective and the objectives are being achieved, the responder must determine whether the incident is stabilizing or increasing in intensity. Factors to be considered include reduction of potential impact to persons or the environment and status of resources available to manage the incident. This evaluation should take place on initiation of the IAP, and the incident commander/unified command and general staff chiefs should constantly monitor the status of the incident. The actions taken should be leading to a desirable outcome, with minimal loss of life and property. Changes in the status of the incident should influence the development of the IAP for the next operational period.

(2) Describe the circumstances under which it would be prudent to withdraw from a hazardous materials/WMD incident

Remaining in the immediate vicinity of an incident when nothing can be done to mitigate it and the situation is about to deteriorate is pointless. If flames are impinging on an LP-Gas vessel, for example, and providing the necessary volume of water to cool it is impossible, it would be prudent to withdraw to a safe distance. Incident commanders should always evaluate the benefit of operations in contrast to the risk taken to implement those operations.

Δ **5.5.2 Communicating the Status of Planned Response.** Given two scenarios involving hazardous materials/WMD incidents, including the incident action plan, the operations level responder shall report the status of the planned response through the normal chain of command by completing the following requirements:

(1) Identify the procedures for reporting the status of the planned response through the normal chain of command

The proper method for communicating the status of the planned response lies within the guidelines of the ICS as dictated by an incident-specific IAP. The ICS identifies two types of communication at incidents: formal and informal. Formal communication should be used for all policy-related communication, using the ICS principles of unity of command (one supervisor), chain of command (reporting only through a supervisor), while maintaining span of control (between three and seven persons per supervisor). All critical information should be communicated face-to-face if possible. All situations involving transfer of command must be performed face-to-face.

The format for communications within the ICS must be established by the incident commander/unified command with input from the general staff chiefs. The IAP must clearly reflect this format.

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(2) Identify the methods for immediate notification of the incident commander and other response personnel about critical emergency conditions at the incident

A procedure should be established to allow responders to notify the incident commander immediately when conditions become critical and personnel are threatened. This notification can take the form of a pre-established emergency radio message or tone that signifies danger, for example, or it might be repeated blasts on an air horn. The message should not be delayed while responders try to locate a specific person in the chain of command.

5.6* Competencies — Terminating the Incident. (Reserved)

A.5.6 No competencies are currently required at this level.

References Cited in Commentary

1. Cote, A., ed. *Fire Protection Handbook®*, 20th ed., National Fire Protection Association, Quincy, MA, 2008.
2. NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, National Fire Protection Association, Quincy, MA, 2012.
3. Cote, A., ed. *Fire Protection Handbook®*, 19th ed., National Fire Protection Association, Quincy, MA, 2003.
4. *Emergency Response Guidebook* (ERG). Office of Hazardous Materials Initiatives and Training, PHH-50, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, 1200 New Jersey Avenue, SE East Building, 2nd Floor, Washington, DC 20590, http://phmsa.dot.gov/hazmat/library/erg, 2016.
5. Benner, Jr, L., *A Textbook for Use in the Study of Hazardous Materials Emergencies*, 2nd ed., Lufred Industries, Inc., Oakton, VA, 1978.
6. Fact Sheet, "Potential Health Hazards of Radiation," U.S. Department of Energy, Grand Junction Projects Office, August 1995.
7. Benner, L., "The Story of GEBMO: How the General Hazardous Materials Behavior Model (GEBMO) for Hazardous Materials Emergency Responders Evolved," 2001. Available online at www.iprr.org/HazMatdocs/GEBMO/GEBMO.html.
8. Title 18, Code of Federal Regulations, Part 1, Chapter 113B, U.S. Government Publishing Office, Washington, DC.
9. OSHA 1910.120, Subpart L, 4iiiD, U.S. Government Publishing Office, Washington, DC.
10. NFPA 1500, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*, National Fire Protection Association, Quincy, MA, 2018.
11. ANSI Z88.6, *Standard for Respiratory Protection — Respirator Use — Physical Qualifications for Personnel*, American National Standards Institute, Inc., New York, NY, 1984.
12. NFPA 1404, *Standard for Fire Service Respiratory Protection Training*, National Fire Protection Association, Quincy, MA, 2006.
13. Title 42, Code of Federal Regulations, Part 84, U.S. Government Publishing Office, Washington, DC.
14. NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety,* National Fire Protection Association, Quincy, MA, 2014.
15. Noll, G., Hildebrand, M., Schnepp, R., and Rudner, G. *Hazardous Materials — Managing the Incident*, 3rd ed., Fire Protection Publications, Oklahoma State University, 2013.
16. Title 29, Code of Federal Regulations, 1910.120, U.S. Government Publishing Office, Washington, DC.
17. Title 29, Code of Federal Regulations, 1910.1200, Appendix A, U.S. Government Publishing Office, Washington, DC.

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Competencies for Operations Level Responders Assigned Mission-Specific Responsibilities

6

The competencies for operations level responders who are assigned mission-specific responsibilities are discussed in this chapter. It is important to note that the authority having jurisdiction (AHJ) might only require some of these competencies for training to the operations level, as some of the competencies might not apply to their local jurisdiction. Chapter 6 describes the competencies from which the AHJ can select for training operations level responders.

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6.1 General.

6.1.1 Introduction.

Δ **6.1.1.1*** This chapter shall address competencies for the following operations level responders assigned mission-specific responsibilities at hazardous materials/WMD incidents by the authority having jurisdiction (AHJ) beyond the competencies at the operations level (see Chapter 5). Operations mission-specific responders will be identified by the specialty area as follows:

(1) Personal protective equipment (PPE) (*see Section 6.2*)
(2) Mass decontamination (*see Section 6.3*)
(3) Technical decontamination (*see Section 6.4*)
(4) Evidence preservation and public safety sampling (*see Section 6.5*)
(5) Product control (*see Section 6.6*)
(6) Detection, monitoring, and sampling (*see Section 6.7*)
(7) Victim rescue/recovery (*see Section 6.8*)
(8) Illicit laboratory incidents (*see Section 6.9*)
(9) Disablement/disruption of improvised explosive devices (IED), improvised WMD dispersal devices, and operations at improvised explosives laboratories (*see Section 6.10*)
(10) Diving in contaminated water environment (*see Section 6.11*)
(11) Evidence collection (*see Section 6.12*)

A.6.1.1.1 Operations level responders need only be trained to meet the competencies in Chapter 5. All of the competencies listed in Chapter 6 (mission-specific competencies) are not required and should be viewed as optional at the discretion of the AHJ based on an assessment of local risks. The purpose of Chapter 6 is to provide a more effective and efficient process so that the AHJ can match the expected tasks and duties of its personnel with the required competencies to perform those tasks.

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Δ **6.1.1.2** The operations level responder who is assigned mission-specific responsibilities at hazardous materials/WMD incidents shall be trained to meet all competencies at the awareness level (*see Chapter 4*), all competencies at the operations level (*see Chapter 5*), and all competencies in Section 6.2 of this chapter, and all competencies for each assigned responsibility in Sections 6.3 through 6.10 in this chapter.

6.1.1.3* The operations level responder who is assigned mission-specific responsibilities at hazardous materials/WMD incidents shall receive additional training to meet applicable governmental occupational health and safety regulations.

A.6.1.1.3 Additional training opportunities can be available through local and state law enforcement, public health agencies, the Federal Bureau of Investigation (FBI), the Drug Enforcement Administration (DEA), and the Environmental Protection Agency (EPA).

6.1.1.4 The operations level responder who is assigned mission-specific responsibilities at hazardous materials/WMD incidents shall operate under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures.

6.1.1.5 The development of assigned mission-specific knowledge and skills shall be based on the tools, equipment, and procedures provided by the AHJ for the mission-specific responsibilities assigned.

6.1.2 Goal. The goal of the competencies in this chapter shall be to provide the operations level responder assigned mission-specific responsibilities at hazardous materials/WMD incidents by the AHJ with the knowledge and skills to perform the assigned mission-specific responsibilities in a safe and effective manner.

6.1.3 Mandating of Competencies. This standard shall not mandate that the response organizations perform mission-specific responsibilities.

6.1.3.1 Operations level responders assigned mission-specific responsibilities at hazardous materials/WMD incidents, operating within the scope of their training in this chapter, shall be able to perform their assigned mission-specific responsibilities.

6.1.3.2 If a response organization desires to train some or all of its operations level responders to perform mission-specific responsibilities at hazardous materials/WMD incidents, the minimum required competencies shall be as set out in this chapter.

6.2 Mission-Specific Competencies: Personal Protective Equipment (PPE).

6.2.1 General.

6.2.1.1 Introduction.

6.2.1.1.1 The operations level responder assigned to use PPE at hazardous materials/WMD incidents shall be that person, competent at the operations level, who is assigned by the AHJ to select, inspect, don, work in, go through decontamination while wearing, and doff PPE at hazardous materials/WMD incidents.

Δ **6.2.1.1.2** The operations level responder assigned to use PPE at hazardous materials/WMD incidents shall be trained to meet all competencies at the awareness level (*see Chapter 4*), all competencies at the operations level (*see Chapter 5*), and all competencies in this section.

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6.2.1.1.3 The operations level responder assigned to use PPE at hazardous materials/WMD incidents shall operate under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures.

Although some of the mission-specific competencies in this section are based on competencies from Chapter 7, Competencies for Hazardous Materials Technicians, the technical committee wants to state clearly that operations level responders with a mission-specific competency are not replacements for a hazardous materials technician (HMT). Operations level responders with a mission-specific competency can perform some technician level skills, but do not have the broader skills and competencies required of an HMT, particularly regarding risk assessment and the selection of control options. The following two options are examples of how guidance can be provided to ensure that operations level responders do not go beyond their level of training and equipment:

- **Direct Guidance:** Operations level responders are working under the direction of an HMT or allied professional who has the ability to (1) continuously assess and/or observe their actions and (2) provide immediate feedback. Guidance from an HMT or an allied professional can be provided through direct visual observation or through assessment reports communicated by the operations level responder to them.
- **Written Guidance:** Written standard operating procedures or similar guidance clearly states the "rules of engagement" for operations level responders with the mission-specific competency. Emphasis should be placed on (1) tasks expected of operations level responders, (2) tasks beyond the capability of operations level responders, (3) required personal protective equipment (PPE) and equipment to perform these expected tasks, and (4) procedures for ensuring coordination in the local incident command system (ICS).

6.2.1.1.4* The operations level responder assigned to use PPE shall receive the additional training necessary to meet specific needs of the jurisdiction.

If the AHJ has supplied specialized hazardous materials/WMD equipment (e.g., PPE, monitoring device) personnel are required to be trained on the selection procedures, proper use and limitations, field maintenance, and calibration of the equipment. For example, law enforcement personnel should be required to conduct firearms training while using respiratory equipment, fire fighters should conduct victim decontamination exercises while wearing hazardous materials/WMD PPE and using decontamination equipment (e.g., pool, tents), and emergency medical services (EMS) personnel should use hazardous materials/WMD PPE while doing victim triage.

A.6.2.1.1.4 See A.6.1.1.3.

6.2.1.2 Goal. The goal of the competencies in this section shall be to provide the operations level responder assigned to select, inspect, don, work in, go through decontamination while wearing, and doff PPE with the knowledge and skills to perform the tasks in a safe and effective manner.

N **6.2.1.2.1** Given a hazardous materials/WMD incident, a mission-specific assignment in an incident action plan (IAP) that requires use of PPE; the scope of the problem; response objectives and options for the incident; policies and procedures; access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures; approved PPE; and policies and procedures, the operations level responder assigned to use PPE shall be able to perform the following tasks:

(1) Select PPE provided by the AHJ based on tasks assigned
(2) Inspect, don, work in, go through emergency and technical decontamination while wearing, and doff PPE provided by the AHJ consistent with the AHJ standard operating

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procedures and the incident site safety and control plan by following safety procedures, avoiding or minimizing hazards, and protecting exposures and personnel
(3) Maintain and store PPE consistent with AHJ policies and procedures
(4) Report and document the use of PPE

6.2.2 Competencies — Analyzing the Incident. (Reserved)

6.2.3 Competencies — Planning the Response.

Δ **6.2.3.1 Selecting Personal Protective Equipment (PPE).** Given scenarios involving hazardous materials/WMD incidents with known and unknown hazardous materials/WMD and the PPE provided by the AHJ, the operations level responder assigned to use PPE provided by the AHJ shall select the PPE required to support assigned mission-specific tasks at hazardous materials/WMD incidents based on AHJ policies and procedures by completing the following requirements:

(1)* Describe the importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures

Δ **A.6.2.3.1(1)** A written personal protective equipment program should be established in accordance with 29 CFR 1910.120. Elements of the program should include personal protective equipment (PPE) selection and use; storage, maintenance, and inspection; and training consideration.

Proper selection of PPE for individual responders during a specific emergency must be based on a careful assessment of two factors:

(1) The hazards anticipated to be present at the scene
(2) The probable impact of those hazards, based on the mission role of the individual

The emergency responder must be provided with appropriate respiratory and dermal protection from suspect or known hazards. The amount of protection required is material and hazard specific. The protective ensembles must be sufficiently strong and durable to maintain protection during operations. According to 29 CFR 1910.120(q)(3)iii, the individual in charge of the ICS ensures that the personal protective ensemble worn is appropriate for the hazards to be encountered.

Currently, no single personal protective ensemble can protect the wearer from exposure to all hazards. It is important that the appropriate combination of respirator, ensemble, and other equipment be selected based on a hazard assessment at the scene.

The OSHA/EPA categories of personal protective equipment are defined in 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response" (HAZWOPER), Appendix B, as follows:

(1) Level A — To be selected when the greatest level of skin, respiratory, and eye protections is required
(2) Level B — To be selected when the highest level of respiratory protection is necessary but a lesser level of skin protection is needed
(3) Level C — To be selected when the concentration(s) and type(s) of airborne substances are known and the criteria for using air-purifying respirators(APRs) are met

Except for the inflation and inward leakage tests on Level A garments, HAZWOPER does not specify minimum performance criteria of protective clothing and respirators required for specific threats, such as chemical permeation resistance and physical property characteristics. The use of these general levels of protection does not ensure that the wearer is adequately protected from CBRN-specific hazards.

Relying solely on OSHA/EPA nomenclatures in selection of personal protective equipment could result in exposure above acceptable limits or an unnecessary reduction in

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operational effectiveness through lack of mobility, decreased dexterity, or reduced operational mission duration.

The clothing and ensemble standards developed by the NFPA Technical Committee on Hazardous Materials Protective Clothing and Equipment establish minimum performance requirements for physical and barrier performance during hazardous materials emergencies, including those involving chemical, biological, and radioactive terrorism materials. These standards are integrated with the NIOSH and NFPA standards on respiratory equipment.

Table A.6.2.3.1(1) is provided to assist emergency response organizations in transitioning from the OSHA/EPA Levels A, B, and C to protection-based standards terminology. Because the OSHA/EPA levels are expressed in more general terms than the standards and do not include testing to determine protection capability, it is not possible to "map" those levels to specific standards. However, it is possible to look at specific configurations and infer their OSHA/EPA levels based on the definitions of those levels. Examples of ensembles and conservative interpretations of their corresponding levels are provided in Table A.6.2.3.1(1).

TABLE A.6.2.3.1(1) *Protective Clothing Standards That Correspond to OSHA/EPA Levels*

Ensemble Description Using Performance-Based Standard(s)[a]	*OSHA/EPA Level*
NFPA 1991 worn with NIOSH CBRN SCBA	A
NFPA 1994 Class 2 worn with NIOSH CBRN SCBAb	B
NFPA 1971 with CBRN option worn with NIOSH CBRN SCBAc	B
NFPA 1994 Class 3 worn with NIOSH CBRN APRb	C
NFPA 1994 Class 4 worn with NIOSH CBRN APR	C

[a] The 2007 edition of NFPA 1994 eliminated the Class 1 requirements, relying instead on NFPA 1991 as the standard for vapor protective ensembles. The 2007 edition of NFPA 1994 also included a new Class 4 requirement for biological and radiological particulate protective ensembles.
[b] Vapor protection for NFPA 1994, Class 2 and Class 3, is based on challenge concentrations established for certification of CBRN open-circuit SCBA and APR respiratory equipment. Class 2 and Class 3 do not require the use of totally encapsulating garments.
[c] The 2007 edition of NFPA 1971 included options for protection from CBRN hazards. Only complete ensembles certified against these additional optional requirements provide this protection. The protection levels set in the NFPA 1971 CBRN option are based on the Class 2 requirements contained in NFPA 1994.

All purchasers of personal protective equipment are cautioned to examine their hazard and mission requirements closely and to select appropriate performance standards. All personal protective equipment must be used in accordance with 29 CFR 1910.120 (or equivalent EPA or state regulations). Also applicable in states with OSHA-approved health and safety programs and for federal employers is 29 CFR 1910.134, "Respiratory Protection" (or an equivalent EPA or state regulation). Both 29 CFR 1910.120 and 29 CFR 1910.134 include requirements for formal plans, medical evaluation, and training to ensure the safety and health of emergency responders. Additional information, a list of allowable equipment, and information on related standards, certifications, and products are available on the Department of Homeland Security (DHS)–sponsored Responder Knowledge Base (http://www.rkb.mipt.org).

Commentary Table I.6.1 compares the NFPA hazardous materials protective clothing standards, the Occupational Safety and Health Administration (OSHA)/Environmental Protection Agency (EPA) Levels A, B, and C, and the new National Institute for Occupational Safety and Health (NIOSH)-certified respirator with chemical, biological, radiological, and nuclear (CBRN) protection standards. See the references at the end of the chapter for more complete information on the NFPA standards cited.

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COMMENTARY TABLE I.6.1 *Comparison of NFPA Standards and OSHA/EPA Levels for Respiratory Protection [1] – [5]*

					Expected Dermal Protection from Suit(s)[5]			
NFPA Standard[1]	*Minimum OSHA/ EPA Level*	*Respirator*[2]	*NFPA Barrier Method(s)*[3]	*Type of Challenge*[4]	*Chemical Vapor*	*Chemical Liquid*	*Particulate*	*Liquid-borne viruses*
1991 (2016)	A	SCBA	Permeation resistance	24 toxic industrial chemicals, 2 CWAs	X	X	X	X
1994 Class 1 (2018)	A	SCBA	Permeation resistance	10 toxic industrial chemicals, 2 CWAs	X	X	X	X
1994 Class 2 or 2R (2018)	B	SCBA	Permeation resistance; viral penetration resistance	5 toxic industrial chemicals, 2 CWAs; Bacteriophage	X	X	X	X
1992 (2018)	B	SCBA	Penetration resistance	10 toxic industrial chemicals		X		
1994 Class 3 or 3R (2018)	C	CBRN APR or CBRN PAPR	Permeation resistance; viral penetration resistance	5 toxic industrial chemicals, 2 CWAs; Bacteriophage	X	X	X	X
1994 Class 4 or 4R (2018)	C	CBRN APR or CBRN PAPR	Viral penetration resistance	Bacteriophage			X	X
1999 Single-Use or Multiple-Use (2018)	C	APR with P100 filter or PAPR with HEPA filter	Viral penetration resistance	Bacteriophage				X

[1] Refers to current edition of NFPA standard that defines complete ensemble (suit or garment, gloves, footwear, and respirator). NFPA 1991 also includes options for liquefied protection and flash fire protection. NFPA 1992 includes option for flash fire protection and addresses both encapsulating and nonencapsulating ensembles. In NFPA 1994, there are four classes of ensembles ranging from Class 1 (highest level of protection) to Class 4 (lowest level of protection). Type R or ruggedized protection is defined for Class 2, 3, and 4 for additional physical protection and durability over baseline ensembles. NFPA 1999 defines two types of ensembles for single use and multiple use (higher level of physical protection and durability).

[2] SCBA – Self-contained breathing apparatus; APR – air-purifying respirator; PAPR – powered air-purifying respirator; all SCBA are certified to at least NFPA 1981 for open-circuit SCBA with mandatory CBRN protection. SCBA specified for NFPA 1992 and NFPA 1994 Class 2 or 2R may alternatively be certified to NFPA 1986 (tactical and technical operations SCBA with CBRN protection). Where specified, APR or PAPR are certified as providing CBRN protection; NFPA 1999 does not require CBRN protection and only addresses particulate protection.

[3] Permeation resistance measures molecular transfer of chemical through materials and seams over a 1-hr period; depending on standard, different chemical challenge concentrations are applied. NFPA 1991 specifies 100 g/m² for liquid challenges and 100% for gas challenges; NFPA 1994, Class 1 specifies 20 g/m² for liquid challenges and 1% for gas challenges; NFPA 1994 Class 2 or 2R specifies 10 g/m² for liquid challenges and 350 ppm for gas challenges; NFPA 1994 Class 3 or 3R specifies 10 g/m² liquid challenge with air flowing and 40 ppm for gas challenges. Penetration resistance testing determines if bulk liquid chemical passes through in a 1-hr period, where part of exposure is at 13.8 kPa (2 psi) pressure; viral penetration resistance determines if bacteriophage (a virus surrogate for hepatitis virus and HIV) suspended in a liquid passes through material over a 1-hr period where part of the exposure is at 13.8 kPa (2 psi) as determined using a microbiological assay procedure.

[4] Different challenge substances are used for the different standards to represent a range of chemical exposures and properties. Where chemical warfare agents (CWAs) are indicated, distilled mustard (HD) and Soman (GD) are evaluated. NFPA 1991 involves the 21 liquid and gaseous chemicals specified in ASTM F1001 less acetonitrile, plus acrolein (liquid), acrylonitrile (liquid), and dimethyl sulfate (liquid); NFPA 1994, Class 1 specifies testing against 10 toxic industrial chemicals that include acrolein (vapor), acrylonitrile (vapor), ammonia (gas), chlorine (gas), diethylamine (vapor), dimethyl sulfate (liquid), ethyl acetate (vapor), sulfuric acid (liquid), tetrachloroethylene (liquid), and toluene (liquid). NFPA 1992 entails only liquids that include butyl acetate, dimethyl formamide, Fuel H (synthetic gasoline), isopropyl alcohol (91%), methyl isobutyl ketone, nitrobenzene, sodium hydroxide (50%), sodium hypochlorite (10%), sulfuric acid (93%), and tetrachloroethylene (95%). Chemicals for NFPA 1994 Class 2, 2R, 3, and 3R include acrolein (vapor), acrylonitrile (vapor), ammonia (gas), chlorine (gas), and dimethyl sulfate (liquid).

[5] In addition to material and seam testing for barrier performance, ensembles compliant to NFPA standards are evaluated for their integrity to different types of exposures. NFPA 1991 and NFPA 1994 Class 1, 2, 2R, 3, and 3R ensembles are evaluated for man-in-simulant testing (MIST) to determine protection for vapor exposures where different levels of performance are specified for each standard and class. Liquid chemical protection is demonstrated by passing performance using a full ensemble liquid integrity test where the exposure time is varied with the particular standard or class. With the exception of NFPA 1994 Class 4 or 4R

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particulate protection is demonstrated through ensembles passing both vapor (MIST) and liquid integrity tests. For NFPA 1994 Class 4 or 4R ensembles, an inward particulate leakage test is conducted. Protection from liquid-borne viruses (and other microorganisms) is demonstrated by the combination of material/seam viral penetration resistance and liquid integrity testing with the exception that NFPA 1994 Class 4 or 4R ensembles are only evaluated for material viral penetration resistance.

(2) Describe the purpose of each type of PPE provided by the AHJ for response to hazardous materials/WMD incidents based on NFPA standards and how these items relate to EPA levels of protection

(3) Describe capabilities and limitations of PPE for the following hazards:
- (a) Thermal
- (b) Radiological
- (c) Asphyxiating
- (d) Chemical (corrosive, toxic)
- (e) Etiological/biological
- (f) Mechanical

(4) Select PPE provided by the AHJ for assigned mission-specific tasks at hazardous materials/WMD incidents based on AHJ policies and procedures
- (a) Describe the following terms and explain their impact and significance on the selection of chemical-protective clothing (CPC):
  - i. Degradation
  - ii. Penetration
  - iii. Permeation
- (b) Identify at least three indications of material degradation of CPC
- (c) Identify the different designs of vapor-protective clothing and liquid splash–protective clothing, and describe the advantages and disadvantages of each type
- (d)* Identify the advantages and disadvantages of the following cooling measures:
  - i. Air cooled
  - ii. Ice cooled
  - iii. Water cooled
  - iv. Phase change cooling technology
- (e) Identify the physiological and psychological stresses that can affect users of PPE
- (f) Describe AHJ policies and procedures for going through the emergency and technical decontamination process while wearing PPE

A.6.2.3.1(4)(d) Phase change technology creates a constant temperature vest and is a completely unique body management device. The unique cooling formulation encapsulated in an anatomically designed device makes a change in minutes from a clear liquid to a semisolid, white waxy form and maintains a temperature of 59°F (15°C). Unlike the extremely cold temperatures of ice and gel, the higher temperature formulation in these devices works in harmony with the body. When an energized cool vest is worn, the cool phase change material absorbs the excessive heat the body creates when wearing protective clothing or encapsulating suits.

N 6.2.4 Competencies — Implementing the Planned Response.

◆ NFPA 1072 NOTE

Safety precautions for wearing PPE include all the items listed in NFPA 472 6.2.3.1(4) and 6.2.4.1(1), as applicable.

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6.2.4.1 Using Personal Protective Equipment (PPE). Given the PPE provided by the AHJ, the operations level responder assigned to use PPE shall demonstrate the ability to inspect, don, work in, go through decontamination while wearing, and doff the PPE provided to support assigned mission-specific tasks by completing the following requirements:

(1) Describe safety precautions for personnel wearing PPE, including buddy systems, backup systems, accountability systems, safety briefings, and evacuation/escape procedures
(2) Inspect, don, work in, and doff PPE provided by the AHJ following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards
(3) Go through the process of being decontaminated (emergency and technical) while wearing PPE
(4) Maintain and store PPE according to AHJ policies and procedures

N **6.2.5 Competencies — Evaluating Progress. (Reserved)**

6.2.6 Competencies — Terminating the Incident.

6.2.6.1 Reporting and Documenting Personal Protective Equipment (PPE) Use. Given a scenario involving a hazardous materials/WMD incident and AHJ policies and procedures, the operations level responder assigned to use PPE shall report and document use of the PPE as required by the AHJ by completing the following:

(1) Identify the reports and supporting documentation required by the AHJ pertaining to PPE use
(2) Describe the importance of personnel exposure records
(3) Identify the steps in keeping an activity log and exposure records
(4) Identify the requirements for filing documents and maintaining records

6.3 Mission-Specific Competencies: Mass Decontamination.

6.3.1 General.

When a release of hazardous materials has potentially contaminated a large number of people, a different approach needs to be taken to decontamination. What constitutes a large number will depend on the response capabilities of the locality where the incident has occurred. If the use of technical decontamination procedures is not feasible due to the volume of victims, then mass decontamination will need to be implemented. Ideally, mass decontamination will use methods that can be readily applied with existing resources and techniques consistent with current responder training, and will take into account resource limits and other constraints such as human nature.

There are many ways to perform mass decontamination, but the choice of procedure depends on the number and types of fire apparatus available locally. The first action to be instigated is disrobing of the victims to their undergarments, as illustrated in Exhibit I.6.1. According to studies conducted in 2001 by the U.S. Army Soldier and Biological Command (SBCCOM) [now U.S. Army Research, Development and Engineering Command (RDECOM)] [6], when harmless nerve agent simulants were used to track contaminants, 80 percent of the contaminants were removed by simply undressing. In most cases, speed is a critical component in limiting victim exposure to contaminant hazards and disrobing achieves speedy contaminant reduction. There could be modesty issues for reasons such as gender, religious beliefs, and other societal norms; therefore provision should be made to preserve victim modesty and not offend their dignity. Victims refusing to disrobe should be flushed while clothed: failure to remove outer garments should never be a cause for excluding victims from the mass decontamination process.

Victims should be flushed with large volumes of low-pressure water applied from fire apparatus through fog lines directed horizontally and vertically down. Where aerial devices are available,

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EXHIBIT I.6.1

Having victims remove their outer garments will significantly reduce contaminant potential. (Courtesy of Hildebrand and Fish, LLC)

a water-tower based "shower" is easily implemented, but fog nozzles can also be attached to one or more ground ladders secured on top of two engines, then aimed downward. Nozzles should be placed into side outlets, trashlines, and deck guns on apparatus to provide a horizontal spray without the need for pump operators or fire fighters to be in the decontamination path. Pressures should be regulated to produce approximately 50 psi (350 kPa). The objective is to gain volume but not to risk hurting or knocking over the people being decontaminated. (See Exhibit I.6.2.)

Where multiple decontamination paths can be established, there will be a benefit in various ways: (a) It could resolve modesty issues if gender-based paths were established; (b) it could increase the number of victims decontaminated in a given time; (c) or it could be used to provide one path for ambulatory victims, one for nonambulatory people requiring assistance from fire fighters or emergency medical technicians (EMTs), and one for critically ill patients who will need immediate EMS attention even while being decontaminated. If multiple decontamination paths are established, it is important to ensure that children are not separated from those responsible for them.

It is generally considered acceptable for a separate decontamination corridor for emergency responders who will undergo technical (rather than mass) decontamination.

It is important to ensure that following their wash-down, victims are marshaled to a controlled area where they can be medically assessed, be given dry garments, and be given psychological support. Law enforcement might wish to conduct interviews, and where available, social services should be in attendance to provide support to those with logistical problems in transportation, housing, and reuniting of families. It is essential that all potential participants in the mass decontamination process, including any required follow-up after the wash-down, establish their roles and responsibilities during local planning for these events.

When responders suspect that a hazardous materials release has been caused through criminal or terrorist activity, triaging needs to be done before mass decontamination is initiated. First, victims should be observed to see if any are symptomatic; those who are should have treatment initiated and continued through decontamination. Second, if everyone appears asymptomatic, a determination needs to be made whether actual chemical agent exposure has occurred. Where exposure appears unlikely, decontamination should be deferred pending on-scene investigation. (If signs or symptoms appear, appropriate treatment of patients and decontamination of all should begin.) The decision to decontaminate should be based on the probability of agent exposure, the environmental conditions at

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EXHIBIT I.6.2

Two engines plus an elevated stream will create a large volume of low-pressure water. (Courtesy of Gaade & Associates)

the time, and the age and health status of the victims. If asymptomatic victims are clamoring for decontamination, this is likely more for psychological reasons, and incident commanders need to weigh the risks inherent in the decontamination process against the benefits gained.

Several factors need to be taken into consideration during decontamination in cold weather: location for wash-down, temperature and windchill, condition of the person being decontaminated, and availability of shelter. In cold weather, decontamination of individuals (technical decontamination) and of groups of people (mass decontamination) can be done either indoors or outdoors; the temperature will be the deciding factor.

According to an RDECOM report on cold weather decontamination procedures, in ambient temperatures over 65°F (18°C), decontamination and follow-up can be done outdoors; when temperatures are above 35°F (2°C), the outdoor decontamination should be done in a covered, sheltered decontamination corridor with follow-up indoors; and where temperatures are below 35°F (2°C), decontamination can be done either indoors or outdoors as long as a heated, sheltered decontamination corridor is used. If during outdoor decontamination the runoff water forms ice and creates slip-and-fall hazards, both the decontamination and follow-up should be done indoors. Note that by definition, emergency decontamination is a critical activity that should be done immediately where and when necessary, without regard for ambient temperature considerations.

Showers can be in indoor locations suitable for technical decontamination: both the regular domestic type found in schools, fitness centers, executive bathrooms, and industrial change rooms, and the industrial safety showers in many facilities where hazardous materials incidents can occur. For mass decontamination, other options are possible for indoor decontamination: buildings such as community centers with shower or swimming pool facilities, sprinkler systems in hallways or warehouses (when water damage to building fabric and contents can be minimized), and indoor open areas such as hockey arenas, where people can be hosed off using fog lines yet the runoff can be controlled and the area heated.

Consideration needs to be given to the proximity of available facilities. If victims have to be transported to a location away from the incident area to achieve warmer conditions for decontamination, they should disrobe before transport and any remaining visible liquids should be blotted off them to minimize chemical exposure during the time prior to decontamination. The interior of any vehicles used for such transport should be able to be hosed down afterward: Transit buses and trucks would be better choices than automobiles and vans.

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When mass decontamination has taken place, the victims need to be given shelter from the cold and issued temporary covering until suitable clothing can be issued. Large towels, sheets, and blankets can be used, and arrangements should be established with local hotels, hospitals, college residences and dormitories, and industrial laundries prior to any event for the loan of such items in an emergency. Post-decontamination observation of victims is necessary to ensure they do not suffer ill effects from cold shock or hypothermia and are kept away from areas where windchill could affect them. Victims who are shivering are displaying a normal physiological response and only need to be attended to if the shivering should stop and they start to display signs of hypothermia.

Whereas emergency responders who are exposed to chemical contamination can undergo technical decontamination in cold weather with minimal effect on their body systems thanks to temperature protection provided by their PPE, citizens being put through mass decontamination in low-temperature (or high windchill) conditions can suffer physiological effects ranging from discomfort to hypothermic reactions. Nevertheless, as in emergency decontamination situations, where people have been in contact with life-threatening levels of contamination, they should disrobe and be flushed with copious amounts of low-pressure, high-volume water regardless of the ambient temperature. They should then be sheltered and warmed as expeditiously as possible.

6.3.1.1 Introduction.

6.3.1.1.1 The operations level responder assigned to perform mass decontamination at hazardous materials/WMD incidents shall be that person, competent at the operations level, who is assigned by the AHJ to select, set up, implement, evaluate, and terminate mass decontamination for ambulatory and nonambulatory victims at hazardous materials/WMD incidents.

Δ **6.3.1.1.2** The operations level responder assigned to perform mass decontamination at hazardous materials/WMD incidents shall be trained to meet all competencies at the awareness level (*see Chapter 4*), all competencies at the operations level (*see Chapter 5*), all mission-specific competencies for PPE (*see Section 6.2*), and all competencies in this section.

6.3.1.1.3 The operations level responder assigned to perform mass decontamination at hazardous materials/WMD incidents shall operate under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures.

Although some of the mission-specific competencies in this section are taken from Chapter 7, Competencies for Hazardous Materials Technicians, the technical committee wants to state that operations level responders with a mission-specific competency are not replacements for an HMT. Operations level responders with a mission-specific competency can perform some technician-level skills but do not have the broader skills and competencies required of an HMT, particularly regarding risk assessment and the selection of control options. The following two options are examples of how guidance can be provided to ensure that operations level responders do not go beyond their level of training and equipment:

- **Direct Guidance:** Operations level responders are working under the control of an HMT or allied professional who has the ability to (1) continuously assess and/or observe their actions, and (2) provide immediate feedback. Guidance from an HMT or an allied professional can be provided through direct visual observation or through assessment reports communicated by the operations level responder to them.
- **Written Guidance:** Written standard operating procedures or similar guidance clearly state the "rules of engagement" for operations level responders with the mission-specific competency. Emphasis should be placed on the following:

  1. Tasks expected of operations level responders
  2. Tasks beyond the capability of operations level responders
  3. Required PPE and equipment to perform these expected tasks
  4. Procedures for ensuring coordination within the local ICS

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6.3.1.1.4* The operations level responder assigned to perform mass decontamination at hazardous materials/WMD incidents shall receive the additional training necessary to meet specific needs of the jurisdiction.

A.6.3.1.1.4 Additional training opportunities can be available through local and state law enforcement, public health agencies, the Federal Bureau of Investigation (FBI), the Drug Enforcement Administration (DEA), and the Environmental Protection Agency (EPA).

6.3.1.2 Goal.

6.3.1.2.1 The goal of the competencies in this section shall be to provide the operations level responder assigned to select, set up, implement, evaluate, and terminate mass decontamination for ambulatory and nonambulatory victims at hazardous materials/WMD incidents with the knowledge and skills to perform the tasks in 6.3.1.2.2 in a safe and effective manner.

Δ **6.3.1.2.2** Given a hazardous materials/WMD incident that requires mass decontamination; an assignment in an IAP; the scope of the problem; policies and procedures; approved tools, equipment, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures responding to hazardous materials/WMD incidents, the operations level responder assigned to perform mass decontamination shall be able to perform the following tasks:

(1) Select a mass decontamination process to minimize the hazard for an assigned mission-specific task within the capabilities of available personnel, PPE, and response equipment provided by the AHJ
(2) Set up and implement the selected mass decontamination process to decontaminate victims, personnel, tools, and equipment consistent with AHJ policies and procedures and the incident site safety and control plan following safety procedures, avoiding or minimizing hazards, and protecting exposures and personnel
(3) Evaluate the effectiveness of the mass decontamination process
(4) Report and document mass decontamination activities

6.3.2 Competencies — Analyzing the Incident. (Reserved)

6.3.3 Competencies — Planning the Response.

Δ **6.3.3.1 Selecting a Mass Decontamination Process.** Given scenarios involving hazardous materials/WMD incidents requiring mass decontamination, the operations level responder assigned to perform mass decontamination shall select a mass decontamination process that will minimize the hazard and spread of contamination based on AHJ policies and procedures by completing the following requirements:

(1) Describe the importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures when performing assigned tasks
(2) Identify the advantages and limitations of mass decontamination methods
(3) Identify sources of information for determining the correct mass decontamination methods, and identify how to access those resources in a hazardous materials/WMD incident
(4) Identify the tools, equipment, and PPE required to set up and implement mass decontamination operations
(5) Describe crowd control techniques that can be used at incidents where mass decontamination is required

The following is according to the Fairfield, CT, Police Department, Special Services Division:

> Emergency responders should understand that when responding to incidents which may involve the release of a hazardous material, they may encounter large crowds requiring direction,

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evaluation, and possibly mass decontamination. Factors affecting crowd size can include location, time of day, day of week, weather, and possible events occurring at the time. During response, personnel should assess these and other relevant factors in order to properly estimate possible crowd size or number of victims and resulting response needs. Generally, law enforcement personnel provide for the protection of the scene, limiting of access, and crowd management. All first responders should be aware of initial steps to control a crowd:

Containment + Communication = Control

Containment is determined by factors including the size and condition of crowds, potential presence of hazardous materials, and number of emergency response personnel present. Responders should realize a crisis situation contained is far better than a crisis situation uncontained. In addition to identifying the hot zone, responders should identify and establish a containment area (perimeter) with controlled access. It helps to locate and use existing natural barriers (bodies of water, trees, etc.) and other landscape barriers (buildings, parked vehicles, fencing, etc.) already present to help define the containment area. Responders may also use wooden barricades, yellow barrier tape, or other visible barriers to identify the containment area clearly. Within the containment area, locations should be identified where victims may be directed. As more resources arrive, the outer perimeter and hot zones should be delineated clearly to prevent responder contamination. These responders, once they are properly protected, should be used to assist in establishing and fortifying containment areas.

Communication: Victims and others within the containment area will seek and need reassurance, information, and direction. It is important to gain their trust and confidence by maintaining a professional controlling demeanor. Responders should not approach individuals with possible exposure until they themselves are properly protected. Generally, the quicker containment is established, and the quicker responders communicate with the victims, the quicker the situation is likely to be controlled. Using bullhorns, vehicle public address equipment, signs or other written displays, or interior building intercom/public address equipment if the situation is located indoors, responders should assume control by identifying themselves or their agency and informing the crowd of their intention to provide help. Regardless of the device or means used to communicate, responders should maintain a command presence by providing specific, authoritative instructions.

Communications should be in short three- to five-word statements repeated over and over again as needed. The message should include instructions to remain calm, confirmation that help has been dispatched, and a statement stressing the need for them to follow these instructions. As the scene becomes more controlled and more resources arrive, more detailed instructions should be included.

First responders should realize that depending on the time that it takes them to get on the scene, a number of the crowd intent on leaving will have done so. Of course this depends on the size of the crowd or the venue where the incident occurs (a concert hall or stadium cannot be emptied in a few minutes). Those left behind may be more likely to listen to and follow instructions, reinforcing the need for the communication process to express competence and authority.

(6) Describe the AHJ's mass decontamination unit/team positions, and describe the roles and responsibilities

6.3.4 Competencies — Implementing the Planned Response.

Δ **6.3.4.1 Performing Decontamination Operations Identified in the Incident Action Plan.** Given the selected mass decontamination process and the tools, equipment, and PPE provided by the AHJ, the operations level responder assigned to perform mass decontamination shall demonstrate the ability to set up and implement mass decontamination operations for ambulatory and nonambulatory victims consistent with AHJ policies and procedures following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards.

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6.3.5 Competencies — Evaluating Progress.

6.3.5.1 Evaluating the Effectiveness of the Mass Decontamination Process. Given examples of contaminated items that have undergone the required decontamination, the operations level responder assigned to mass decontamination operations shall identify procedures for determining whether the items have been fully decontaminated according to the standard operating procedures of the AHJ or the incident action plan.

6.3.6 Competencies — Terminating the Incident.

Δ **6.3.6.1 Reporting and Documenting Mass Decontamination Operations.** Given a scenario involving a hazardous materials/WMD incident involving mass decontamination operations/activities and AHJ policies and procedures, the operations level responder assigned to perform mass decontamination shall report and document the mass decontamination operations/activities as required by the AHJ by completing the following:

(1) Identify the reports and supporting documentation required by the AHJ pertaining to mass decontamination operations/activities

6.4 Mission-Specific Competencies: Technical Decontamination.

6.4.1 General.

6.4.1.1 Introduction.

6.4.1.1.1 The operations level responder assigned to perform technical decontamination at hazardous materials/WMD incidents shall be that person, competent at the operations level, who is assigned by the AHJ to select, set up, implement, evaluate, and terminate technical decontamination in support of entry operations and for ambulatory and nonambulatory victims at hazardous materials/WMD incidents.

Δ **6.4.1.1.2** The operations level responder assigned to perform technical decontamination at hazardous materials/WMD incidents shall be trained to meet all competencies at the awareness level (*see Chapter 4*), all competencies at the operations level (*see Chapter 5*), all mission-specific competencies for PPE (*see Section 6.2*), and all competencies in this section.

6.4.1.1.3 The operations level responder assigned to perform technical decontamination at hazardous materials/WMD incidents shall operate under the guidance of a hazardous materials technician, an allied professional, or standard operating procedures.

Although some of the mission-specific competencies in this section are taken from Chapter 7, Competencies for Hazardous Materials Technicians, the technical committee wants to state that operations level responders with a mission-specific competency are not replacements for an HMT. Operations level responders with a mission-specific competency may perform some technician-level skills but do not have the broader skills and competencies required of an HMT, particularly regarding risk assessment and the selection of control options. The following two options are examples of how guidance can be provided to ensure that operations level responders do not go beyond their level of training and equipment:

- **Direct Guidance:** Operations level responders are working under the control of an HMT or allied professional who has the ability to (1) continuously assess and/or observe their actions and (2) provide immediate feedback. Guidance from an HMT or an allied professional can be provided

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through direct visual observation or through assessment reports communicated by the operations level responder to them.

- **Written Guidance:** Written standard operating procedures or similar guidance clearly state the "rules of engagement" for operations level responders with the mission-specific competency. Emphasis should be placed on the following:

1. Tasks expected of operations level responders
2. Tasks beyond the capability of operations level responders
3. Required PPE and equipment to perform these expected tasks
4. Procedures for ensuring coordination within the local ICS

6.4.1.1.4* The operations level responder assigned to perform technical decontamination at hazardous materials/WMD incidents shall receive the additional training necessary to meet specific needs of the jurisdiction.

A.6.4.1.1.4 See A.6.3.1.1.4.

6.4.1.2 Goal.

6.4.1.2.1 The goal of the competencies in this section shall be to provide the operations level responder assigned to select, set up, implement, evaluate, and terminate technical decontamination in support of entry operations and for ambulatory and nonambulatory victims at hazardous materials/WMD incidents with the knowledge and skills to perform the tasks in 6.4.1.2.2 in a safe and effective manner.

Δ **6.4.1.2.2** Given a hazardous materials/WMD incident that requires technical decontamination; an assignment in an IAP; the scope of the problem; policies and procedures for technical decontamination; approved tools, equipment, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, the operations level responder assigned to perform technical decontamination shall be able to perform the following tasks:

(1) Select a technical decontamination process in support of entry operations and/or for ambulatory and nonambulatory victims, the capabilities of available personnel, PPE, and response equipment in accordance with AHJ policies and procedures

At every incident involving hazardous materials, there is a possibility that personnel, their equipment, and members of the general public will become contaminated. The contaminant poses a threat, not only to the persons contaminated but to other personnel who might subsequently come into contact with the contaminated personnel and equipment. The entire process of decontamination should be directed toward confinement of the contaminant within the hot zone and the decontamination corridor to maintain the safety and health of response personnel, the general public, and the environment. Sound judgment should be exercised, and the potential effects of the decontamination process on personnel should be considered when developing the decontamination plan.

Although decontamination is typically performed following site entry, the determination of applicable decontamination methods and procedures needs to be considered before the incident as part of the overall pre-incident planning and hazard and risk evaluation process. No entry into the hot zone should be permitted until decontamination methods are determined and established based on the hazards present, except in those situations where a rescue might be possible and emergency decontamination is available.

Personnel and their equipment can be decontaminated by removing or neutralizing the contaminants that have accumulated on them or by disposing of their protective clothing. Decontamination requires an organized and well-ordered procedure, hence the need for a plan for successful execution. The plan must take into account measures that minimize contamination as a line of first defense.

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The decontamination plan should address such factors as the following:

1. Site layout
2. Decontamination methods to be used and equipment needed
3. Number of personnel needed
4. Level of protective clothing and equipment that have to be processed
5. Disposal methods
6. Runoff control
7. Emergency medical requirements
8. Methods for collecting and disposing of contaminated clothing and equipment

(2) Set up and implement the selected technical decontamination operations and methods following safety procedures, avoiding or minimizing hazards, and protecting exposures and personnel

(3) Evaluate the effectiveness of the technical decontamination process

The process of evaluating the effectiveness of decontamination in the field is mainly limited to visually determining whether the contaminants have been removed from PPE and by using monitoring instruments available that might be available to emergency responders.

(4) Report and document the technical decontamination operations

6.4.2 Competencies — Analyzing the Incident. (Reserved)

6.4.3 Competencies — Planning the Response.

Δ **6.4.3.1 Selecting a Technical Decontamination Process.** Given a hazardous materials/WMD incident that requires technical decontamination; an assignment in an IAP; the scope of the problem; policies and procedures; approved tools, equipment, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, the operations level responder assigned to perform technical decontamination shall select a technical decontamination process to minimize the hazard and spread of contamination in support of entry operations and for ambulatory and nonambulatory victims by completing the following requirements:

Typically, the PPE worn by personnel performing technical decontamination duties is one level down from the persons they are decontaminating, but at a minimum it will include liquid-splash-protective clothing (or bunker gear where fire fighters are involved) with face and respiratory protection such as offered by SCBA or supplied air respirator (SAR). See Exhibit I.6.3.

Decontamination consists of reducing and preventing the spread of contamination from persons and equipment used at a hazardous materials incident by physical and/or chemical processes. Emergency response personnel should implement a thorough, technically sound decontamination procedure until it is determined by technically knowledgeable staff at the scene to be no longer necessary.

The two basic ways to decontaminate something are physical and chemical. Physical methods manually separate the chemical from the material being decontaminated by scrubbing or washing the material, or both. Physical decontamination is often easier than chemical decontamination, but it might not completely remove all the contaminants. Chemical methods involve adding another chemical that changes the physical or chemical properties of one chemical into another or into a form that facilitates its removal. Unfortunately, the chemical process involved could introduce other hazards. Care must be taken to collect all the contamination that has been removed by either method and to dispose of it properly.

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EXHIBIT I.6.3

This photograph shows typical PPE for personnel performing technical decontamination. (Courtesy of Hildebrand and Fish, LLC)

Emergency response personnel should have an established procedure to minimize contamination or contact, to limit migration of contaminants, and to dispose of contaminated materials. The primary objective of decontamination is to avoid becoming contaminated or contaminating other personnel or equipment outside the hot zone. If contamination is suspected, decontamination of personnel, equipment, and apparatus should be performed.

Procedures for all types of decontamination need to be developed and implemented to reduce the possibility of contamination to personnel and equipment. Initial procedures should be upgraded or downgraded as additional information is obtained concerning the type of hazardous materials involved, the degree of hazard, and the probability of exposure of response personnel. Assuming protective equipment is contaminated, decontamination methods should be used appropriate to the hazards presented by the chemicals encountered.

The decision to implement all or part of a decontamination procedure should be based on a field analysis of the hazards and risks involved. This analysis generally consists of referring to technical reference sources to determine the general hazards, such as flammability and toxicity, and then evaluating the relative risks. Decontamination procedures should be implemented on arrival at the scene, should provide an adequate number of decontamination stations and personnel, and should continue until the incident commander determines that decontamination procedures are no longer required.

There are occasions when an apparently normal alarm response turns into a hazardous materials incident. Frequently, most of the initial assignment crews will have already gone into the incident area and exposed themselves to the contamination threat.

It is essential that all members so involved remove themselves from the area at once, call for decontamination capability, and stay together in one location. They must not wander around, climb into and out of vehicles, and mix with other personnel because there is a potential for them to be contaminated.

Responders so exposed should be given gross decontamination as a precautionary measure. Knowledgeable hazardous materials personnel, such as the hazardous materials officer, in

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conjunction with the incident commander, should determine whether technical decontamination is necessary.

The primary objective of decontamination is to avoid contaminating anyone or anything beyond the hot zone. When in doubt about contamination, decontaminate all involved personnel, equipment, and apparatus.

(1) Describe the importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures when performing assigned tasks

(2) Describe the advantages and limitations of each of the following technical decontamination methods:

(a) Absorption

Absorption is the process by which materials hold liquids. Many types of commercial absorbents are available. Sand or soil can also be used for this purpose, although they are more suited for decontaminating equipment or the area surrounding a spill than they are for decontaminating personnel. Absorbents are often readily available, but they must be disposed of properly because the absorbent substance retains the properties of the material absorbed.

(b) Adsorption

Adsorption is a chemical method of decontamination involving the interaction of a hazardous liquid and a solid sorbent surface. Examples of adsorbents are activated charcoal, silica or aluminum gel, fuller's earth, and other clays. Adsorption produces heat and can cause spontaneous combustion. Adsorbents must be disposed of properly.

(c) Chemical degradation

Chemical degradation is the natural breakdown of the contaminants as they age. An example of chemical degradation is the evaporation of a flammable liquid spill. The decontamination of an oil spill on a beach because of manual (pressure washer) or natural (wave action) action is an example of physical degradation. Either of the two methods has limitations depending on factors such as the location of the spill and the toxicity of the material. In some cases, however, these methods are the most practical.

(d) Dilution

Dilution, which simply reduces the concentration of a contaminant, is best used on materials that are soluble or miscible in water, such as chlorine and ammonia. An advantage of dilution is that solutes, especially water, are generally available in large quantities. A disadvantage is that the runoff must be collected and disposed of.

(e) Disinfection

Disinfection is a process to kill most (but not all) pathogenic microorganisms. The two types of disinfectants are chemical disinfectants and antiseptic disinfectants. The limitations and capabilities of each disinfectant should be known.

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Proper disinfection results in a reduction in the number of viable organisms to some acceptable level. It might not totally destroy 100 percent of the microorganisms.

(f) Evaporation

In some cases, responders can allow a hazardous material to evaporate, particularly if the vapors do not present a hazard. A small spill of gasoline, for example, might be allowed to evaporate as long as it does not present a vapor problem. Evaporation is an easy operation and requires minimal personnel. This method is not as effective on porous surfaces as it is on nonporous surfaces, however, and it could take quite a while, depending on the quantity of the chemical involved.

(g) Isolation and disposal

Disposal is the direct removal of a contaminant from a carrier. An example of this method is the removal of a contaminated object from a piece of equipment. This type of decontamination might not entirely remove all contamination.

(h) Neutralization

Neutralizers alter a contaminant chemically so that the resulting chemical is harmless. For example, the addition of soda ash to an acidic solution can increase the pH, making it a chemically harmless substance. Many neutralizing chemicals present their own hazards, however, and should only be used by HMTs who are fully aware of the consequences. One advantage of neutralizers is that by rendering the remaining material harmless, they reduce the problem of disposal.

(i) Solidification

Commercial products are available that cause certain liquids to solidify. One advantage of solidification is that it allows responders to confine a small spill relatively quickly. As with other decontaminants, however, the resulting solid must be disposed of properly when the incident is over.

(j) Sterilization

Sterilization destroys all microorganisms through the use of steam, concentrated chemical agents, or ultraviolet light radiation. Although some liquid disinfectants can be concentrated enough to sterilize, the products then have side effects. The field use of sterilization is therefore limited.

(k) Vacuuming

Vacuuming allows for the collection of materials, either liquid or solid, into containers. The equipment being used must be appropriate for the material being vacuumed. If the material is corrosive or flammable, for example, specialized equipment is needed.

(l) Washing

A very effective decontamination process for many materials involves washing the contaminated person, building, or equipment. Materials that are not soluble in water, such as oil-based contaminants, can be washed with detergent solutions. Washing equipment, protective clothing, and personnel is one of the easiest methods of decontamination. However, collecting and properly disposing of any runoff is necessary. See Exhibit I.6.4.

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EXHIBIT I.6.4

The method of decontamination must take into account the state of the contaminant and the type of PPE worn. (Courtesy of Gaade & Associates)

(3) Identify sources of information on the technical decontamination operations and methods available, and identify how to access those sources in a hazardous materials/WMD incident

Technical reference sources such as books and databases are the best references for hazard information on contaminants, but they often are lacking in details concerning the best methods for removing the contaminant safely and effectively from people and equipment. The best sources for this information come from the manufacturer of the product. Manufacturers have years of experience handling product emergencies and usually have current information on the best techniques as well as emergency medical treatment. CHEMTREC/CANUTEC/SETIQ can facilitate access to manufacturers. Local and regional poison control centers are frequently a source of technical information to aid in determining the correct decontamination procedure.

An HMT or allied professional can also provide information regarding decontamination methods. The ultimate responsibility for implementing a decontamination plan falls to the incident commander. The hazardous materials officer often oversees the implementation of the decontamination procedures.

(4) Identify the tools, equipment, and PPE for performing required setup, and implement the selected technical decontamination operations

A standard complement for decontamination may include the following:

- Containment to prevent runoff
- A water source
- Tarps and plastic sheeting suitable to prevent surface contamination
- Brushes and sponges
- Bucket
- Containment and disposal vessels for contaminants

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Closer Look

Physical Methods

Physical methods generally involve the physical removal of the contaminant from the contaminated person or object and containment of the contaminant for disposal. While these methods can reduce the contaminant's concentration, generally the containment remains chemically unchanged. Examples of physical decontamination methods include the following:

1. Absorption
2. Brushing and scraping
3. Isolation and disposal
4. Vacuuming
5. Washing

Placing contaminated outer clothing on a plastic drop cloth within the decontamination area of the warm zone is a common and useful procedure when using the physical methods of decontamination. Contaminated clothing and equipment should be packed in hazardous waste containers. Lined containers should be on hand in which to pack the contaminated clothing and equipment.

If time is not an overriding factor, and if technicians are not on site or immediately available, the detergent–water solution method of preliminary decontamination is the safest and most appropriate approach. Metal or plastic drums are effective for storing washing or rinsing solutions used in decontamination work.

For radioactive materials decontamination, use of traditional hazardous materials decontamination procedures might not be necessary if radioactive material is the only hazard present. While use of traditional hazardous material decontamination processes are effective for radioactive material, their use can generate large quantities of wastewater. Consideration should be given to methods that minimize the amount of waste generated. Simpler methods are available for decontamination that are less time consuming, require fewer resources, and generate less waste.

Removing all clothing can dramatically reduce the radioactive contaminants on a person's body. After performing a gross decontamination, clothing should be left inside the hot zone. This clothing should be contained and controlled until surveyed. Minimizing the accumulation of contaminated or radioactive material, such as removed clothing, packages, and so forth, in the area helps keep area radiation dose rates low.

Radiological survey instruments can be used to locate radioactive contamination on personnel and to determine the effectiveness of decontamination efforts. Personnel decontamination can be accomplished by using conventional cleansing techniques on localized contaminated body surfaces (i.e., gentle washing and flushing that does not abrade the skin surface). When washing and flushing skin surfaces, mild soap and lukewarm water are preferred. Lukewarm water is preferred because cold water can cause skin pores to close, fixing the contamination into the skin. Hot water can cause skin pores to open, allowing the contamination to go deeper into the skin. Any water or material used in this process needs to be contained and considered as radioactive waste. Techniques beyond gross decontamination should only be performed by properly trained personnel.

Chemical Methods

Chemical methods are used on equipment, not people, and generally involve decontamination by changing the contaminant through some type of chemical reaction in an effort to render the contaminant less harmful. In the case of etiologic contaminants, chemical methods are actually biologically "killing" the organism. Examples of chemical methods include the following:

1. Absorption
2. Chemical degradation
3. Disinfection or sterilization
4. Neutralization
5. Solidification

The precaution on limiting the use of chemical methods to decontaminate equipment deserves emphasis. Chemical degradation, for example, is used to alter the chemical structure of the hazardous material. Commonly used agents, including sodium hypochlorite (household bleach), sodium hydroxide as a saturated solution (household drain cleaner), and calcium oxide slurry (lime), are harmful to skin and never should be applied directly to skin.

Some decontamination procedures can actually present additional hazards. For example, the decontamination solution could react with the chemical to which the clothing was exposed, it could permeate or degrade some protective clothing, or it could emit harmful vapors. Compatibility should be determined before use: Technical advice might be needed to ensure that any solution used on equipment is not reactive with the contaminant.

Prevention Methods

If contact with a contaminant can be controlled, the risk of exposure is reduced and the need for decontamination can be minimized. The following points should be considered to prevent contamination:

1. Stress work practices that minimize contact with hazardous substances
2. Wear limited-use or disposable protective clothing and equipment, where appropriate

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(5) Identify the procedures, tools, equipment, and safety precautions for processing evidence collected during technical decontamination at hazardous materials/WMD incidents

A hazard risk assessment is performed to determine the method for decontamination of items of evidence from the exclusion zone. A separate decontamination line needs to be established for evidence decontamination at the entrance to the decontamination corridor. Evidence decontamination is designed to remove contamination from the exterior evidence packaging container only. At no time is the exterior evidence container to be breached for the purposes of decontaminating the interior evidence packaging; care must be taken to preserve the integrity of forensic evidence, such as fingerprints, during the decontamination process. Once the exterior evidence packaging is decontaminated, the evidence is moved following law enforcement AHJ procedures for chain of custody to an evidence custodian for documentation into the evidence chain.

(6) Identify procedures, equipment, and safety precautions for handling tools, equipment, weapons, criminal suspects, and law enforcement/search canines brought to the decontamination corridor at hazardous materials/WMD incidents

Procedures for the decontamination of law enforcement tools, equipment, and weapons must be designed with cooperation between local or state and federal public safety and law enforcement agencies. Law enforcement personnel, whether patrol officers or tactical team members, could be wearing several layers of law enforcement–specific equipment outside their chemical-protective clothing. Procedures for the decontamination of law enforcement personnel should focus on systematic removal of these layers of external equipment, isolation and security of that equipment pending a hazard risk assessment of the potential contamination to the equipment, followed by standard technical decontamination procedures for the personnel. The law enforcement AHJ must have a procedure in place for the clearing of ammunition from weapons and securing of distraction devices, to ensure the safety of the personnel in the decontamination corridor.

Procedures for the decontamination of criminal subjects must meet the added challenge of positive custodial control over the subjects by law enforcement personnel. Non–law enforcement responders should not be placed in a position where they are the sole custodian of criminal suspects. Law enforcement authorities must follow their procedures regarding the control of criminal suspects in the decontamination corridor. It might be necessary for law enforcement personnel in chemical protective clothing to accompany the suspect. Decontamination of suspects should follow procedures developed by the AHJ for emergency decontamination of civilians.

The use of law enforcement or search canines at incidents involving the known use of hazardous materials/WMD is cautioned. Development of procedures for decontamination of canines must be drafted through cooperation between the AHJ and their veterinary medicine specialist.

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6.4.4 Competencies — Implementing the Planned Response.

6.4.4.1 Setting Up and Implementing Technical Decontamination. Given the selected technical decontamination operations and methods and the tools, equipment, and PPE provided by the AHJ, the operations level responder assigned to perform technical decontamination shall set up and implement technical decontamination operations and methods in support or entry operations and for ambulatory and nonambulatory victims following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards.

During doffing of PPE, the clothing should be removed in such a manner that the outside surfaces do not touch or make contact with the wearer. A log of PPE used during the incident should be

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maintained. Personnel wearing disposable PPE should proceed through the decontamination process set up in the decontamination area, and the disposable protective equipment should be containerized and identified for disposal in accordance with established procedures.

The log should record the type of equipment used, the duration of use of the equipment and exposure to the chemicals, the decontamination procedures used, and the types of chemicals to which the equipment was exposed. The log should also record the name of the person using the equipment.

Disposable protective equipment should be placed in plastic bags or plastic trash cans pending final disposal.

The physical and chemical compatibility of decontamination solutions needs to be determined before they are used. Any decontamination method that permeates, degrades, damages, or otherwise impairs the safe function of PPE should not be used unless there are plans to isolate and dispose of the PPE.

Water or other solutions for washing or rinsing may have to be confined, collected, containerized, and analyzed for treatment and disposal. Consult with environmental and public health agencies or other reference sources and guidelines to determine the need for confinement and the disposal methods for collected decontamination fluids and PPE.

Decontamination methods vary in effectiveness for removing different substances. The effectiveness of any decontamination method should be assessed throughout the decontamination operation. If decontamination does not appear to be effective, a different method should be selected and implemented. Before initiating decontamination, the following questions should be considered:

1. Can decontamination be conducted safely?
2. Are existing resources adequate and immediately available to perform decontamination of personnel and equipment? If not, where can they be obtained, and how long will it take to get them?

If the decontamination method being used is not effectively removing contaminants, different and additional measures must be taken to prevent further contamination. If necessary, technical specialists should be consulted.

The decontamination plan might have to be changed whenever the type of protective clothing and equipment changes, when site conditions change, or when new information is received. If necessary, the manufacturers of the protective clothing and equipment should be consulted.

Criteria that can be used for evaluating decontamination effectiveness during field operations include the following:

1. Contamination levels are reduced as personnel move through the decontamination area.
2. Contamination is confined to the hot zone and decontamination area.
3. Contamination is reduced to a level that is as low as reasonably achievable.

Large items of equipment, such as vehicles and trucks, should be subjected to decontamination by washes, high-pressure washes, steam, or special solutions. Water or other solutions used for washing or rinsing might have to be confined, collected, containerized, analyzed, and treated prior to disposal. Consult with environmental and public health agencies to determine the appropriate disposition.

Vehicles can become contaminated in several ways. These situations include parking them downwind where smoke or vapors can contaminate them, driving through a spill, parking the vehicle too close to the isolation area where it can be splashed or sprayed by the hazardous material, and placing contaminated equipment inside the vehicle. Placing contaminated persons in police and EMS vehicles has been a source of contamination that has led to extensive downtime while the vehicle was

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EXHIBIT I.6.5

This victim is being decontaminated to prevent contamination of an ambulance. (Courtesy of Hildebrand and Fish, LLC)

decontaminated. To prevent contamination of an ambulance, a victim must undergo gross decontamination before hand-off to EMS, as shown in Exhibit I.6.5.

If a large number of vehicles needs to be decontaminated, the following recommendations should be considered:

1. Establish a decontamination pad as a primary wash station. The pad might be a coarse gravel pad, a concrete slab, or a pool liner. It might be necessary to collect these decontamination fluids, and the decontamination pad can be bermed or diked with a sump or some form of water recovery system.
2. Completely wash and rinse vehicles several times with detergent. Pay particular attention to wheel wells, radiators, engines, and chassis. Depending on the nature of the contaminant, it might be necessary to collect all runoff water from the initial gross rinse, particularly if there is contaminated mud and dirt on the underside of the chassis.
3. Inspect vehicles thoroughly for possible mechanical or electrical damage. Areas of concern include air intakes, filters, cooling systems, and air-operated systems.
4. Empty completely and thoroughly wash any outside compartments that were opened. The equipment should be washed and rinsed prior to being replaced.
5. Equipment sprayed with acids should be flushed or washed as soon as possible with a neutralizing agent such as baking soda and then flushed again with rinse water.
6. Decontaminate vehicles on-site if they have been exposed to minimal contaminants such as smoke and vapors. They can then be driven to an off-site car wash for a second, more thorough washing. Car washes can be suitable if the drainage area is fully contained and all runoff drains into a holding tank.
7. Verify adequacy of decontamination, which can consist of samples collected from the cab and exterior surfaces that are analyzed in an off-site laboratory.

Personnel assigned to the decontamination team should wear an appropriate level of PPE and could require decontamination themselves. PPE can be upgraded or downgraded as additional information is obtained concerning the type of hazardous materials involved, the degree of hazard, and the probability of exposure of response personnel.

The members of the decontamination team closest to the hot zone might require a higher level of protective clothing than those closest to the cold zone. The level of protection required varies with the decontamination equipment in use. Protective clothing should be selected by an HMT under the direction of the hazardous materials officer. The selection should be approved by the incident commander.

If personnel display any symptoms of heat exhaustion or possible exposure, emergency measures need to be implemented to doff PPE, while protecting the individual from contaminants and preventing the spread of any contaminants. These individuals should be transferred to the care of EMS personnel who have completed training in accordance with applicable standards such as NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents* [7].

The responder in PPE must be aware of the signs and symptoms of heat exhaustion or other adverse effects and be able to request assistance at the first indication of a problem. For the wearer to doff the PPE quickly and be decontaminated properly, sufficient time must be allowed for the process.

A debriefing should be held for those involved in decontamination as soon as practical. Exposed persons should be provided with as much information as possible about the delayed health effects of the hazardous materials involved in the incident. If necessary, follow-up examinations should be scheduled with medical personnel.

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Exposure records should be maintained for future reference by the individual's personal physician and employer.

Responders might encounter ambulatory and nonambulatory victims who need to be decontaminated. The primary methodology will be gross decontamination or emergency decontamination sufficient to safely forward the patients to EMS for treatment.

•

6.4.5 Competencies — Evaluating Progress.

6.4.5.1 Evaluating the Effectiveness of the Technical Decontamination Process. Given examples of contaminated victims, personnel, tools, equipment, and PPE that have undergone the selected technical decontamination operations and methods, the operations level responder assigned to perform technical decontamination shall evaluate the effectiveness of the technical decontamination process consistent with AHJ policies and procedures or the incident action plan (IAP) by completing the following:

(1) Describe the procedures for evaluating effectiveness of the technical decontamination process by visual observations, monitoring device, ultraviolet light, wipe sampling, and chemical analysis

Methods that can be useful in assessing the effectiveness of decontamination include the following:

1. Visual observation (stains, discolorations, corrosive effects, etc.).
2. Monitoring devices [Devices such as photoionization detectors (PIDs), detector tubes, radiation monitors, and pH paper strips/meters can show that contamination levels are at least below the device's detection limit.]
3. Wipe sampling. Such sampling provides after-the-fact information on the effectiveness of decontamination. Once a wipe swab is taken, it is analyzed by chemical means, usually in a laboratory. Protective clothing, equipment, and skin can be tested using wipe samples.

6.4.6 Competencies — Terminating the Incident.

Δ **6.4.6.1 Reporting and Documenting Technical Decontamination Operations.** Given a scenario involving a hazardous materials/WMD incident involving technical decontamination operations/activities and AHJ policies and procedures, the operations level responder assigned to perform technical decontamination shall report and document the technical decontamination operations/activities as required by the AHJ by completing the following:

(1) Identify the reports and technical documentation required by the AHJ pertaining to technical decontamination operations/activities

6.5 Mission-Specific Competencies: Evidence Preservation and Sampling.

6.5.1 General.

6.5.1.1 Introduction.

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6.5.1.1.1 The operations level responder assigned to perform evidence preservation and public safety sampling shall be that person, competent at the operations level, who is assigned by the AHJ to preserve forensic evidence and take public safety samples at hazardous materials/WMD incidents involving potential violations of criminal statutes or governmental regulations, including those involving suspicious letters and packages, illicit laboratories, a release/attack with a WMD agent, and environmental crimes.

This mission-specific competency is designed to prepare the operations level responder to support law enforcement operations in providing evidence preservation and public safety sampling tasks at a crime scene involving hazardous materials. The competency is designed to raise the awareness of the responder during crime scene operations and to prepare them to collect public safety samples. See Exhibit I.6.6.

Additional guidance in evidence preservation and sampling can be obtained from the local office of the Federal Bureau of Investigation's (FBI) Weapons of Mass Destruction Coordinator, the local office of the Drug Enforcement Agency (DEA), state or local law enforcement, or government-sponsored training programs.

Responders who are assigned by the AHJ to perform evidence collection must meet the provisions of Section 6.12.

Δ **6.5.1.1.2** The operations level responder assigned to perform evidence preservation and public safety sampling at hazardous materials/WMD incidents shall be trained to meet all competencies at the awareness level (*see Chapter 4*), all competencies at the operations level (*see Chapter 5*), all mission-specific competencies for PPE (*see Section 6.2*), and all competencies in this section.

EXHIBIT I.6.6

Law enforcement officers look for the vehicle identification number on a vehicle involved in the detonation of a radiological dispersal device.

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6.5.1.1.3 The operations level responder assigned to perform evidence preservation and public safety sampling at hazardous materials/WMD incidents shall operate under the guidance of a hazardous materials technician, an allied professional, or standard operating procedures.

Although some of the mission-specific competencies in this section are taken from Chapter 7, Competencies for Hazardous Materials Technicians, the technical committee wants to state clearly that operations level responders with a mission-specific competency are not replacements for an HMT. Operations level responders with a mission-specific competency can perform some technician-level skills but do not have the broader skills and competencies required of an HMT, particularly regarding risk assessment and the selection of control options. The following two options are examples of how guidance can be provided to ensure that operations level responders do not go beyond their level of training and equipment:

- **Direct Guidance:** Operations level responders are working under the control of an HMT or allied professional who has the ability to (1) continuously assess and/or observe their actions and (2) provide immediate feedback. Guidance from an HMT or an allied professional can be provided through direct visual observation or through assessment reports communicated by the operations level responder to them.
- **Written Guidance:** Written standard operating procedures or similar guidance clearly state the "rules of engagement" for operations level responders with the mission-specific competency. Emphasis should be placed on the following:

  1. Tasks expected of operations level responders
  2. Tasks beyond the capability of operations level responders
  3. Required PPE and equipment to perform these expected tasks
  4. Procedures for ensuring coordination within the local ICS

6.5.1.1.4* The operations level responder assigned to perform evidence preservation and public safety sampling at hazardous materials/WMD incidents shall receive the additional training necessary to meet specific needs of the jurisdiction.

A.6.5.1.1.4 See A.6.3.1.1.4.

6.5.1.2 Goal.

6.5.1.2.1 The goal of the competencies in this section shall be to provide the operations level responder assigned to perform evidence preservation and public safety sampling at hazardous materials/WMD incidents with the knowledge and skills to perform the tasks in 6.5.1.2.2 in a safe and effective manner.

6.5.1.2.2 Given a hazardous materials/WMD incident involving potential violations of criminal statutes or governmental regulations including those involving suspicious letters and packages, illicit laboratories, a release/attack with a WMD agent, and environmental crimes; an assignment in an IAP; the scope of the problem; policies and procedures; and approved tools, equipment, and PPE, the operations level responder assigned to perform evidence preservation and public safety sampling shall be able to perform the following tasks:

(1) Analyze a hazardous materials/WMD incident to determine the complexity of the problem and potential outcomes by completing the following tasks:

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(a) Determine if the incident is potentially criminal in nature, and identify the law enforcement agency having investigative jurisdiction
(b) Identify unique aspects of criminal hazardous materials/WMD incidents

(2) Plan a response for an incident where there is potential criminal intent involving hazardous materials/WMD within the capabilities and competencies of available personnel, PPE, and response equipment by completing the following tasks:
(a) Determine the response options to conduct public safety sampling and evidence preservation operations
(b) Describe how the options are within the legal authorities, capabilities, and competencies of available personnel, PPE, and response equipment

(3) Implement the planned response to a hazardous materials/WMD incident involving potential violations of criminal statutes or governmental regulations by completing the following tasks under the guidance of law enforcement:
(a) Preserve forensic evidence
(b) Take samples
(c) Seize evidence

(4) Report and document evidence preservation and public safety sampling operations

6.5.2 Competencies — Analyzing the Incident.

6.5.2.1 Determining If the Incident Is Potentially Criminal in Nature and Identifying the Law Enforcement Agency That Has Investigative Jurisdiction. Given examples of hazardous materials/WMD incidents involving potential criminal intent, the operations level responder assigned to evidence preservation and public safety sampling shall describe the potential criminal violation and identify the law enforcement agency having investigative jurisdiction by completing the following requirements:

> Law enforcement jurisdiction, investigative guidelines, and investigative priorities are complex and dynamic. Specific jurisdictional situations should be identified with the responder's local or state law enforcement authorities and federal investigative agencies such as the FBI, DEA, U.S. Postal Inspection Service, and EPA.
>
> Response agencies should understand that many criminal statutes are written such that the presence of actual hazardous materials is not required to charge a subject with a crime. Agencies should contact law enforcement for any threats encountered, whether actual or implied.

(1) Given examples of the following hazardous materials/WMD incidents, the operations level responder shall describe products that might be encountered in the incident associated with each situation:

> Response agencies should maintain situational awareness by receiving a briefing from law enforcement officials concerning the anticipated threats from hazardous materials/WMD incidents and being aware of potential illicit uses for hazardous materials in their community.

(a) Hazardous materials/WMD suspicious letter
(b) Hazardous materials/WMD suspicious package

> There have been actual cases of hazardous materials/WMD sent in letters and packages that contained explosive materials, explosive devices, chemicals, toxins, biological materials, and radioactive materials.

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(c) Hazardous materials/WMD illicit laboratory

Illicit laboratories illegally manufacture items including drugs, toxins, nontraditional chemical weapons, and biologic agents. Specific guidance on the products that might be encountered must be obtained from local or state law enforcement or federal agencies, based on current threats and trends. Personnel who respond to illicit laboratory incidents must meet the provisions of Section 6.9.

(d) Release/attack with a WMD agent

Identifying the products and methods that can be used during a WMD agent attack is complex. Special attention should be given to materials that are commonly found or acquired either in transportation or at fixed facilities, such as industrial chemicals and toxins.

(e) Environmental crimes

Illegal disposal of either hazardous materials or hazardous waste is incident specific. The potential threat from chemical, biological, or radiological materials or waste materials must be assessed in cooperation with local or state and federal agencies.

(2) Given examples of the following hazardous materials/WMD incidents, the operations level responder shall identify the agency(s) with investigative authority and the incident response considerations associated with each situation:
   (a) Hazardous materials/WMD suspicious letter
   (b) Hazardous materials/WMD suspicious package
   (c) Hazardous materials/WMD illicit laboratory
   (d) Release/attack with a WMD agent
   (e) Environmental crimes

Law enforcement jurisdiction, investigative guidelines, and investigative priorities are complex and dynamic. The specific jurisdictional situations should be identified with the responder's local or state law enforcement authorities and federal investigative agencies. Agencies should interact with their local or state law enforcement and federal investigative agencies to determine investigative authorities and other response considerations for each of the situations listed in 6.5.2.1(2) (a) through (e).

6.5.3 Competencies — Planning the Response.

6.5.3.1 Identifying Unique Aspects of Criminal Hazardous Materials/WMD Incidents. The operations level responder assigned to evidence preservation and public safety sampling shall describe the unique aspects associated with illicit laboratories, hazardous materials/WMD incidents, and environmental crimes by completing the following requirements:

When responding to hazardous materials/WMD incidents, the operations level responder should be observant for signs of criminal activity involving chemical, biological, radiological, or explosive materials or devices. The operations level responder should be familiar with the jurisdictional procedures for operation within a crime scene.

(1) Given an incident involving illicit laboratories, a hazardous materials/WMD incident, or an environmental crime, the operations level responder shall perform the following tasks:
   (a) Describe the procedure for securing the scene and characterizing and preserving evidence at the scene

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The operations level responder should follow local or state and federal jurisdictional procedures for crime scene security, at the direction of law enforcement. These activities can include full accountability and identification of all personnel in the crime scene, documentation of any items disturbed within the crime scene, and protection of evidence from potential damage or destruction.

(b) Describe the procedure to document personnel and scene operations associated with the incident

Local procedures vary for crime scene documentation. For example, some jurisdictions do not allow the use of video documentation. The operations level responder should become familiar with the local or state and federal procedures for documentation at a crime scene.

(c) Describe the procedure to determine whether the operations level responders are within their legal authority to perform evidence preservation and public safety sampling tasks

It is very important for the operations level responder to coordinate all evidence preservation and sampling tasks with the law enforcement AHJ. All evidentiary tasks are required to follow rules of evidence, Fourth Amendment guarantees, and judicial precedents. Current information involving judicial case law is available from the law enforcement AHJ, and it is absolutely critical that the operations level responder be aware of this information to avoid problems with inadmissible evidence.

(d) Describe the procedure to notify the agency with investigative authority

Early notification of the agency with investigative authority is crucial in initiating the investigative process. Personnel must know the local procedures used to make these notifications.

(e) Describe the procedure to notify the hazardous devices technician
(f) Identify potential sample/evidence

Working with response partner agencies, the operations level responder should determine whether the sample to be collected is for public safety or for evidentiary purposes. Public safety samples should be identified in accordance with AHJ guidelines for hazmat sample collection. Evidence samples should be identified by law enforcement agencies in accordance with AHJ statutes and guidelines.

(g) Identify the applicable public safety sampling equipment

The operations level responder should be familiar with any existing local or state and federal requirements for the selection of appropriate sampling equipment.

(h) Describe the procedures to protect public safety samples and evidence from secondary contamination

The operations level responder needs to ensure that all sampling containers and equipment are free of contamination. This could involve the use of sterile containers for the collection of biological materials, certified clean containers for chemicals and radiological materials, and blank samples. Blank samples are a collection of each type and lot of sampling equipment used during crime scene sampling operations, isolated in their clean or sterile packaging, and entered into evidence.

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(i) Describe documentation procedures

Documentation procedures vary among law enforcement agencies. Specific guidance must be obtained to ensure that the documentation requirements of the law enforcement AHJ have been met.

(j) Describe evidentiary sampling techniques

Public safety samples are collected and tested to make decisions regarding the safety of the public and responders. Generally, the same principals can be followed to collect public safety samples as those used to collect evidence. Before sampling operations begin, a sampling plan should be developed to determine what to sample, where to sample, and why to sample. This plan will identify sampling techniques required to obtain evidence public safety sample, ensure appropriate documentation, and maintain sample integrity. A sampling team may include three personnel: a sampler, an assistant, and a documenter.

(k) Describe field screening protocols for collected public safety samples and evidence

Field screening is a measure used to determine certain characteristics used to ensure the safety of the sample, responders, the public, and laboratory personnel. The field screening must include, at a minimum, nondestructive testing to identify the presence of improvised explosives devices (IED)/ explosive ordnance disposal (EOD) devices, radiological materials, flammable materials, toxic materials, strong oxidizers, and the corrosive properties of liquid samples.

(l) Describe evidence labeling and packaging procedures

Public safety samples may be labeled and packaged using the same procedures as evidence. If samples are sent to a laboratory, responders must coordinate with the laboratory to ensure proper labeling and packaging of hazardous materials/WMD samples. The labeling system must be clear to all personnel collecting and packaging samples. Labeling of packaging materials can be best performed before entering the exclusion zone. Selection of packaging materials and procedures will be guided by the evidence sampling plan, in cooperation with the receiving laboratory.

(m) Describe evidence decontamination procedures

A hazard risk assessment should be performed to determine the method for decontamination of samples brought from the exclusion zone. A separate decontamination line should be established for sample decontamination at the entrance to the decontamination corridor. Sample decontamination is designed to remove contamination from the exterior packaging container only. At no time can the exterior evidence container be breached for the purposes of decontaminating the interior evidence packaging. Care must be taken to preserve the integrity of possible forensic evidence, such as fingerprints, during the decontamination process.

◆ **NFPA 1072 NOTE**

It was the committee's intent to replace 6.5(B)'s "decontaminating samples" phrase with "decontaminating outside sample packaging." Both phrases were left in the final document, but as stated above, evidence decontamination is designed to remove contamination from the exterior evidence packaging container only.

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(n) Describe evidence packaging procedures for evidence transportation

Procedures for the safe external packaging and transportation of samples are the responsibility of the AHJ, in cooperation with the receiving laboratory and the operator of the transport vehicle. Packaging for transportation must ensure the safe transit of the sample, prevent release of the hazardous material during transport, and follow any applicable regulations or AHJ policy. Whenever possible, the external sample container should fit within a standard bio-safety protection cabinet or chemical hood.

(o) Describe chain-of-custody procedures

Public safety samples, environmental samples, and evidence all require a chain of custody. A chain of custody is the practice of maintaining positive visual or physical control over samples from collection at a site until final disposition. Each person encountering positive control over the evidence must be entered into the chain-of-custody documentation. The chain-of-custody procedures are the responsibility of the AHJ.

(2) Given an example of an illicit laboratory, the operations level responder assigned to evidence preservation and public safety sampling shall be able to perform the following tasks:

Illicit laboratories take several forms and involve numerous types of hazards. It is important for the operations level responder to understand that the potential for chemical, biological, radiological, and explosive materials is present at all illicit laboratories. Consultation with local or state and federal law enforcement about current intelligence, recent incidents, and local trends is critical for the operations level responder.

(a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident

Illicit laboratories are designed for the production of many different products, including illegal drugs such as methamphetamine, chemical modification such as distillation of pesticides, and biological toxins or pathogens. Operators of illicit laboratories often have a vested interest in the protection of their product and evading law enforcement. There is a risk that the operator will be present in the laboratory and have access to weapons. The human element must be addressed by law enforcement tactical teams trained to operate in a hazardous environment.

The level of protection for the tactical team should be based on an assessment of the intelligence and information available on the intent of the laboratory, and it should also include any protective clothing used by the operator, activity of animals in the laboratory, interviews with neighbors, and so forth. Additionally, there is a risk of antipersonnel devices (booby traps) around and in the laboratory. The operations level responder must leave clearance of potential antipersonnel devices to hazardous device technician or EOD personnel trained for these procedures.

Once the human and explosive hazards have been cleared, the operations level responder should conduct a hazard risk assessment to determine the potential harm from hazardous materials/WMD in the illicit laboratory. Decontamination procedures should be based on the results of the hazard risk assessment.

(b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, and public safety sample and evidence packaging and transport containers

Selection of PPE and detection devices are based on assessment of the intelligence, warning signs, and detection clues. The detection and monitoring equipment selected must be capable of assisting

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in the performance of the hazard risk assessment and, at a minimum, should include a combustible gas indicator, oxygen level meter, photoionization meter, pH paper, and radiological monitoring equipment. The selection of sampling devices, packaging, and transport containers is predicated on the evidence sampling plan developed by the AHJ in coordination with the receiving laboratory. Refer to the mission-specific competencies for PPE in Section 6.2.

(c) Describe the sampling options associated with liquid and solid public safety sample and evidence collection

The decision on sampling techniques and collection tools will be guided by the evidence sampling plan. Tools that could be used to collect liquid samples include syringes, pipettes, composite liquid waste sampler (coliwasa) tubes, drum thieves, certified clean jars, and sterile vials. Tools that could be used to collect solid samples include swabs, scoops, spatulas, certified clean jars, and sterile vials.

(d) Describe the field screening protocols for collected public safety samples and evidence

The operations level responder must field screen samples to ensure the safety of the sample, responders, the public, and laboratory personnel. The field screening must include, at a minimum, nondestructive testing to identify the presence of IEDs/EODs, radiological materials, flammable materials, toxic materials, strong oxidizers, and the corrosive properties of liquid samples.

(3) Given an example of an environmental crime, the operations level responder assigned to evidence preservation and public safety sampling shall be able to perform the following tasks:

(a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident

Environmental crime sites could involve the illegal use and disposal of hazardous materials and hazardous waste. Operators and/or owners of environmental crime sites might be evading law enforcement. There is a risk that the operator and/or owner will be present at the site, with access to weapons. The human element must be addressed by law enforcement personnel. The level of protection for the site entry should be based on an assessment of the intelligence and information on the intent of the environmental crime site. This information should include any protective clothing used by the operator, activity of animals in the area, and interviews with neighbors and employees.

Once human and EOD hazards have been cleared, the operations level responder should conduct a hazard risk assessment to determine the potential harm from hazardous materials/WMD at the environmental crime site. Decontamination procedures should be based on the results of the hazard risk assessment.

(b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, and public safety sample and evidence packaging and transport containers

Selection of PPE and detection devices is based on assessment of the intelligence, warning signs, and detection clues. The detection and monitoring equipment selected must be capable of assisting in the performance of the hazard risk assessment, and at a minimum, it should include a combustible gas indicator, oxygen level meter, photoionization meter, pH paper, and radiological monitoring equipment. The selection of sampling devices, packaging, and transport containers is predicated on the sampling plan developed by the AHJ in coordination with the receiving laboratory.

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(c) Describe the sampling options associated with the collection of liquid and solid public safety samples and evidence

The decision on sampling techniques and collection tools will be guided by the evidence sampling plan. Tools that could be used to collect liquid samples include syringes, pipettes, coliwasa tubes, drum thieves, certified clean jars, and sterile vials. Tools that could be used to collect solid samples include swabs, scoops, spatulas, certified clean jars, and sterile vials.

(d) Describe the field screening protocols for collected public safety samples and evidence

The operations level responder must field screen samples to ensure the safety of the sample, responders, the public, and laboratory personnel. The field screening must include, at a minimum, nondestructive testing to identify the presence of IEDs/EOD devices, radiological materials, flammable materials, toxic materials, strong oxidizers, and the corrosive properties of liquid samples.

Once the letter has been cleared for IED/EOD hazards, the operations level responder should conduct a hazard risk assessment. The assessment should include field screening to determine the potential harm from hazardous materials/WMD in the suspicious letter. In the presence of an articulated or implied threat, the operations level responder must ensure that the bulk of any potential hazardous materials found in the letter, as well as the envelope containing the letter, are packaged for law enforcement–supervised transport to a receiving laboratory. Decontamination procedures should be based on the results of the hazard risk assessment.

(4) Given an example of a hazardous materials/WMD suspicious letter, the operations level responder assigned to evidence preservation and public safety sampling shall be able to perform the following tasks:

(a) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, and public safety sample and evidence packaging and transport containers

Selection of PPE and detection devices is based on assessment of the intelligence, warning signs, and detection clues. The detection and monitoring equipment selected must be capable of assisting in the performance of the hazard risk assessment, and at a minimum should include a combustible gas indicator, oxygen level meter, photoionization meter, pH paper, and radiological monitoring equipment. The selection of sampling devices, packaging, and transport containers is based on the evidence sampling plan developed by the law enforcement AHJ in coordination with the receiving laboratory.

(b) Describe the sampling options associated with the collection of liquid and solid public safety samples and evidence

The decision on sampling techniques and collection tools will be guided by the evidence sampling plan. Tools that could be used to collect liquid samples include syringes, pipettes, certified clean jars, and sterile vials. Tools that could be used to collect solid samples include swabs, scoops, spatulas, certified clean jars, and sterile vials. The operations level responder should make every effort to document any text or graphics on the letter or envelope containing the letter. This could include law enforcement–approved photographs, notes, or packaging of the letter and envelope in clear packaging bags.

(c) Describe the field screening protocols for collected public safety samples and evidence

The operations level responder must field screen samples to ensure the safety of the sample, responders, the public, and laboratory personnel. The field screening must include, at a minimum, nondestructive

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testing to identify the presence of IEDs/EOD devices, radiological materials, flammable materials, toxic materials, strong oxidizers, and the corrosive properties of liquid samples.

(5) Given an example of a hazardous materials/WMD suspicious package, the operations level responder assigned to evidence preservation and public safety sampling shall be able to perform the following tasks:

(a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident

Hazmat/WMD suspicious packages have the potential to contain explosive devices, explosive materials, chemicals, biological materials, or radioactive materials. The operations level responder should participate in a threat credibility evaluation with local or state and federal law enforcement, hazardous materials response authorities, and public health officials to evaluate the articulated or implied threat from the suspicious package. The threat credibility evaluation should include evaluation of the behavioral resolve of the originator of the package, the technical feasibility that hazardous materials are present, and the operational practicality of successful delivery of hazardous materials in the package.

Once the package has been cleared of IED/EOD hazards, the operations level responder should conduct a hazard risk assessment to include field screening to determine the potential harm from hazardous materials/WMD in the suspicious package. In the presence of an articulated or implied threat, the operations level responder must ensure that the bulk of any potential hazardous materials found in the package, as well as the outer package, are packaged for law enforcement supervised transport to a receiving laboratory. Decontamination procedures should be based on the results of the hazard risk assessment.

(b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, and public safety sample and evidence packaging and transport containers

Selection of PPE and detection devices is based on assessment of the intelligence, warning signs, and detection clues. The detection and monitoring equipment selected must be capable of assisting in the performance of the hazard risk assessment, and at a minimum should include a combustible gas indicator, oxygen level meter, photoionization meter, pH paper, and radiological monitoring equipment. The selection of sampling devices, packaging, and transport containers is based on the sampling plan developed by the AHJ in coordination with the receiving laboratory.

(c) Describe the sampling options associated with liquid and solid public safety sample and evidence collection

The decision on sampling techniques and collection tools will be guided by the sampling plan. Tools that could be used to collect liquid samples include syringes, pipettes, certified clean jars, and sterile vials. Tools that could be used to collect solid samples include swabs, scoops, spatulas, certified clean jars, and sterile vials. The operations level responder should make every effort to document any text or graphics present on any materials within the package, and on the package itself, including law enforcement–approved photographs, notes, or packaging of any written materials found within the package in clear packaging bags.

(d) Describe the field screening protocols for collected public safety samples and evidence

The operations level responder must field screen samples to ensure the safety of the sample, responders, the public, and laboratory personnel. The field screening must include, at a minimum, nondestructive

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testing to identify the presence of IEDs/EOD devices, radiological materials, flammable materials, toxic materials, strong oxidizers, and the corrosive properties of liquid samples.

(6) Given an example of a release/attack involving a hazardous materials and WMD agent, the operations level responder assigned to evidence preservation and public safety sampling shall be able to perform the following tasks:

(a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident

Potential attack scenarios involving hazardous materials/WMD include explosive devices, biological toxins, release or burning of toxic industrial chemicals, biological pathogens, radioactive sources, chemical warfare agents, or nuclear devices. In the event that the release/attack has already occurred, operations level responders should perform their duties as prescribed in the local emergency response plan. The operations level responder should participate in a threat credibility evaluation with local or state and federal law enforcement, hazardous materials response authorities, and public health officials to evaluate the articulated or implied threat from the release/attack. The threat credibility evaluation should include evaluation of the behavioral resolve of the originator of the release/attack, the technical feasibility that hazardous materials are present, and the operational practicality of successful delivery of hazardous materials during the release/attack.

Once the release/attack site has been cleared for IED/EOD hazards, the operations level responder should conduct a hazard risk assessment, including field screening to determine the potential harm from any hazardous materials/WMD involved in the release/attack. Decontamination procedures should be based on the results of the hazard risk assessment.

(b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, and public safety sample and evidence packaging and transport containers

Selection of PPE and detection devices is based on assessment of the intelligence, warning signs, and detection clues. The detection and monitoring equipment selected must be capable of assisting in the performance of the hazard risk assessment and, at a minimum, should include a combustible gas indicator, oxygen level meter, photoionization meter, pH paper, and radiological monitoring equipment. The selection of sampling devices, packaging, and transport containers is based on the sampling plan developed by the AHJ in coordination with the receiving laboratory.

(c) Describe the sampling options associated with the collection of liquid and solid public safety samples and evidence

The decision on sampling techniques and collection tools will be guided by the evidence sampling plan. Tools that could be used to collect liquid samples include syringes, pipettes, certified clean jars, and sterile vials. Tools that could be used to collect solid samples include swabs, scoops, spatulas, certified clean jars, and sterile vials.

(d) Describe the field screening protocols for collected public safety samples and evidence

The operations level responder must field screen samples to ensure the safety of the sample, responders, the public, and laboratory personnel. The field screening must include, at a minimum, nondestructive testing to identify the presence of IEDs/EOD devices, radiological materials, flammable materials, toxic materials, strong oxidizers, and the corrosive properties of liquid samples.

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(7) Given examples of different types of potential criminal hazardous materials/WMD incidents, the operations level responder shall identify and describe the application, use, and limitations of the various types of field screening tools that can be utilized for screening the following:
   (a) Corrosivity
   (b) Flammability
   (c) Oxidation
   (d) Radioactivity
   (e) Volatile organic compounds (VOC)

Refer to the mission-specific competencies in Section 6.7, Mission-Specific Competencies: Air Monitoring and Sampling.

(8) Describe the potential adverse impact of using destructive field screening techniques
(9) Describe the procedures for maintaining the evidentiary integrity of any item removed from the crime scene

6.5.4 Competencies — Implementing the Planned Response.

6.5.4.1 Implementing the Planned Response. Given the incident action plan for a criminal incident involving hazardous materials/WMD, the operations level responder assigned to evidence preservation and public safety sampling shall implement selected response actions consistent with the emergency response plan or standard operating procedures by completing the following requirements:

(1) Demonstrate how to secure the scene and characterize and preserve evidence at the scene
(2) Document personnel and scene operations associated with the incident
(3) Determine whether responders are within their legal authority to perform evidence collection and public safety sampling tasks
(4) Describe the procedure to notify the agency with investigative authority
(5) Notify the hazardous devices technician
(6) Identify potential public safety samples and evidence to be collected
(7) Demonstrate procedures to protect samples and evidence from secondary contamination
(8) Demonstrate correct techniques to collect public safety samples utilizing the equipment provided
(9) Demonstrate documentation procedures
(10) Demonstrate public safety sampling protocols
(11) Demonstrate field screening protocols for public safety samples and evidence collected
(12) Demonstrate evidence/sample labeling and packaging procedures
(13) Demonstrate evidence/sample decontamination procedures
(14) Demonstrate evidence/sample packaging procedures for evidence transportation
(15) Describe chain of custody procedures for evidence/sample preservation

6.5.4.2 The operations level responder assigned to evidence preservation and public safety sampling shall describe AHJ policies and procedures for the technical decontamination process.

Refer to the mission-specific competencies for decontamination in Section 6.3.

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6.5.5 Competencies — Evaluating Progress. (Reserved)

6.5.6 Competencies — Terminating the Incident. (Reserved)

N **6.5.6.1 Reporting and Documenting Evidence Preservation and Public Safety Sampling Operations.** Given a scenario involving a hazardous materials/WMD incident involving evidence preservation and public safety sampling operations and AHJ policies and procedures, the operations level responder assigned to perform evidence preservation and public safety sampling shall report and document the evidence preservation and public safety sampling operations as required by the AHJ by completing the following:

(1) Identify the reports and supporting documentation required by the AHJ pertaining to evidence preservation and public safety sampling operations.

6.6 Mission-Specific Competencies: Product Control.

6.6.1 General.

6.6.1.1 Introduction.

Most law enforcement responders do not need to be trained to implement product control as a core competency, but it is expected that most AHJs will require fire fighters to be trained to mission-specific competencies product control.

6.6.1.1.1 The operations level responder assigned to perform product control with limited risk of personal exposure shall be that person, competent at the operations level, who is assigned by the AHJ to confine and contain releases of hazardous materials/WMD and control flammable liquid and flammable gas releases at hazardous materials/WMD incidents.

Δ **6.6.1.1.2** The operations level responder assigned to perform product control at hazardous materials/WMD incidents shall be trained to meet all competencies at the awareness level (*see Chapter 4*), all competencies at the operations level (*see Chapter 5*), all mission-specific competencies for PPE (*see Section 6.2*), and all competencies in this section.

6.6.1.1.3 The operations level responder assigned to perform product control at hazardous materials/WMD incidents shall operate under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures.

Although some of the mission-specific competencies in this section are taken from Chapter 7, which covers the HMT, the technical committee wants to clearly state that first responder operational (FRO) level personnel with a mission-specific competency is not a replacement for an HMT. FRO personnel with a mission-specific competency can perform some technician-level skills but do not have the broader skills and competencies required of an HMT, particularly regarding risk assessment and the selection of control options. The following two options are examples of how guidance can be provided to ensure that FRO personnel do not go beyond their level of training and equipment:

- **Direct Guidance:** FRO personnel are working under the control of an HMT or allied professional who has the ability to (1) continuously assess and/or observe their actions, and (2) provide immediate feedback. Guidance from an HMT or an allied professional can be provided through direct visual observation or through assessment reports communicated by the FRO to them.

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- **Written Guidance:** Written standard operating procedures or similar guidance clearly states the "rules of engagement" for FRO personnel with the mission-specific competency. Emphasis should be placed on (1) tasks expected of FRO personnel, (2) tasks beyond the capability of FRO personnel, (3) required PPE and equipment to perform these expected tasks, and (4) procedures for ensuring coordination within the local ICS.

6.6.1.1.4* The operations level responder assigned to perform product control at hazardous materials/WMD incidents shall receive the additional training necessary to meet specific needs of the jurisdiction.

A.6.6.1.1.4 See A.6.3.1.1.4.

6.6.1.2 Goal.

6.6.1.2.1 The goal of the competencies in this section shall be to provide the operations level responder assigned to perform product control, including to confine or contain releases of hazardous materials/WMD and to control flammable liquid and flammable gas releases, with limited risk of personal exposure at hazardous materials/WMD incidents with the knowledge and skills to perform the tasks in 6.6.1.2.2 in a safe and effective manner.

6.6.1.2.2 Given a hazardous materials/WMD incident with release of product; an assignment in an IAP; the scope of the problem; policies and procedures; approved tools, equipment, control agents, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, the operations level responder assigned to perform product control shall be able to perform the following tasks:

(1) Select techniques to control releases with limited risk of personal exposure at hazardous materials/WMD incidents within the capabilities and competencies of available personnel, tools and equipment, control agents, and PPE, in accordance with the AHJ policies and procedures, by completing the following requirements:
   (a) Describe control techniques to confine/contain released product with limited risk of personal exposure available to the operations level responder.
   (b) Describe the location and operation of remote control/emergency shutoff devices on cargo and intermodal tanks, and containers at fixed facilities containing flammable liquids and gases.
   (c) Describe the characteristics and applicability of available control agents and equipment available for controlling flammable liquid and flammable gas releases.

(2) Implement selected techniques for controlling released product with limited risk of personnel exposure at the incident following safety procedures, avoiding or minimizing hazards, and protecting exposures and personnel.

(3) Report and document product control operations.

6.6.2 Competencies — Analyzing the Incident. (Reserved)

6.6.3 Competencies — Planning the Response.

Δ **6.6.3.1 Selecting Product Control Techniques.** Given examples of hazardous materials/WMD incidents, the operations level responder assigned to perform product control with limited risk of personal exposure shall select techniques to confine or contain releases of hazardous materials/WMD and to control flammable liquid and flammable gas releases within the capabilities and competencies of available personnel, tools and equipment, PPE, and control agents and equipment in accordance with the AHJ's policies and procedures by completing the following requirements:

(1) Explain the importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures.

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(2) Explain the difference between control, confinement, containment, and extinguishment.

(3) Describe the product control techniques available to the operations level responder.

(4) Describe the application, necessary tools, equipment, control agents, and safety precautions associated with each of the following control techniques:

   (a) Absorption
   (b) Adsorption
   (c) Damming
   (d) Diking
   (e) Dilution
   (f) Diversion
   (g) Remote valve shutoff
   (h) Retention
   (i) Vapor dispersion
   (j) Vapor suppression

Operations level responders with this mission-specific competency need to understand the advantages and limitations of each of the techniques described earlier. Their application is dependent on the chemical and physical properties of the product as well as the environmental factors. Each of the methods has a specific methodology to be used when making the application. A good example of this would be the appropriate type, use, and application of Class B foam. There is a concern today about the use of the wrong foam on ethanol blended fuels versus on standard hydrocarbon fires.

(5) Identify and describe the use of tools and equipment provided by the AHJ for product control, including Class B foam application equipment, diking equipment, damming equipment, approved absorbent materials and products, shovels and other hand tools, piping, heavy equipment (such as backhoes), floats, and spill booms and control agents, including Class B foam and dispersal agents.

(6) Identify the characteristics and applicability of the following Class B foams if supplied by the AHJ:

   (a) Aqueous film-forming foam (AFFF)
   (b) Alcohol-resistant concentrates
   (c) Fluoroprotein
   (d) High-expansion foam

(7) Identify the location and describe the operation of remote control/emergency shutoff devices to contain flammable liquid and flammable gas releases on cargo tanks on MC/DOT-306/406, MC/DOT-307/407, and MC-331 cargo tanks, intermodal tanks, and containers at fixed facilities.

(8) Describe the safety precaution associated with each product control technique.

Personnel who are trained to this competency should understand that the type of PPE worn at an incident requiring product control is dependent on the proximity to the release. For example, if the responder is constructing underflow dams, overflow dams, or retention basins and is far enough away from the release, he or she should wear only the appropriate safety equipment for the hazards. However, if a responder is dealing with a point release and using adsorbents or absorbents, the proximity to the spill would require the need for PPE, depending on the product and the equipment provided by the AHJ.

• **6.6.4 Competencies — Implementing the Planned Response.**

6.6.4.1 Performing Product Control Techniques. Given the selected product control technique and the tools and equipment, PPE, and control agents and equipment provided by the AHJ, at a hazardous materials/WMD incident, the operations level responder assigned to

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perform product control shall implement the product control technique to confine/contain the release with limited risk of personal exposure by completing the following requirements:

(1) Using the tools and equipment provided by the AHJ, perform the following product control techniques following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards:

(a) Operate remote control/emergency shutoff devices to reduce or stop the flow of hazardous material from MC-306/DOT-406, MC-407/DOT-407, and MC-331 cargo tanks, intermodal tanks, and containers at fixed facilities containing flammable liquids or gases

The committee added shutoff valves for intermodal containers to this competency.

◆ NFPA 1072 NOTE

Activating Intermodal shutoff valves, cargo tanks, and fixed facilities are included as skills in Section 6.6(B).

N **6.6.4.2** Given the required tools and equipment provided by the AHJ, perform product control techniques following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards with the following:

(1) Using the equipment provided by the AHJ, control flammable liquid and flammable gas releases using techniques, including hose handling, nozzle patterns, and attack operations, found in NFPA 1001.

(2) Using the Class B foams or agents and equipment provided by the AHJ, control the spill or fire involving flammable liquids by application of the foam(s) or agent(s).

•

6.6.5 Competencies — Evaluating Progress. (Reserved)

6.6.6 Competencies — Terminating the Incident.

N **6.6.6.1 Reporting and Documenting Product Control Operations.** Given a scenario involving a hazardous materials/WMD incident involving product control, the operations level responder assigned to perform product control shall document the product control operations as required by the AHJ by completing the following requirement:

(1) Identify the reports and supporting documentation required by the AHJ pertaining to product control operations

6.7 Mission-Specific Competencies: Detection, Monitoring, and Sampling.

6.7.1 General.

6.7.1.1 Introduction.

6.7.1.1.1 The operations level responder assigned to perform detection, monitoring, and sampling shall be that person, competent at the operations level, who is assigned by the AHJ to detect, monitor, and sample at hazardous materials/WMD incidents.

Δ **6.7.1.1.2** The operations level responder assigned to perform detection, monitoring, and sampling at hazardous materials/WMD incidents shall be trained to meet all competencies at the awareness level (*see Chapter 4*), all competencies at the operations level (*see Chapter 5*), all mission-specific competencies for PPE (*see Section 6.2*), and all competencies in this section.

6.7.1.1.3 The operations level responder assigned to perform detection, monitoring, and sampling at hazardous materials/WMD incidents shall operate under the guidance of a hazardous

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materials technician, an allied professional, an emergency response plan, or standard operating procedures.

Although some of the mission-specific competencies in this section are taken from Chapter 7, which covers the HMT, the technical committee wants to state clearly that FRO personnel with a mission-specific competency are not substitutes for HMTs. FRO personnel with a mission-specific competency can perform some technician-level skills but do not have the broader skills and competencies required of an HMT, particularly regarding risk assessment and the selection of control options. The following two options are examples of how guidance can be provided to ensure that FRO personnel do not go beyond their level of training and equipment:

- **Direct Guidance:** FRO personnel are working under the control of an HMT or allied professional who has the ability to (1) continuously assess and/or observe their actions, and (2) provide immediate feedback. Guidance from an HMT or an allied professional can be provided through direct visual observation or through assessment reports communicated by the FRO to them.
- **Written Guidance:** Written standard operating procedures or similar guidance clearly states the "rules of engagement" for FRO personnel with the mission-specific competency. Emphasis should be placed on (1) tasks expected of FRO personnel, (2) tasks beyond the capability of FRO personnel, (3) required PPE and equipment to perform these expected tasks, and (4) procedures for ensuring coordination within the local ICS.

6.7.1.1.4* The operations level responder assigned to perform air monitoring and sampling at hazardous materials/WMD incidents shall receive the additional training necessary to meet specific needs of the jurisdiction.

A.6.7.1.1.4 See A.6.3.1.1.4.

Air monitoring equipment is used to detect or measure amounts of hazardous materials/WMD agents. The equipment that could be expected to be used by operations trained responders includes the following:

1. Carbon monoxide meter
2. Colorimetric tubes
3. Combustible gas indicator
4. Oxygen meter
5. Passive dosimeters
6. pH indicators and/or pH meters
7. Photoionization and/or flame ionization detectors
8. Radiation detection instruments
9. Reagents
10. Test strips
11. WMD detectors (chemical and/or biological)
12. Toxic gas meters
13. Other equipment provided by the AHJ

Sampling equipment that can be used under this competency is intended to be used for environmental sampling and not for evidence collection. If it is intended for evidence sampling and collection, the FRO must be trained to mission-specific competency of Section 6.5, which covers evidence preservation and sampling. The sampling equipment that can be expected to be used by operations trained responders, based on AHJ requirements, includes but is not limited to the following:

1. Any tool designated to remove liquid or solid product from a container for the purpose of environmental sampling and testing
2. Any container suitable for the collection of a liquid or solid sample based on the type and quantity

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6.7.1.2 Goal.

Mission-specific competencies for air monitoring and sampling were added to this standard with the thought that operations trained responders are now expected to operate air monitoring equipment, based on AHJ requirements, under the guidance of HMTs, allied professionals, or standard operating procedures. Before this update, operations trained responders had no standardized competencies when the AHJ required air monitoring and/or sampling at hazardous materials incidents.

6.7.1.2.1 The goal of the competencies in this section shall be to provide the operations level responder assigned to air monitoring and sampling at hazardous materials/WMD incidents with the knowledge and skills to perform the tasks in 6.7.1.2.2 safely and effectively.

6.7.1.2.2 Given a hazardous materials/WMD incident; an assignment in an IAP; the scope of the problem; policies and procedures; approved resources; detection, monitoring, and sampling equipment; PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, the operations level responder assigned to perform detection, monitoring, and sampling shall be able to perform the following tasks:

(1) Select equipment for detecting, monitoring, and sampling suitable for the hazardous materials/WMD present at the incident within the capabilities and competencies of available personnel; approved resources including detection, monitoring, and sampling equipment; and PPE in accordance with the AHJ policies and procedures

(2) Operate the selected equipment to detect, monitor, and sample hazardous materials/WMD present at the incident following safety procedures, avoiding or minimizing hazards, and protecting exposures and personnel

(3) Report and document detection, monitoring, and sampling operations

Commentary Table I.6.2 can help the responder select appropriate air monitoring equipment and sampling protocols.

***COMMENTARY TABLE I.6.2** Air Monitoring Equipment and Sampling Protocols Selection Table*

	Hazard Class									
Characteristics	**1**	**2**			**3**	**4**	**5**	**6**	**7**	**8**
Division	All	2.1	2.2	2.3	—	4.1 4.2 4.3	5.1 5.2	—	—	—
Can it be detected?	No	Yes	Yes Gas specific	Yes Gas specific	Yes Gas specific			Yes	Yes	Yes
Can it be monitored?	No	Yes	Yes	Yes	Yes			Yes	Yes	Yes
Units, Note*: Also found as micro, mille, or sieverts	—	% LEL	O2 – % Others – PPM	PPM	% LEL			PPM	Atmospheric* •R/hr mR/hr R/hr Individual dose* •R mR R	pH 0 – 14
Equipment used to detect/ monitor	—	CGI PID	Electro – chemical cell Colorimetric tube Specific Sensor	Electro – chemical cell Colorimetric tube Specific Sensor	Electro – chemical cell Colorimetric tube Specific Sensor			Specific test kits Pesticide PCB Chlorine	G/M tube Alpha scintillators Gamma scintillators	pH paper pH meter

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6.7.2 Competencies — Analyzing the Incident. (Reserved)

6.7.3 Competencies — Planning the Response.

6.7.3.1 Selecting Detection, Monitoring, and Sampling Equipment. Given a hazardous materials/WMD incident and the detection, monitoring, and sampling equipment provided by the AHJ, the operations level responder assigned to perform detection, monitoring, and sampling hazardous materials/WMD at the incident shall be able to perform the following:

(1) Describe the importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures
(2) Describe detection, monitoring, and sampling methods and equipment available
(3) Describe the considerations for selecting detection, monitoring, and sampling equipment for an assigned task within the capabilities and competencies of available personnel and approved detection, monitoring, sampling equipment, and PPE
(4) Given the detection, monitoring, and sampling equipment provided by the AHJ, describe the following for each piece of equipment:
  (a) Application, capabilities, and limitations
  (b) Procedures operating the equipment, including field testing, safety precautions, and action levels
  (c) Procedures for reading, interpreting, documenting, and communicating results of detection, monitoring, and sampling operations
  (d) Procedures for decontaminating detection, monitoring, and sampling equipment according to manufacturer's recommendations or AHJ policies and procedures
  (e) Procedures for maintaining detection, monitoring, and sampling equipment according to manufacturers' specifications or AHJ policies and procedures

It is expected that operations level responders will, as a prerequisite, be trained to meet the requirements of Section 6.2, Mission-Specific Competencies: Personal Protective Equipment.

6.7.4 Competencies — Implementing the Planned Response.

Δ **6.7.4.1 Operating Detection, Monitoring, and Sampling Equipment.**

Given a hazardous materials/WMD incident and the selected detection, monitoring, and sampling equipment, the operations level responder assigned to perform detection, monitoring, and sampling shall implement detection, monitoring, and sampling operations as necessary and shall be able to perform the following:

The personnel assigned to this task — when given three hazardous materials/WMD, one of which is a solid, one a liquid, and one a gas, and using the following monitoring equipment, test strips, and reagents — need to be able to select the equipment and demonstrate the correct techniques to identify the hazards (e.g., corrosivity, flammability, oxygen content, oxygen deficiency, radioactivity, toxicity, and pathogenicity) using the following equipment:

1. Carbon monoxide meter
2. Colorimetric tubes
3. Combustible gas indicator
4. Oxygen meter
5. Passive dosimeters
6. pH indicators and/or pH meters

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7. Photoionization and/or flame ionization detectors
8. Radiation detection instruments
9. Reagents
10. Test strips
11. WMD detectors (chemical and/or biological)
12. Toxic gas meters
13. Other equipment provided by the AHJ

(1) Field test the detection, monitoring, and sampling equipment to be used according to the manufacturers' specification and AHJ policies and procedures, including the following:
   (a) Functional (i.e., bump) test
   (b) Calibration
   (c) Other required tests
(2) Operate the equipment to detect, monitor, and sample the hazardous materials/WMD present following safety procedures, avoiding or minimizing hazards, and protecting exposures and personnel
(3) Read, interpret, and document readings from the detection, monitoring, and sampling equipment
(4) Communicate results of detection, monitoring, and sampling operations
(5) Decontaminate the detection, monitoring, and sampling equipment
(6) Maintain detection, monitoring, and sampling equipment according to the manufacturers' specifications or AHJ policies and procedures

Operations level trained responders will also be expected to meet the requirements of Section 6.4, Mission-Specific Competencies: Technical Decontamination, which will train them on the proper decontamination of themselves and equipment.

• **6.7.5 Competencies — Evaluating Progress. (Reserved)**

6.7.6 Competencies — Terminating the Incident.

N **6.7.6.1 Reporting and Documenting Detection, Monitoring, and Sampling Operations.** Given a scenario involving a hazardous materials/WMD incident involving detection, monitoring, and sampling operations and AHJ policies and procedures, the operations level responder assigned to perform detection, monitoring, and sampling shall report and document the detection, monitoring, and sampling operations as required by the AHJ by completing the following:

(1) Identify the reports and supporting documentation required by the AHJ pertaining to detection, monitoring, and sampling operations

6.8 Mission-Specific Competencies: Victim Rescue and Recovery.

6.8.1 General.

6.8.1.1 Introduction.

6.8.1.1.1 The operations level responder assigned to perform victim rescue and recovery at hazardous materials/WMD incidents shall be that person, competent at the operations level,

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who is assigned to rescue and recover exposed and/or contaminated victims at hazardous materials/WMD incidents.

Operations level responders conducting victim rescue missions might be fire fighters, HMTs, EMS personnel, law enforcement officers, other trained personnel (e.g., industrial or transportation carrier employees), or a combination of those personnel assembled into a team under a predetermined response plan by the AHJ. Victim rescue missions can have a different meaning for each discipline based on the given hazardous materials/WMD incident, but should all be conducted on a risk-based model.

Δ **6.8.1.1.2** The operations level responder assigned to perform victim rescue and recovery at hazardous materials/WMD incidents shall be trained to meet all competencies at the awareness level (*see Chapter 4*), all competencies at the operations level (*see Chapter 5*), all mission-specific competencies for PPE (*see Section 6.2*), and all competencies in this section.

6.8.1.1.3 The operations level responder assigned to perform victim rescue and recovery at hazardous materials/WMD incidents shall operate under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures.

Although some of the mission-specific competencies in this section are taken from Chapter 7, which covers the HMT, the technical committee wants to state clearly that FRO personnel with a mission-specific competency are not substitutes for HMTs. FRO personnel with a mission-specific competency can perform some technician-level skills but do not have the broader skills and competencies required of an HMT, particularly regarding risk assessment and the selection of control options. The following two options are examples of how guidance can be provided to ensure that FRO personnel do not go beyond their level of training and equipment:

- **Direct Guidance:** FRO personnel are working under the control of an HMT or allied professional who has the ability to (1) continuously assess and/or observe their actions, and (2) provide immediate feedback. Guidance from an HMT or an allied professional can be provided through direct visual observation or through assessment reports communicated by the FRO personnel with the mission-specific competency to them.
- **Written Guidance:** Written standard operating procedures or similar guidance clearly states the "rules of engagement" for FRO personnel with the mission-specific competency. Emphasis should be placed on (1) tasks expected of FRO personnel with the mission-specific competency, (2) tasks beyond the capability of FRO personnel with the mission-specific competency, (3) required PPE and equipment to perform these expected tasks, and (4) procedures for ensuring coordination within the local ICS.

6.8.1.1.4* The operations level responder assigned to perform victim rescue and recovery at hazardous materials/WMD incidents shall receive the additional training necessary to meet specific needs of the jurisdiction.

A.6.8.1.1.4 See A.6.3.1.1.4.

6.8.1.2 Goal.

6.8.1.2.1 The goal of the competencies in this section shall be to provide the operations level responder assigned to rescue and/or recover exposed and/or contaminated victims at hazardous materials/WMD incidents with the knowledge and skills to perform the tasks in 6.8.1.2.2 in a safe and effective manner.

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6.8.1.2.2 Given a hazardous materials/WMD incident involving exposed and/or contaminated victims; an assignment in an IAP; the scope of the problem; policies and procedures; approved tools, equipment, including special rescue equipment, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, the operations level responder assigned to perform victim rescue and recovery shall be able to perform the following tasks:

(1) Select rescue and/or recovery options for victims at the incident within the capabilities of available personnel and approved tools, equipment, special rescue equipment, and PPE in accordance with the AHJ's policies and procedures by completing the following requirements:
   (a) Identify the status of potential victims
   (b) Select rescue and/or recovery options based on the status of potential victims

(2) Search for, rescue, and recover victims following safety procedures, avoiding or minimizing hazards, and protecting exposures and personnel

The personnel involved in victim rescue/recovery should be proficient in the use of the type of protective clothing offered as well as the selection procedures, proper use, and limitations of the PPE, and should meet the requirements of Section 6.2, Mission-Specific Competencies: Personal Protective Equipment.

(3) Report and document victim rescue and/or recovery operations

6.8.2 Competencies — Analyzing the Incident. (Reserved)

6.8.3 Competencies — Planning the Response.

Δ **6.8.3.1 Selecting Rescue and Recovery Options.**

Personnel planning a victim rescue operation should consider all hazards that are or could be present during the incident. Efforts should be made to identify whether hostile human threats, improvised explosive devices, or other devices used in an intentional release incident are still present, simultaneously with evaluation of the agent type and potential harm. Additional consideration should also include the following precautions:

1. Emergency responders will enter potentially contaminated areas only to perform rescue of known live victims or to perform an immediate reconnaissance to determine if live victims exist.
2. Emergency responders will immediately exit any area where they encounter evidence of a hazardous material/WMD and cannot identify any viable victims or the risk outweighs the benefit.
3. Emergency responders will avoid contact with any unidentified materials.
4. Emergency responders and rescued victims will undergo an emergency decontamination immediately on exit from the potentially hazardous area.
5. If needed, immediate medical assistance such as that provided by EMS providers can be immediately available at the safe refuge area (SRA) or casualty collection point (CCP).
6. If possible, emergency responders, when finding conditions in excess of immediately dangerous to life or health (IDLH) should attempt to change the environment (ventilation, vapor dispersion/suppression, etc.) to enable others to respond and assist.
7. While reducing the hazards to create a safer environment in which to operate is always a good work practice, it is essential when performing victim recovery.

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Given a hazardous materials/WMD incident involving exposed and/or contaminated victims; an assignment in an IAP; the scope of the problem; policies and procedures; approved tools, equipment, including special rescue equipment, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, the operations level responder assigned to rescue and recover victims shall select the victim rescue and recovery option(s) for the assignment and be able to perform the following tasks:

(1) Describe the importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures

> Personnel who are to perform duties as described in this competency must have completed the mission-specific competencies for PPE in Section 6.2.

(2) Choose whether the task is victim rescue, victim recovery, or both
  (a) Describe the difference between victim rescue and victim recovery operations
  (b) Describe considerations for determining the feasibility of conducting rescue or recovery operations in each of the following situations:
    (i) Line-of-sight with ambulatory victims
    (ii) Line-of-sight with nonambulatory victims
    (iii) Non-line-of-sight with ambulatory victims
    (iv) Non-line-of-sight with nonambulatory victims
    (v) Victim rescue operations versus victim recovery operations

(3) Select the rescue and recovery options within the capabilities of available personnel, approved tools, equipment, special rescue equipment, and PPE for the situation at hand
  (a) Describe both rescue and recovery options for each of the following situations:
    (i) Line-of-sight with ambulatory victims
    (ii) Line-of-sight with nonambulatory victims
    (iii) Non-line-of-sight with ambulatory victims
    (iv) Non-line-of-sight with nonambulatory victims

(4) Describe the procedures for implementing victim rescue and recovery operations within the incident command system

(5) Select the victim rescue or recovery option(s) and equipment for the assigned situation within the capabilities of available personnel, approved tools, equipment, special rescue equipment, and PPE

(6) Identify the PPE protection options required to protect victims during rescue and recovery operations

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6.8.4 Competencies — Implementing the Planned Response.

Δ **6.8.4.1 Searching for Rescuing and Recovering Victims.** Given a hazardous materials/WMD incident and the recommended victim rescue and recovery option(s) for the incident, the operations level responder assigned to rescue and recover victims shall implement the selected victim rescue and recovery options by completing the following requirements:

(1) Identify the different victim and recovery team positions, roles, and responsibilities

(2) Select and use specialized rescue equipment and procedures provided by the AHJ to support victim rescue and recovery

(3) Search for, rescue, and recover victims following safety procedures, avoiding or minimizing hazards, and protecting exposures and personnel

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(4) Select required PPE for victims and rescuers
(5) Triage and transfer victims to the decontamination group, casualty collection point, or area of safe refuge or emergency medical care in accordance with the IAP
(6) Follow the AHJ's procedures for the decontamination of rescue/recovery personnel and their equipment

6.8.5 Competencies — Evaluating Progress. (Reserved)

6.8.6 Competencies — Terminating the Incident.

N **6.8.6.1 Reporting and Documenting Victim Rescue and Recovery Operations.** Given a scenario involving a hazardous materials/WMD incident involving victim rescue and recovery operations and AHJ policies and procedures, the operations level responder assigned to perform victim rescue and recovery shall report and document the victim rescue and recovery operations as required by the AHJ by completing the following:

(1) Identify the reports and supporting documentation required by the AHJ pertaining to victim rescue and recovery operations

Personnel who are to perform duties as described in this competency must have completed the mission-specific competencies for PPE in Section 6.2.

6.9 Mission-Specific Competencies: Response to Illicit Laboratory Incidents.

6.9.1 General.

6.9.1.1 Introduction.

6.9.1.1.1 The operations level responder assigned to respond to illicit laboratory incidents shall be that person, competent at the operations level, who, at hazardous materials/WMD incidents involving potential violations of criminal statutes specific to the illegal manufacture of drugs or WMD, is assigned to secure the scene, identify the laboratory or process, and preserve evidence at hazardous materials/WMD incidents involving potential violations of criminal statutes specific to the illegal manufacture of drugs or WMD.

This mission-specific competency is designed to prepare the operations level responder to support law enforcement operations in the identification of illicit laboratories and evidence preservation tasks at a crime scene. The competency is designed to raise the awareness of responders and to prepare them to assist crime scene investigators during the performance of their jobs.

Additional guidance in response to illicit laboratories can be obtained from the Weapons of Mass Destruction Coordinator for the local office of the FBI, for the local office of the DEA, state or local law enforcement, or government-sponsored training programs.

Δ **6.9.1.1.2** The operations level responder who responds to illicit laboratory incidents shall be trained to meet all competencies at the awareness level (*see Chapter 4*), all competencies at the operations level (*see Chapter 5*), all mission-specific competencies for PPE (*see Section 6.2*), and all competencies in this section.

6.9.1.1.3 The operations level responder who responds to illicit laboratory incidents shall operate under the guidance of a hazardous materials technician, an allied professional, or standard operating procedures.

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Although some of the mission-specific competencies in this section are taken from Chapter 7, Competencies for Hazardous Materials Technicians, the technical committee wants to state clearly that operations level responders with a mission-specific competency are not replacements for an HMT. Operations level responders with a mission-specific competency can perform some technician-level skills but do not have the broader skills and competencies required of an HMT, particularly regarding risk assessment and the selection of control options. The following two options are examples of how guidance can be provided to ensure that operations level responders do not go beyond their level of training and equipment:

- **Direct Guidance:** Operations level responders are working under the control of an HMT or allied professional who has the ability to (1) continuously assess and/or observe their actions, and (2) provide immediate feedback. Guidance from an HMT or an allied professional can be provided through direct visual observation or through assessment reports communicated by the operations level responder to them.
- **Written Guidance:** Written standard operating procedures or similar guidance clearly states the "rules of engagement" for operations level responders with the mission-specific competency. Emphasis should be placed on the following:

Closer Look

Best Practices for Emergency Response to Synthetic Opioids, Including Fentanyl and Fentanyl Analogues

Since 2013, more than 30,000 people per year have died of opioid overdose in the United States. This problem has become an epidemic with drug overdoses exceeding all other causes of death for persons under age 50 in the United States. The main culprits behind this epidemic are fentanyl and its analogues. Fentanyl is a synthetic opioid primarily used for anesthesia, post-surgical pain, and pain management in opioid-tolerant patients. It is 100 times more powerful than morphine and 50 times more powerful than heroin.

Synthetic opioids are becoming the most common high-hazard response. However, there are many ways that the overall risk can be managed. Recognizing and understanding the threat is critical to determining the appropriate response. Regardless of the investigative intelligence available, all clandestine labs should be approached using an all-hazard approach. Never assume a clandestine lab involves only the production of illicit drugs. Consider the possibility that the clandestine lab may involve the production of chemical agents, biological agents, homemade explosives, or a combination.

What Are Synthetic Opioids?

Synthetic opioids (fentanyl, sufentanil, lofentanil, carfentanil, U-47700, and others) are highly toxic organic solids (identified as UN 2811, which is assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods). They have a particle size ranging from 0.2 to 2 µm and have been found as powders, liquids, nasal sprays, pills, and aerosols. Synthetic opioids are powders that are easily aerosolized.

Powderlike substances can become airborne and present with respiratory hazards particularly during activities such as "burping" containers of potential narcotics or "brushing" powdered residues from surfaces. Therefore, during encounters involving these types of materials, actions must be taken to avoid such aerosolization. Covering, wetting, or leaving containers unopened are essential safety precautions. Use of proper PPE and standard safe work practices to prevent inhalation of powders and to minimize direct skin contact with residues should be instituted as soon as the potential of the presence of such materials is determined to exist.

Protection

Synthetic opioids, particularly the fentanyl series, are respiratory and dermal hazards. However, the extent to which they are dermal hazards is not clear. Early estimates based on available data and known behaviors of fentanyl show that it cannot be discounted as a dermal hazard, but large amounts or long contact times would be necessary.

Typical responses and recommended best practices include:

- For response to an overdose situation where no visible, uncontained product is evident, standard universal precautions such as nitrile gloves and uniform are sufficient.
- For response to low to mid-volume threats where potential synthetic opioid materials are visible, the use of a P100 filtering facepiece respirator, eye protection, nitrile gloves, and long-sleeved shirts and pants are sufficient for protective equipment.

For response to high-volume threats where the threat is powder in nature, such as a milling laboratory, an ensemble certified to NFPA 1999 multiuse or NFPA 1994 Class 4, 4R should be employed.

For response to high-volume threats where the threat is powder, liquid, or aerosol, such as production laboratories, an ensemble certified to NFPA 1994 Class 3, 3R or higher should be employed. The specific level of chemical protection should dictate the use of higher classes within NFPA 1994 (or transitioning up to NFPA 1991).

Note: For any of the high-volume, high-hazard environments, NFPA certified gear is recommended because it has been tested extensively against the scenarios of concern. These are ensemble certifications, so care must be taken to use the entire ensemble to guarantee the certified level of protection.

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Closer Look *(Continued)*

Decontamination and Destruction

Fentanyl and fentanyl analogues are water soluble. Fentanyl in its hydrochloride form (most common for street drugs) is more soluble than the citrate form (most common for medical-grade pharmaceuticals), which is more soluble than the free base (often seen in transport). Therefore, expedient rinsing of any contacted areas with water is advisable. Consider adding soap to the wash water to account for the slightly soluble free base. Be sure to minimize splashing as this could cause aerosolization of the materials.

Contaminated PPE should be removed using techniques to prevent aerosolizing powdered contaminants while avoiding unprotected contact with outer layers of the PPE. All items should be isolated for further decontamination or disposal. Consider decontaminating the surface of the PPE before doffing using a highly absorbent wipe and a peracetic acid (5 percent) or hydrogen peroxide-based (10 percent) decontamination solution. Minimize the use of free chlorine-based decontamination solutions, such as dichloroisocyanuric acid, on PPE surfaces as they may deteriorate the PPE materials.

Site cleanup and public access must be managed carefully to ensure there are no secondary exposures. If the peracetic acid (5 percent) or hydrogen peroxide (10 percent) decontamination solution, which is recommended for PPE decontamination, is not available, swimming pool dry chlorine powder or crushed tablets containing chloroisocyanuric acids in a solution [.50 oz per 1 qt (14 gm per 946 ml) water] can be effective for decontaminating equipment and treating contaminated decon wastewater. Contaminated wastewater must be captured for proper disposal.

Note: Do not use isocyanuric acid-based materials on PPE or sensitive equipment. Do not mix the swimming pool dry chlorine powders and hypochlorite solutions together. These solutions are incompatible and can be explosive.

Sampling and Detection

No interaction with the samples should be considered without the use of appropriate PPE. In the case of synthetic opioids, the first determination should be whether or not detection and identification of the material will change the response. If the answer is no, then strong consideration should be given to not interacting with the threat material for detection purposes. It should instead be packaged and provided to law enforcement for laboratory testing.

Ensure that evidence is properly packaged and that the outer materials are decontaminated with 5 percent peracetic acid solution, or similar materials, before shipment. Evidence or samples should be clearly marked with bright pink warning labels that state: Danger Synthetic Opioid. Labels can be printed as needed to create synthetic opioid warning labels. A print template is available here, under HAZMAT: https://www.fentanylsafety.com/job-specific. Consider using a collapsible particulate-tight glove box at the scene for collection and assessment of evidence so the material can then be shipped within the glove box.

There are many analytical techniques available for the detection, classification, and identification of synthetic opioids. For trace levels (less than 1 mg) of materials, two available techniques are thermal desorption mass spectrometry and ion mobility spectroscopy. For bulk levels (great than 1 mg), technologies such as infrared and Raman spectroscopy can provide detection and identification of the materials of interest while colorimetric techniques generally provide detection and classification, with a few exceptions. For any of the spectrometry and spectroscopy systems for field analysis, operators must ensure the instrument library includes updated spectrums for the synthetic opioids and standard binders. Also, techniques that provide better resolution on mixtures, whether that be via separation technologies, sample interrogation techniques, or mathematical algorithms, should be considered as the standard "street" sample generally contains less than 5 percent threat material.

The common methods for the production of fentanyl and fentanyl analogues are available for responder awareness within the Laboratory Identifier Tool of the Emergency Response Decision Support System (available at www.chemicalcompanion.org). For more detailed recommendations, go to www.iab.gov.

1. Tasks expected of operations level responders
2. Tasks beyond the capability of operations level responders
3. Required PPE and equipment to perform these expected tasks
4. Procedures for ensuring coordination within the local ICS

6.9.1.1.4* The operations level responder who responds to illicit laboratory incidents shall receive the additional training necessary to meet specific needs of the jurisdiction.

A.6.9.1.1.4 See A.6.3.1.1.4.

6.9.1.2 Goal.

6.9.1.2.1 The goal of the competencies in this section shall be to provide the operations level responder assigned to respond to illicit laboratory incidents with the knowledge and skills to perform the tasks in 6.9.1.2.2 in a safe and effective manner.

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6.9.1.2.2 Given a hazardous materials/WMD incident involving an illicit laboratory; an assignment in an IAP; scope of the problem; policies and procedures; approved tools, equipment, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, the operations level responder assigned to respond to illicit laboratory incidents shall be able to perform the following tasks:

(1) Analyze a hazardous materials/WMD incident to determine the complexity of the problem, potential outcomes, and whether the incident has the potential to be a criminal illicit laboratory operation
(2) Plan a response for a hazardous materials/WMD incident involving potential illicit laboratory operations in compliance with evidence preservation operations within the capabilities and competencies of available personnel, PPE, and response equipment after notifying the responsible law enforcement agencies of the problem
(3) Implement the planned response to a hazardous materials/WMD incident involving potential illicit laboratory operations utilizing applicable evidence preservation guidelines
(4) Report and document illicit laboratory response operations

6.9.2 Competencies — Analyzing the Incident.

Δ **6.9.2.1 Determining If a Hazardous Materials/WMD Incident Is an Illicit Laboratory Operation.** Given examples of hazardous materials/WMD incidents involving illicit laboratory operations, the operations level responder assigned to respond to illicit laboratory incidents shall identify the potential drugs/WMD being manufactured by completing the following related requirements:

Illicit laboratories are designed for the production of many different products including illegal drugs such as methamphetamine, chemical modification such as distillation of pesticides, and biological toxins or pathogens. Identification of the materials being produced is based on a scientific assessment of the tools and materials used in the process combined with law enforcement intelligence. Various specialized teams exist to assist in this process and support these types of operations. Examples of these teams include DEA Clandestine Lab Teams, local or state law enforcement lab teams for illegal manufacture of drugs, and the FBI for manufacture of WMD materials.

Operators of these illicit laboratories often have a vested interest in the protection of their product and eluding law enforcement. There is a risk that the operator will be present in the laboratory with access to weapons. The human element must be addressed by law enforcement tactical teams specifically trained to operate within a hazardous environment. The level of protection for the tactical team should be based on an assessment of the intelligence, information on the materials being produced, and information including any protective clothing used by the operator, activity of animals in the laboratory, and interviews with neighbors. Additionally, there is a risk of antipersonnel devices (booby traps) around and in the laboratory. The operations level responder must leave clearance of potential antipersonnel devices to IED/EOD personnel trained for these procedures. Once the human and IED/EOD hazards have been cleared, the operations level responder should rely on the hazard risk assessment provided by the HMT or allied professional to determine the potential harm from hazardous materials/WMD in the illicit laboratory. Evidence recovery and forensic operations must be conducted by a specialized team trained for these specific operations.

All site activities are guided by the law enforcement agency having jurisdiction, within the parameters established by the search warrant or protocol in effect authorizing the seizure of the illicit laboratory. Decontamination procedures should be based on the results of the hazard risk assessment.

(1) Given examples of illicit drug manufacturing methods, describe the operational considerations, hazards, and products involved in the illicit process

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The processes involved in illicit drug production change frequently, and as such response agencies must maintain frequent interaction with law enforcement drug response teams. Response agencies should maintain situational awareness by receiving a briefing from law enforcement concerning the anticipated threats from hazardous materials/WMD incidents. These agencies should be aware of potential hazards involving illicit drug production, including but not limited to flammable gases, flammable solvents, and toxic by inhalation and/or by dermal contact materials.

(2) Given examples of illicit chemical WMD methods, describe the operational considerations, hazards, and products involved in the illicit process

Illicit chemical WMD methods include such procedures as distillation of organophosphate pesticides or the use of acids and cyanides. Identifying the products and methods that can be utilized in a WMD chemical process is complex. Special attention should be given to materials that are commonly found or acquired either in transportation or at fixed facilities, such as industrial chemicals and toxins.

(3) Given examples of illicit biological WMD methods, describe the operational considerations, hazards, and products involved in the illicit process

Illicit biological WMD methods include procedures such as the processing of castor beans to refine the protein toxin ricin and the culture of bacterial or viral agents. Identifying the products and methods that might be used in a WMD biological process is complex. Special attention should be given to scenes involving the discovery of potential biological laboratory equipment, such as incubators, fermenters, and agar growth plates.

(4) Given examples of illicit laboratory operations, describe the booby traps that have been encountered by response personnel

Specific information on booby traps should be obtained from EOD or bomb squad teams. The information should be used for awareness only. Searching for and dismantling booby traps should only be done by IED/EOD teams trained in this task.

(5) Given examples of illicit laboratory operations, describe the agencies that have investigative authority and operational responsibility to support the response

Law enforcement jurisdiction, investigative guidelines, and investigative priorities are complex and dynamic. Specific jurisdictional situations should be identified with the responder's local or state law enforcement authorities and federal investigative agencies such as the FBI, DEA, U.S. Postal Inspection Service, and EPA.

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6.9.3 Competencies — Planning the Response.

6.9.3.1 Determining the Response Options. Given an analysis of hazardous materials/WMD incidents involving illicit laboratories, the operations level responder assigned to respond to illicit laboratory incidents shall identify possible response options.

6.9.3.2 Identifying Unique Aspects of Criminal Hazardous Materials/WMD Incidents.

6.9.3.2.1 The operations level responder assigned to respond to illicit laboratory incidents shall identify the unique operational aspects associated with illicit drug manufacturing and illicit WMD manufacturing.

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Δ **6.9.3.2.2** Given an incident involving illicit drug manufacturing or illicit WMD manufacturing, the operations level responder assigned to illicit laboratory incidents shall describe the following tasks:

(1) Securing and preserving the scene

These tasks include neutralization of any tactical threat, rendering safe any IED/EOD or booby traps, full accountability and identification of all personnel at the crime scene, documentation of any items disturbed within the crime scene, and protection of evidence from potential damage or destruction.

(2) Joint hazardous materials and hazardous devices technician site reconnaissance and hazard identification

Hazmat and hazardous devices teams will need to work together to resolve situations found within illicit drug or WMD laboratories — for example, explosive/chemical, explosive/radiological, or explosive/biological devices and materials; clearance of booby traps; and characterization of IED/EOD and hazmat hazards. Responders should develop liaison between hazardous devices/EOD and hazardous materials personnel in preparation for such events.

(3) Determining atmospheric hazards through air monitoring and detection

Assessment of atmospheric hazards is a primary task performed as part of the site hazard risk assessment. The detection and monitoring equipment selected to determine atmospheric hazards must be capable of assisting in the performance of the hazard risk assessment and, at a minimum, should include a combustible gas indicator, oxygen level meter, photoionization meter, pH paper, and radiological monitoring equipment.

(4) Mitigation of immediate hazards while preserving evidence

Standard priorities of scene operations apply during responses to illicit drug or WMD laboratories, specifically, life safety, incident stabilization, and preservation of property. In the course of reconnaissance of the laboratory, responders should assess immediate hazards to life and the safety of responders and investigators. Responders should establish connections with the appropriate law enforcement agency prior to reconnaissance operations to be briefed on intelligence involving the laboratory or site.

(5) Coordinated crime scene operation with the agency having investigative authority

When responding to potential illicit drug or WMD laboratories, the operations level responder should be observant for signs of criminal activity involving chemical, biological, radiological, or explosive materials or devices. The operations level responder should be familiar with the jurisdictional procedures for operation within a crime scene, to include investigative law enforcement leadership, search warrant requirements, rules of evidence, crime scene documentation, policies regarding photography, evidence custodial requirements, chain of custody, and specific requirements set forth by the prosecuting attorney.

The operations level responder should be an advocate for the law enforcement operation, and support the operation within their scope of training.

(6) Documenting personnel and scene operations associated with the incident

Local procedures vary for crime scene documentation. For example, some jurisdictions do not allow the use of video documentation. The operations level responder should become familiar with the local or state and federal procedures for documentation at a crime scene.

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Δ **6.9.3.3 Identifying the Agency That Has Investigative Jurisdiction.** The operations level responder assigned to respond to illicit laboratory incidents shall identify the agency having investigative jurisdiction by completing the following:

(1) Given scenarios involving illicit drug manufacturing or illicit WMD manufacturing, identify the agency(s) with investigative authority for the following situations:
   (a) Illicit drug manufacturing
   (b) Illicit WMD manufacturing
   (c) Environmental crimes resulting from illicit laboratory operations

Law enforcement jurisdiction, investigative guidelines, and investigative priorities are complex and dynamic. Specific jurisdictional situations should be identified with the responder's local or state law enforcement authorities and federal investigative agencies such as the FBI, DEA, U.S. Postal Inspection Service, and EPA.

   (d) Improvised explosive devices, improvised WMD dispersal devices, and improvised explosives laboratories

6.9.3.4 Identifying Unique Tasks and Operations at Sites Involving Illicit Laboratories.

6.9.3.4.1 The operations level responder assigned to respond to illicit laboratory incidents shall identify and describe the unique tasks and operations encountered at illicit laboratory scenes.

Unique tasks include clearance of hostile suspects, clearance of IEDs/EOD devices or materials, clearance of antipersonnel devices (booby traps), performance of tactical decontamination, acquisition of warrants and affidavits, isolation of chemical reactions, collection of evidence, and site remediation.

6.9.3.4.2 Given scenarios involving illicit drug manufacturing or illicit WMD manufacturing, describe the following:

(1) Hazards, safety procedures, and tactical guidelines for this type of emergency

Illicit laboratories are designed for the production of many different products, for example, illegal drugs such as methamphetamine, chemical modification such as distillation of pesticides, and biological toxins or pathogens. Operators of these illicit laboratories often have a vested interest in the protection of their product and evading law enforcement. There is a risk that the operator will be present in the laboratory and have access to weapons. The human element must be addressed by law enforcement tactical teams specifically trained to operate in hazardous environments. Additionally, there is a risk of antipersonnel devices (booby traps) around and in the laboratory. The operations level responder must leave clearance of potential antipersonnel devices to hazardous device technicians/EOD personnel trained for these procedures. Once the human and explosive hazards have been cleared, the operations level responder should conduct a hazard risk assessment to determine the potential harm from hazardous materials/WMD in the illicit laboratory.

(2) Factors to be evaluated in selection of the proper PPE for each type of tactical operation

Selection of PPE is based on an assessment of available intelligence, warning signs, and detection clues and includes protective clothing used by the operator, activity of animals in the laboratory, and interviews with neighbors. Law enforcement activities may require PPE designed for tactical law

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enforcement operations; however, the PPE must be evaluated for appropriate protection from the anticipated hazards as identified during the hazard risk assessment. IED/EOD operations will require the appropriate level of explosive protective garment, augmented by chemical protective clothing appropriate for the anticipated hazard identified during the hazard risk assessment.

(3) Factors to be considered in selection of appropriate decontamination procedures

Decontamination procedures should be based on the results of the hazard risk assessment. Dynamic tactical entries may require the use of tactical decontamination procedures. Tactical decontamination is based on rapid deployment and a focus on reception of four potential situations: uninjured tactical operators and their equipment, injured tactical operators, uninjured suspects, and injured suspects. Operations level responders must coordinate decontamination procedures with law enforcement tactical teams to resolve potential issues, such as live ammunition, pyrotechnic devices, and custody of suspects.

(4) Factors to be evaluated in the selection of detection devices

The detection and monitoring equipment selected must be capable of assisting in the performance of the hazard risk assessment, and at a minimum should include a combustible gas indicator, oxygen level meter, photoionization meter, pH paper, and radiological monitoring equipment.

(5) Factors to be considered in the development of a remediation plan

The operations level responder must become familiar with local or state and federal agency policies concerning the remediation of illicit drug/WMD scenes. Potential sources of assistance include local or state health and/or environmental departments, emergency management agencies, and federal agencies such as the DEA or EPA.

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6.9.4 Competencies — Implementing the Planned Response.

6.9.4.1 Implementing the Planned Response. Given scenarios involving an illicit drug/WMD laboratory operation involving hazardous materials/WMD, the operations level responder assigned to respond to illicit laboratory incidents shall implement or oversee the implementation of the selected response options in a safe and effective manner.

The responder should demonstrate competency in the areas described in 6.9.4.1.1 through 6.9.4.1.5 using AHJ-approved evaluation tools and/or scenarios.

Δ **6.9.4.1.1** Given a simulated illicit drug/WMD laboratory incident, the operations level responder assigned to respond to illicit laboratory incidents shall be able to perform the following tasks:

(1) Describe safe and effective methods to secure the scene
(2) Demonstrate decontamination procedures for tactical law enforcement personnel to include weapons and law enforcement K-9s securing an illicit laboratory
(3) Demonstrate decontamination procedures for potential suspects
(4) Describe methods to identify and avoid hazards found at illicit laboratories such as booby traps and releases of hazardous materials
(5) Describe procedures for conducting joint hazardous materials/hazardous devices assessment operations

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6.9.4.1.2 Given a simulated illicit drug/WMD laboratory entry operation, the operations level responder assigned to respond to illicit laboratory incidents shall describe methods for identifying the following during reconnaissance operations:

(1) Manufacture of illicit drugs
(2) Manufacture of illicit WMD materials
(3) Environmental crimes associated with the manufacture of illicit drugs/WMD materials
(4) Improvised explosive devices, improvised WMD dispersal devices, and improvised explosives laboratories

6.9.4.1.3 Given a simulated illicit drug/WMD laboratory incident, the operations level responder assigned to respond to illicit laboratory incidents shall describe joint agency crime scene operations, including support to forensic crime scene processing teams.

6.9.4.1.4 Given a simulated illicit drug/WMD laboratory incident, the operations level responder assigned to respond to illicit laboratory incidents shall describe the policy and procedures for post–crime scene processing and site remediation operations.

6.9.4.1.5 The operations level responder assigned to respond to illicit laboratory incidents shall describe local procedures for performing decontamination upon completion of the illicit laboratory mission.

6.9.5 Competencies — Evaluating Progress. (Reserved)

6.9.6 Competencies — Terminating the Incident.

N **6.9.6.1 Reporting and Documenting Illicit Laboratory Response Operations.** Given a scenario involving a hazardous materials/WMD incident involving illicit laboratory response operations and AHJ policies and procedures, the operations level responder assigned to perform illicit laboratory response shall report and document the illicit laboratory response operations as required by the AHJ by completing the following:

(1) Identify the reports and supporting documentation required by the AHJ pertaining to illicit laboratory response operations

6.10 Mission-Specific Competencies: Disablement/Disruption of Improvised Explosive Devices (IEDs), Improvised WMD Dispersal Devices, and Operations at Improvised Explosives Laboratories.

6.10.1 General.

This mission-specific competency was developed in cooperation with the National Bomb Squad Commanders Advisory Board and FBI Hazardous Devices School. The intended scope of the mission-specific competency is the responder who is *already* certified as an EOD technician/hazardous devices technician (bomb technician), who may be called to IED/EOD incidents with hazardous materials involvement.

This mission-specific competency does not imply that current hazmat technicians must achieve certification as bomb technicians, nor does it imply that hazmat operations level responders do not meet the competencies of NFPA 472 if they do not meet the competencies in this section.

Hazmat operations level responders must never approach, manipulate, or attempt to render safe any actual or suspected explosive devices without explicit on-scene guidance from a certified bomb technician.

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6.10.1.1 Introduction.

6.10.1.1.1 The operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall be that person, competent at the operations level, who is assigned to interrupt the functioning of an IED or an improvised WMD dispersal device or conduct operations at improvised explosives laboratories.

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be the person designated by the AHJ to respond to incidents involving explosive devices or materials for the purposes of protecting the public by disrupting the function of a device, or prevent ignition and/or detonation of explosive materials.

This section does not include personnel who are assigned to the response from a strict hazardous materials mitigation perspective.

6.10.1.1.2 The operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall possess current certification as a Hazardous Device Technician from the FBI Hazardous Devices School, Department of Defense, or equivalent certifying agency as determined by the AHJ and be functioning as a member of a bomb squad or recognized military unit.

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories must hold current certification to perform the role of a bomb technician. The certification should be issued by an organization that meets the AHJ's requirements for certification.

The responder should be functioning as a member of an organized bomb squad or military EOD unit, rather than functioning independently of a recognized national accreditation program.

Δ **6.10.1.1.3** The operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall be trained to meet all competencies at the awareness level (see Chapter 4), all competencies at the operations level (see Chapter 5), all mission-specific competencies for PPE (see Section 6.2), mission-specific competencies for response to illicit laboratories (see Section 6.9), and all competencies in this section.

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories must possess the knowledge of a hazmat operations level responder, including mission-specific competencies for use of PPE and response to illicit laboratories.

Although the responder should be performing the hazmat component of the response under the advice of an HMT or other allied professional, there will be situations where the bomb technician is operating in a hazmat environment without the immediate ability to consult these hazmat professionals; therefore, the responder must possess basic hazmat knowledge and skills.

6.10.1.1.4 The operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall operate under the guidance of an allied professional or standard operating procedures.

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The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should operate at hazmat incidents under the advice and guidance of an AHJ-approved hazmat technician or an AHJ-approved allied professional such as an industrial hygienist, chemist, or similar professional, or have specific standard operating procedures as written and adopted by the AHJ for independent operations.

The intent of this section strictly relates to the safety of the bomb technician concerning exposure from hazardous materials and does not imply that the AHJ-approved hazmat technician or allied professional will dictate any render-safe or other explosive device–related advice to the bomb technician. The bomb technician is the final authority for any explosive device or explosive related materials, as dictated by the AHJ.

6.10.1.1.5 The operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall receive the additional training necessary to meet the specific needs of the jurisdiction and/or agency.

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should maintain additional training as dictated by the AHJ for performance of their tasks. Examples include permit-required confined space operations, lockout/tagout procedures, trenching operations, maritime operations, or related skills.

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6.10.1.2 Goal.

6.10.1.2.1 The goal of the competencies in this section shall be to provide the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories with the knowledge and skills to perform the tasks in 6.10.1.2.2 and 6.10.1.2.3 in a safe and effective manner.

Δ **6.10.1.2.2** When responding to hazardous materials/WMD incidents involving a potential IED or improvised WMD dispersal device, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall be able to perform the following tasks:

(1) Analyze a hazardous materials/WMD incident involving an improvised WMD dispersal device to determine the complexity of the problem and potential outcomes by completing the following tasks:

  (a) Determine if an IED or WMD dispersal device is present
  (b) Categorize the device by its delivery method

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories must develop the skills and knowledge to analyze a potential explosive device or dispersal device to determine the credibility of the threat and potential impact of the device on the public. Additional guidance can be found in 6.10.2.

(2) Plan a response for a hazardous materials/WMD incident where there is a potential improvised WMD dispersal device within the capabilities and competencies of available personnel, PPE and response equipment by completing the following tasks:

  (a) Determine if response options can be employed to conduct a disablement/disruption of the device

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(b) Describe the actions to be taken and the resources to be requested if the incident exceeds the available capabilities

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories must develop the skills and knowledge to plan a response to a potential explosive device or dispersal device. The response planning should include an assessment of available options to render safe or otherwise disrupt the device, and an evaluation of assets that may be requested for situations beyond the capability of local resources. Additional guidance can be found in 6.10.3.

(3) Implement the planned response to a hazardous materials/WMD incident involving an IED or WMD dispersal device by completing the following tasks under the guidance of the senior hazardous devices technician (HDT) present:

(a) Employ disablement/disruption techniques in accordance with the FBI Hazardous Devices School "logic tree," the current edition of the National Bomb Squad Commanders Advisory Board's (NBSCAB) "A Model for Bomb Squad Standard Operating Procedures," established protocol of military units, or the AHJ

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories must develop the skills and knowledge to implement a planned response to an incident involving an explosive device or dispersal device. The implementation process should follow AHJ-approved protocols, procedures, and guidelines. Additional guidance can be found in 6.10.4.

(4) Report and document potential IED or improvised WMD dispersal device operations

6.10.1.2.3 When responding to hazardous materials/WMD incidents involving potential improvised explosives laboratories, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall be able to perform the following tasks:

(1) Analyze a hazardous materials/WMD incident involving a potential improvised explosives laboratory to determine the complexity of the problem and potential outcomes and whether the incident has the potential for being an improvised explosives laboratory operation

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories must develop the skills and knowledge to analyze a potential explosive laboratory to determine the credibility of the threat and potential impact of the laboratory operation on the public. Additional guidance can be found in 6.10.2.

(2) Plan a response to a hazardous materials/WMD incident involving a potential improvised explosives laboratory in compliance with mitigation techniques and evidence recovery within the capabilities and competencies of available personnel, PPE, and control equipment, after notifying the responsible investigative agencies of the problem

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories must develop the skills and knowledge to plan a

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response to a potential explosives laboratory. The response planning should include an assessment of available options to stabilize the laboratory and an evaluation of assets that may be requested for situations beyond the capability of local resources. Additional guidance can be found in 6.10.3.

(3) Implement the planned response to a hazardous materials/WMD incident involving a potential improvised explosives laboratory utilizing applicable standard operating procedures and/or technical advice from qualified allied professionals

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories must develop the skills and knowledge to implement a planned response to an incident involving an explosives laboratory. The implementation process should follow AHJ-approved protocols, procedures, and guidelines. Additional guidance can be found in 6.10.4.

(4) Report and document potential improvised explosives laboratories operations

6.10.2 Competencies — Analyzing the Incident.

6.10.2.1 Determining If the Incident Involves the Potential Presence of an Improvised WMD Dispersal Device. Given examples of hazardous materials/WMD incidents involving an IED or improvised WMD dispersal device, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall identify and/or categorize the hazard by completing the following:

(1) Given examples of the following hazardous materials/WMD incidents involving an IED or improvised WMD dispersal device, describe products that might be encountered in the incident associated with each situation:

(a) Letter/package-based improvised dispersal device

Letters and small packages may contain both explosives and hazardous materials. The responder must be aware that although the quantity of materials may be small, the energy and hazards from the products can still cause injury or death. Products that might be encountered include propellants, fuels, composition explosives, corrosives, toxins, peroxides and peroxide-based explosives, biological materials, radiological materials, mechanical devices, compressed gases, shrapnel and fragmentation materials, and so on.

(b) Briefcase/backpack-based improvised dispersal device

Briefcases and backpacks allow for larger quantities of both explosives and hazardous materials. The bomb technician responder must consider that abandoned briefcases and backpacks may include hazards above those presented by explosives. Products that might be encountered include propellants, fuels, composition explosives, corrosives, toxins, peroxides and peroxide-based explosives, biological materials, radiological materials, mechanical devices, compressed gases, shrapnel and fragmentation materials, and so on.

(c) Transportation-borne WMD dispersal device

Transportation-borne devices present greater hazards to the responder due to the large quantities of hazardous materials potentially held within transportation containers. Explosive materials can be placed either to breach the container, allowing a release of product, or to use the chemical and physical

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properties of the product to increase the energy of the explosives. Products that might be encountered include propellants, fuels, composition explosives, corrosives, toxins, peroxides and peroxide-based explosives, toxic industrial materials, biological materials, radiological materials, mechanical devices, compressed gases, shrapnel and fragmentation materials, and so on.

(d) Fixed location hazards where an IED has been placed to cause the deliberate release of a material

Fixed location hazards present even greater hazards to the responder due to the large quantities of hazardous materials potentially held within the fixed location, including storage tanks, chemical processes, hazardous materials storage, or similar hazards. Explosive materials can be placed to breach tanks and damage chemical processes, allowing a release of a product, or to use the chemical and physical properties of a product to increase the energy of the explosives. Products that might be encountered include propellants, fuels, composition explosives, corrosives, toxins, peroxides and peroxide-based explosives, toxic industrial materials, biological materials, radiological materials, mechanical devices, compressed gases, shrapnel and fragmentation materials, and so on.

Δ **6.10.2.2 Determining If the Hazardous Materials/WMD Incident Involves an Improvised Explosives Laboratory Operation.** Given examples of hazardous materials/WMD incidents involving improvised explosives laboratories, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall identify the potential explosives/WMD being manufactured by completing the following related requirements:

(1) Given examples of improvised explosives manufacturing methods, describe the operational considerations, hazards, and products involved in the process

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories must be familiar with the hazards from improvised explosives manufacturing to ensure safe conditions for hazardous technician/EOD operations and other response personnel. Methods of improvised explosives manufacturing are dynamic and changing, and the responder must develop methodology to remain knowledgeable on current methods.

Potential methods include the use of chemical reactions to develop desired chemical compounds from peroxides, fuels, hydrocarbons, and other industrial chemicals. Techniques of facilitating the reaction may include heating, blending, drying, or other potentially dangerous tasks. The responder must consider that any explosives laboratory is unstable until proven otherwise.

The AHJ should identify likely production methods based on experience, intelligence information, and test responder awareness based on the existence and operation of those production methods.

(2) Given examples of improvised explosives laboratory operations, describe the booby traps that have been encountered by response personnel

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories must consider that the owner of the laboratory has a desire to protect the laboratory from being disturbed or discovered. The responder should be familiar with the various types of antipersonnel devices in current use by improvised explosives laboratory operators, based on intelligence, experience, and continuing education. Devices such as contact

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plates, monofilament tripwires, mercury switches, passive infrared sensors (PIR), and similar devices may be included as part of the competency process for the responder.

The AHJ should identify likely booby traps based on experience and intelligence information and test responder awareness of the existence and operation of those devices.

(3) Given examples of improvised explosives laboratory operations, describe the agencies that have investigative authority and operational responsibility to support the response

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with all agencies in the AHJ's area of operation that have investigative authority involving improvised explosives laboratory responses, to include local, state, and federal agencies. Responders should also be familiar with the jurisdictional delineation for nonterrorism vs. terrorism incidents.

6.10.3 Competencies — Planning the Response.

6.10.3.1 Identifying Unique Aspects of Improvised WMD Dispersal Device Related Hazardous Materials/WMD Incidents. When responding to hazardous materials/WMD incidents, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratory incidents shall be capable of identifying the unique aspects associated with such incidents by completing the following requirements:

(1) Given an incident involving a non-vehicle-based WMD dispersal device, shall be able to perform the following tasks:

(a) Describe the hazards, safety procedures, and tactical guidelines for this type of incident

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with the standard operating guidelines of the AHJ for response to nonvehicle-based IEDs or improvised WMD dispersal devices. The guidelines should include procedures to facilitate a hazard risk assessment on these devices to include thermal, radiological, asphyxiation, chemical, biological, and mechanical threats.

(b) Describe the factors to be evaluated in selecting the PPE

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with the PPE provided by the AHJ for response to nonvehicle-based IED or improvised WMD dispersal devices. The PPE selection could include blast protection, thermal regulation, chemical protection, respiratory protection, fall protection, and related items.

(c) Describe the procedure for identifying and obtaining the appropriate emergency response elements to support disablement/disruption operations

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and

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operations at improvised explosives laboratories should be familiar with the response elements available in the AHJ's area of operation that would respond to an incident involving a nonvehicle-based IED or improvised WMD dispersal device. Agencies might include fire, EMS, law enforcement, emergency management, industrial partners, military, health, hospital, and related agencies.

(2) Given an incident involving a vehicle-borne WMD dispersal device, shall be able to perform the following tasks:

(a) Describe the hazards, safety procedures, and tactical guidelines for this type of incident

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with the standard operating guidelines of the AHJ for response to vehicle-borne IEDs or improvised WMD dispersal devices. The guidelines should include procedures to facilitate a hazard risk assessment on these devices, to include thermal, radiological, asphyxiation, chemical, biological, and mechanical threats.

(b) Describe the factors to be evaluated in selecting the PPE

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with the PPE provided by the AHJ for response to vehicle-borne IED or improvised WMD dispersal devices. The PPE selection could include blast protection, thermal regulation, chemical protection, respiratory protection, fall protection, and related items.

(c) Describe the procedure for identifying and obtaining the appropriate emergency response elements to support disablement/disruption operations

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with the response elements available in the AHJ's area of operation that would respond to an incident involving a vehicle-borne IED or improvised WMD dispersal device. Agencies might include fire, EMS, law enforcement, emergency management, industrial partners, military, health, hospital, railroad, trucking, maritime, and related agencies.

(3) Given examples of different types of incidents involving an improvised WMD dispersal device, shall identify and describe the application use and limitations of various types of field screening tools that can be utilized for determining the presence of the following materials:

(a) Gamma and neutron radiation

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with all of the radiation detection equipment made available by the AHJ. Responders should be aware that any IED or WMD dispersal device could involve radioactive materials and should develop a radiation monitoring plan to confirm their absence or presence. The AHJ should confirm the responder's knowledge of gamma and neutron radiation detection by developing potential scenarios to be addressed by the responder.

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Gamma and neutron detectors function by passively monitoring ionizing radiation and in some cases can gather spectra for nuclide identification. Gamma and neutron detectors will not detect the presence of either alpha or beta particles, which are often associated with the presence of radioactive contamination. Responders should not rely on gamma and neutron detectors to search for radioactive contamination, or "clear" items suspected of being contaminated. Responders must be aware that some radiation detectors are not rated intrinsically safe for flammable environments and should not be used without consultation with hazmat or use of a combustible gas indicator.

Responders should be familiar with the AHJ's guidelines regarding the collection of spectra and transmission of spectra to a nuclear spectroscopist for analysis. Responders should also be familiar with the AHJ's procedures for calibration and maintenance of all radiation detection equipment.

(b) Explosive materials [commercial and homemade explosives (HME)]

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with all of the explosive detection equipment made available by the AHJ. Responders should be aware that any IED or WMD dispersal device could involve explosive materials and should develop a monitoring plan to confirm their absence or presence. The AHJ should confirm the responder's knowledge of explosives detection by developing potential scenarios to be addressed by the responder.

Explosives detection devices are available using numerous technologies, including Fourier transform infrared, Raman spectroscopy, reagents, electrochemical sensors, combustible gas indicators, and others. Each of these technologies involves unique issues that concern training, operation, and maintenance. For example, Raman must be used with caution on dark energetic powders.

6.10.3.2 Identifying Unique Aspects of Improvised Explosives Laboratory-Related Hazardous Materials/WMD Incidents. When responding to conduct mitigation procedures on energetic materials at an improvised explosives laboratory, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall be capable of identifying the unique aspects associated with such incidents by completing the following requirements:

(1) Given a scenario involving an improvised explosives laboratory and detection devices provided by the AHJ, complete the following:

(a) Describe the hazards, safety procedures, and tactical guidelines for this type of incident

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with the standard operating guidelines of the AHJ for response to vehicle borne IEDs or improvised WMD dispersal devices. The guidelines should include procedures to facilitate a hazard risk assessment on these devices, to include thermal, radiological, asphyxiation, chemical, biological, and mechanical threats.

(b) Describe the factors to be evaluated in selecting the PPE

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with the PPE provided by the AHJ for response to vehicle borne IED or improvised WMD dispersal devices. The PPE selection could

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include blast protection, thermal regulation, chemical protection, respiratory protection, fall protection, and related items.

(c) Describe the application, use, and limitations of various types of field screening tools that can be utilized for determining the presence of the following materials:

i. Radioactive materials that emit alpha, beta, gamma, or neutron radiation, including radionuclide identification of gamma emitting radioactive materials

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with all of the radiation detection equipment made available by the AHJ. Responders should be aware that any incident involving an improvised explosives laboratory could involve radioactive materials and should develop a radiation monitoring plan to confirm their absence or presence. The AHJ should confirm the responder's knowledge of radiation detection by developing potential scenarios to be addressed by the responder.

Alpha, beta, gamma, and neutron detectors function by passively monitoring ionizing radiation and in some cases can gather spectra for nuclide identification. Radiation detectors are specific to their target radiation types, and responders must develop procedures to use each detector type as appropriate. Responders should not rely on gamma and neutron detectors to search for radioactive contamination, or "clear" items suspected of being contaminated. Responders must be aware that some radiation detectors are not rated intrinsically safe for flammable environments and should not be used without consultation with hazmat or use of a combustible gas indicator.

Responders should be familiar with the AHJ's guidelines on the collection of spectra and transmission of spectra to a nuclear spectroscopist for analysis. Responders should also be familiar with the AHJ's procedures for calibration and maintenance of all radiation detection equipment.

ii. Explosive materials (commercial and HME)

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with all of the explosives detection equipment made available by the AHJ. Responders should be aware that any improvised explosive laboratory could involve explosive materials and should develop a monitoring plan to confirm their absence or presence. The AHJ should confirm the responder's knowledge of explosives detection by developing potential scenarios to be addressed by the responder.

Explosives detection devices are available using numerous technologies, including Fourier transform infrared, Raman spectroscopy, reagents, electrochemical sensors, combustible gas indicators, and others. Each of these technologies involves unique issues concerning training, operation, and maintenance. For example, Raman must be used with caution on dark energetic powders.

(d) Demonstrate the field test and operation of each detection device and interpret the readings based on local procedures

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with the preparation and operation of all detection devices used by the AHJ. The responder should further have the ability to interpret the indications and readings from all detectors used by the AHJ. The AHJ should develop competency evaluation tools to determine the responder's level of knowledge on each detector in use.

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(e) Describe local procedures for decontamination of themselves and their detection devices upon completion of the material detection mission

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with the decontamination procedures for each of the agencies responsible for technical and emergency decontamination within the AHJ's area of operation. The responder should be able to describe the steps to drop equipment, remove external protective clothing (such as blast protection), and enter both technical and emergency decontamination processes.

(f) Describe the procedure for identifying and obtaining the appropriate emergency response elements to support disablement/disruption or mitigation operations

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with the response elements available within the AHJ's area of operation that would respond to an incident involving an improvised explosives laboratory. Agencies might include fire, EMS, law enforcement, emergency management, industrial partners, military, health, hospital, railroad, trucking, maritime, allied professional laboratory personnel, and related agencies.

6.10.3.3 Identifying Potential Response Options.

Δ **6.10.3.3.1** Given scenarios of an incident involving a potential IED or improvised WMD materials dispersal device, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall identify possible response options.

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with all response guidelines established by the AHJ. Guidelines for response to a potential IED or improvised WMD dispersal device should be developed to include decision processes for approach to the IED or dispersal device, procedures to secure safe operating areas for responders, considerations for minimum numbers of personnel required for downrange operations, decision processes for the use of robotics, selection of appropriate detection and monitoring equipment, selection of appropriate PPE, contact of appropriate support agencies including medical and tactical units, and similar considerations.

Δ **6.10.3.3.2** Given scenarios of an incident involving a potential improvised explosives laboratories, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall identify possible response options.

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be familiar with all response guidelines established by the AHJ. Guidelines for response to an improvised explosives laboratory should be developed to include decision processes for approach and entry to the laboratory, procedures to secure safe

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operating areas for responders, considerations for minimum numbers of personnel required for down-range operations, decision processes for the use of robotics, selection of appropriate detection and monitoring equipment, selection of appropriate PPE, contact of appropriate support agencies including medical and tactical units, and similar considerations.

Δ **6.10.3.4 Selecting Personal Protective Equipment.** Given the PPE provided by the AHJ, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at an incident at improvised explosives laboratories shall select the PPE required to support such operations at hazardous materials/WMD incidents based on the National Guidelines for Bomb Technicians adopted by the National Bomb Squad Commanders Advisory Board (NBSCAB) (*see Section 6.2*).

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be able to select the appropriate PPE based on existing national guidance documents. Based on a hazard risk assessment by the responder, appropriate PPE to include blast protection, chemical protection, respiratory protection, and similar equipment should be selected and evaluated for compatibility during use.

6.10.4 Competencies — Implementing the Planned Response.

Δ **6.10.4.1** Given scenarios of an incident involving a potential IED or improvised WMD dispersal device, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at an improvised explosives laboratory shall be able to complete the following tasks:

(1) Using detection and monitoring devices provided by the AHJ, demonstrate the field test and operation of each device and interpret the readings based on local or agency procedures

Based on a realistic IED or improvised WMD dispersal device scenario developed by the AHJ, the operations level responder should be able to prepare each appropriate detection device for use and interpret readings from each device to determine response options. The operations level responder is assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories.

(2) Perform diagnostics based on procedures instructed by a nationally accredited hazardous devices school or program

Based on a realistic IED or improvised WMD dispersal device scenario developed by the AHJ, the operations level responder should be able to prepare and perform diagnostics with all equipment provided by the AHJ (e.g., robotics, camera systems, x-ray imaging, and similar equipment). The operations level responder is assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories.

(3) Perform disablement/disruption techniques in accordance with the FBI Hazardous Devices School "logic tree," the NBSCAB "A Model for Bomb Squad Standard

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Operating Procedures," established protocol for military units, or established protocol of the AHJ

Based on a realistic IED or improvised WMD dispersal device scenario developed by the AHJ, the operations level responder should be able to safely perform disablement or disruption, render-safe techniques in accordance with guidelines endorsed by the AHJ. The responder should demonstrate competency with all disablement or disruption tools used by the AHJ (e.g., hook and line kits, PAN disrupters, water bottle disrupters, hand tools, counter-charges, and similar equipment). The operations level responder is assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories.

(4) Assist in planning the air monitoring and sampling operations within the capabilities and competencies of available personnel, PPE, and response equipment and, in accordance with the AHJ, describe the air monitoring and sampling options available

Based on a realistic IED or improvised WMD dispersal device scenario developed by the AHJ, the operations level responder should be able to describe the selection of appropriate detection and monitoring equipment from a list of available detection equipment used by the AHJ that is appropriate for the level of training achieved by the responder. The operations level responder is assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories.

(5) Given the air monitoring and sampling equipment provided by the AHJ, shall complete the following:

(a) Select the detection or monitoring equipment suitable for detecting or monitoring of the IED or improvised WMD dispersal device

Given a selection of all detection and monitoring equipment used by the AHJ, the operations level responder should select the appropriate detectors for downrange operations on an IED or improvised WMD dispersal device. Examples include gamma radiation detectors, neutron radiation detectors, combustible gas detectors, oxygen sensors, electrochemical sensors, photo-ionization detectors, and similar equipment. The operations level responder is assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories.

(b) Describe the operation, capabilities, limitations, local monitoring procedures, field-testing, and maintenance procedures associated with each device provided by the AHJ

Given a selection of all detection and monitoring equipment used by the AHJ, the operations level responder should describe the operation, capabilities, limitations, AHJ guidelines for use, calibration, and monitoring for each detector that could be used on an IED or improvised WMD dispersal device. Examples include gamma radiation detectors, neutron radiation detectors, combustible gas detectors, oxygen sensors, electrochemical sensors, photo-ionization detectors, and similar equipment. The operations level responder is assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories.

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(c) Describe local procedures for decontamination of the detection and monitoring devices upon completion of the mission

Given a selection of all detection and monitoring equipment used by the AHJ, the operations level responder should describe the AHJ-approved decontamination procedures for each detector that could be used on an IED or improvised WMD dispersal device. The operations level responder is assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories. Examples include gamma radiation detectors, neutron radiation detectors, combustible gas detectors, oxygen sensors, electrochemical sensors, photo-ionization detectors, and similar equipment.

Δ **6.10.4.2** Given a simulated improvised explosives laboratory incident, the operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations shall be able to perform the following tasks:

(1) Describe the safe and effective methods for law enforcement to secure the scene

Based on a realistic improvised explosives laboratory scenario developed by the AHJ, the operations level responder should describe safe procedures for law enforcement to secure the laboratory prior to EOD arrival. The operations level responder is assigned to respond to IED/ WMD dispersal devices, and operations at improvised EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised explosives laboratories. Possible actions include securing perimeter streets (distance based on threat), denying entry to the laboratory structure, establishing surveillance on the laboratory structure, evacuation of surrounding structures based on the threat, controlling civilian and media access, and related procedures.

(2) Demonstrate methods to identify and avoid safety hazards at improvised explosives laboratories such as booby traps, releases of hazardous materials, and initiating components

Based on a realistic improvised explosives laboratory scenario developed by the AHJ, the operations level responder should demonstrate the ability to assess and avoid safety hazards at improvised explosives laboratories in accordance with AHJ guidelines. The operations level responder is assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories. Possible actions include detection and avoidance of booby traps such as contact plates, tripwires, passive infrared (PIR) sensors, and chemical reaction devices, and detection and avoidance of hazardous materials such as compressed gas cylinders, corrosive carboys, chemical containment bottles and cans, solid chemical bags, solid chemical explosive precursors, biological laboratory supplies and equipment, and radiological materials.

(3) Using detection and monitoring devices provided by the AHJ, demonstrate the field test and operation of each device and interpret the readings based on local or agency procedures

Based on a realistic improvised explosives laboratory scenario developed by the AHJ, the operations level responder should be able to prepare each detection device for use, assess the hazards present, and interpret readings from each device to determine response options as defined by AHJ guidelines. The operations level responder is assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories.

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(4) Describe the methods that could be utilized to mitigate the hazards identified

Based on a realistic improvised explosives laboratory scenario developed by the AHJ, the operations level responder should perform an assessment of the structure to determine if the hazards present may be safely mitigated in accordance with AHJ guidelines. The responder should then describe potential methods to mitigate the hazards (e.g., isolation of materials, mechanical removal of materials, robotics, disruption) and other methods approved by the AHJ. The operations level responder is assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories.

6.10.4.3 The operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall demonstrate the ability to wear an appropriate combination of chemical protective clothing, respiratory protection, and ballistic protection for the hazards identified in 6.10.2.1 and 6.10.2.2.

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should demonstrate the ability to wear all PPE provided by the AHJ, including chemical protective clothing such as splash and vapor protective suits, respiratory protection such as APRs and SCBA, and ballistic protection such as bomb suits or blast suits.

6.10.4.4 The operations level responder assigned to perform disablement/disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories shall describe the local procedures for the technical decontamination process.

The operations level responder assigned to respond to IED/EOD incidents with hazardous materials involvement to perform disablement or disruption of IEDs, improvised WMD dispersal devices, and operations at improvised explosives laboratories should be able to describe the AHJ guidelines for each step of the technical decontamination process for a responder wearing AHJ-issued chemical protective clothing, respiratory protection, and blast protection.

6.10.5 Competencies — Evaluating Progress. (Reserved)

6.10.6 Competencies — Terminating the Incident. (Reserved)

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N 6.11 Diving in Contaminated Water Environments.

N 6.11.1 General.

This operations level responder mission-specific competency is intended for personnel assigned to perform emergent life safety dive operations, in the role of either a diver or as surface support, in water potentially contaminated with hazardous materials.

N **6.11.1.1 Introduction.**

N **6.11.1.1.1** The operations level responder assigned to perform diving in contaminated water environments shall be that person, competent at the operations level, who is assigned to

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perform either dive or dive surface support operations in water suspected to be contaminated with hazardous materials during emergency response operations, defined as "no notice" dive operations for the purposes of immediate protection of lives or property.

> This mission-specific competency is intended to specifically cover "no notice" emergent dive operations, not planned dives. Non-emergency, scheduled dive operations should be managed via the dive site risk assessment process used by the AHJ.

N **6.11.1.1.2** The operations level responder assigned to perform contaminated water diving during emergency response operations shall possess current certification per the policies of the AHJ to perform diving operations, to include the use of Self Contained Underwater Breathing Apparatus (SCUBA) (which may include rebreather diving apparatus), and/or Surface Supplied Diving apparatus.

> The AHJ must confirm certifications for all personnel assigned to use SCUBA or surface-supplied diving equipment.

N **6.11.1.1.3** The operations level responder assigned to perform contaminated water surface support operations during emergency response shall be certified per the policies of the AHJ to perform all surface support operations tasks assigned by the AHJ; such as dive tender, air console operator, dive supervisor, or other related tasks.

> The AHJ must confirm certifications for all personnel assigned to provide surface support tasks such as operation of air consoles, providing surface safety functions, tending diver tether or umbilical lines, or related tasks.

N **6.11.1.1.4** The operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall be trained to meet all competencies at the awareness level (Chapter 4), all core competencies at the operations level (Chapter 5), all mission-specific competencies for personal protective equipment (Chapter 6.2) and all competencies in this section.

N **6.11.1.1.5** The operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall operate under the guidance of a hazardous materials technician, allied professional, or standard operating procedures.

N **6.11.1.1.6** The operations level assigned to perform contaminated water diving or dive surface support operations during emergency response shall receive the additional training necessary to meet the specific needs of the jurisdiction and/or agency.

N **6.11.1.2 Goal**

N **6.11.1.2.1.** The goal of the competencies in this section shall be to provide the operations level responder assigned to perform contaminated water diving or dive surface support operations with the knowledge and skills to perform the tasks in 6.11.1.2.2 safely and effectively.

> All aspects of this mission-specific competency are focused on assisting dive operations personnel with increased awareness and preparation for dives in potentially contaminated water. The competency emphasizes the importance of a cooperative relationship between dive operations personnel and HMTs, allied professionals, or pre-existing standard operations procedures developed specifically for potential contaminated water dive operations.

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N **6.11.1.2.2** When responding to emergency incidents involving water potentially contaminated with hazardous materials, the operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall be able to perform the following tasks:

(1) Analyze an emergency incident involving water potentially contaminated with hazardous materials to determine the complexity of the problem and potential outcomes by completing the following tasks:

(a) Determine if hazardous materials are potentially present.

(b) Categorize the hazards to the dive responder by performance of a hazard risk assessment.

> The operations level responder assigned to perform contaminated water diving or dive surface support should assess the dive site for the presence of hazardous materials. The aim is to limit hazardous materials exposure to divers and surface support personnel.

(2) Plan a response for an emergency incident where there is a potential to dive in water contaminated with hazardous materials within the capabilities and competencies of available personnel, personal protective equipment and control equipment by completing the following tasks:

(a) Determine if response options can be effectively employed to conduct a safe diving operation.

> The operations level responder should be able to assess the situation using existing responder knowledge and skills, PPE, and hazard control equipment to determine if the agency can safely conduct dive operations in potentially contaminated water.

(b) Describe the actions to be taken and the resources to be requested if the incident exceeds the available capabilities

> The operations level responder should be able to describe the response area diving and hazardous materials resources, and develop contingencies to assist with potentially contaminated dive operations if the situation exceeds AHJ capabilities.

(3) Implement the planned response to a contaminated water diving operation by completing the following tasks under the guidance of a hazardous materials technician, allied professional, or standard operating procedures:

(a) Employ diving operations in accordance with the policies of the AHJ.

> The operations level responder should implement the response plan to conduct dive operations in potentially contaminated water. Based on the assessment, the plan might be to modify procedures, modify equipment selection, call for additional resources, not dive, or another option as determined by the AHJ.

(4) Evaluate the response to a contaminated water diving operation by completing the following tasks:

(a) Determine the effectiveness of protective equipment and efficiency of decontamination.

(5) Terminate the response to a contaminated water diving operation by completing the following tasks:

(a) Document the incident and determine the levels of contamination on diving equipment.

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N 6.11.2. Competencies — Analyzing the Incident.

N **6.11.2.1 Performing a Pre-Dive Assessment of the Dive Location.** Given a dive location, the operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall perform a risk assessment to determine the presence of hazards to divers and dive surface support personnel by completing the following:

(1) Given examples of potential hazards at planned dive locations, describe the hazards that might be associated with each situation:
   (a) Hazards associated with dive locations documented in available reference materials, such as but not limited to Emergency Planning and Community Right-to-Know Act (EPCRA) Tier II reporting, Combined Sewer Overflow reports, state environmental reports, fish advisories, and identified Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, aka Superfund) reporting.
   (b) Historical releases of hazardous materials near or upstream from the dive location.
   (c) Knowledge of hazardous materials containers or vessels near or upstream from the dive location.

Operations level hazmat responders might proactively identify likely dive locations within the jurisdiction of the AHJ, and perform dive site risk assessments of those locations for potential hazardous material exposure risks. Superfund Amendment and Reauthorization Act (SARA) Title III Tier II reporting facilities, historical release information from Clean Air Act Section 112r (Risk Management Plan) reporting, sewer outflow reports, and numerous other reporting can assist the operations level responder in development of plans for likely dive locations within the jurisdiction of the AHJ.

N **6.11.2.2 Determining if the Incident involves potential contamination of the water.** Given examples of hazardous materials/WMD incidents involving the potential contamination of water, the operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall identify and/or categorize the hazard by completing the following:

(1) Given examples of the following hazardous materials/WMD incidents involving potentially contaminated water, describe the hazards that might be encountered from the incident associated with each situation:
   (a) Chemicals floating on the surface of the water

Chemicals on the surface possessing low specific gravity and poor miscibility, such as hydrocarbon fuels, can present hazards for surfaced divers and surface support personnel.

   (b) Chemicals stratified in the water column or infiltrated in bottom sediment

Chemicals with high specific gravity and poor miscibility, such as some acids, can present hazards for divers at depth.

   (c) Pathogenic biological materials in the water

Pathogenic biological materials can present hazards for divers and surface support personnel not wearing an appropriate level of PPE.

   (d) Radiological particulates or radioactive sources in the water

Radiological materials can present exposure and contamination hazards for divers and surface support personnel during dives and during decontamination efforts.

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(e) Hazmat containers floating on the surface of the water

Hazmat containers that are intact with sufficient gas present to provide buoyancy (e.g., propane cylinders) can present hazards for divers and surface support personnel. Floating containers should be assessed for damage and potential for release of their contents by trained personnel.

(f) Hazmat containers below the surface of the water

Hazmat containers found below the surface of the water can present hazards to dive personnel. These containers are likely either breached and void of gases, or are nearly full of liquid with insufficient gas present to provide buoyancy.

N **6.11.2.3 Determining the Risk from Hazards Present at the Dive Location.** Given examples of hazardous materials/WMD present at the dive location, the operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall identify the potential risk to divers and dive surface support personnel by completing the following related requirements:

(1) Given examples of hazardous materials/WMD identified at the dive location, describe the hazards to divers and dive surface support personnel, and operational considerations associated with each hazard:
    (a) Flammable or combustible materials
    (b) Flammable solid/dangerous when wet materials
    (c) Organic peroxides and oxidizers
    (d) Poisons and toxins
    (e) Radioactive materials
    (f) Pathogenic biologic materials
    (g) Corrosive materials
(2) Given examples of hazardous materials/WMD containers identified at the dive location, describe the secondary hazards (including mechanical hazards) to divers and dive surface support personnel, and operational considerations associated with each hazard:
    (a) Drums, cargo tanks, or other low pressure containers floating on the surface

Hazmat containers that are intact with sufficient air or vapor present to provide buoyancy can present hazards for divers and surface support personnel. Floating containers should be assessed for damage and potential for release of their contents by trained personnel.

(b) Drums, cargo tanks, or other low pressure containers resting on the bottom

Such vessels are likely breached, or if they are intact, they have insufficient air or vapor to provide buoyancy. Breached containers can present significant chemical risk based on the miscibility of the material.

(c) Compressed Gas cylinders, containers, cargo tanks, or other pressure vessels floating on the surface

Hazmat containers that are intact with sufficient gas present to provide buoyancy (e.g., propane cylinders), may present hazards for divers and surface support personnel. Floating containers should be assessed for damage and potential for release of their contents by trained personnel. The assessment should include an evaluation of product valve and relief valve condition.

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d. Compressed Gas cylinders, containers, cargo tanks, or other pressure vessels resting on the bottom

Such vessels are likely breached, or if they are intact, they have insufficient gas to provide buoyancy. Breached containers can present significant chemical risk based on the miscibility of the material. The assessment should include an evaluation of product valve and relief valve condition.

N 6.11.3 Competencies — Planning the Response.

N **6.11.3.1 Identifying Unique Aspects of Dive Related Hazardous Materials/WMD Incidents.** When responding to hazardous materials/WMD incidents, the operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall be capable of identifying the unique aspects associated with such incidents by completing the following requirements:

(1) Given an incident involving contaminated water diving emergency response operations perform the following:

(a) Describe the safety procedures and guidelines required by the AHJ for this type of incident.

The operations level responder should be able to describe the AHJ policies that apply during dive operations as they relate to potentially contaminated dive operations.

(b) Describe the factors to be evaluated in selecting the personal protective equipment for surface support personnel.

The operations level responder should be able to describe the personal protective clothing available within the purview of the AHJ for surface support operations, and the limitations for each type of PPE, as they relate to contaminated water dive operations.

(c) Describe the factors to be evaluated in selecting dive suit types.

The operations level responder assigned to dive operations in potentially contaminated water should be able to describe the advantages and limitations of each type of diving ensemble available for use within the purview of the AHJ, as they relate to contaminated water dive operations.

(d) Describe the factors to be evaluated in selecting dive suit materials.

The operations level responder assigned to dive operations in potentially contaminated water should be able to describe the advantages and limitations of each type of dive suit material available for use within the purview of the AHJ, as they relate to contaminated water dive operations.

(e) Describe the factors to be evaluated in selecting diver breathing air supply systems.

The operations level responder assigned to dive operations in potentially contaminated water should be able to describe the advantages and limitations of each type of dive respiratory system available for use within the purview of the AHJ, as they relate to contaminated water dive operations.

(f) Describe the factors to be evaluated in selecting the detection and monitoring used by surface support personnel.

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The operations level responder assigned to dive operations in potentially contaminated water should be able to describe the advantages and limitations of each type of detection and monitoring available for use within the purview of the AHJ, as they relate to contaminated water dive operations including diver decontamination.

(g) Describe the factors to be evaluated in selecting decontamination procedures and solutions.

The operations level responder assigned to dive operations in potentially contaminated water should be able to describe the advantages and limitations of decontamination procedures and decontamination solutions available for use within the purview of the AHJ, as they relate to contaminated water diver decontamination.

(h) Describe the factors to be evaluated by medical personnel in support of contaminated dive operations.
(i) Describe the procedures for evaluating the diver's readiness to dive as required by the AHJ.
(j) Describe techniques for contamination avoidance, including buoyancy techniques when applicable.

The operations level responder assigned to dive operations in potentially contaminated water should be able to describe buoyancy techniques that help avoid contact with contaminates on the bottom or the surface of the dive location.

(k) Describe the factors to be evaluated in selecting water quality sampling equipment in support of the operation, as required by the AHJ.

The operations level responder assigned to dive operations in potentially contaminated water should be able to describe the techniques for collection of water samples at the dive location for subsequent water quality testing as required by the AHJ.

(l) Describe the factors to be evaluated in selecting sediment sampling equipment in support of the operation, as required by the AHJ

The operations level responder assigned to dive operations in potentially contaminated water should be able to describe the techniques for collection of sediment samples from the bottom at the dive location for subsequent testing as required by the AHJ.

(2) Given an incident involving a contaminated water diving emergency response operation perform the following support functions:
  (a) Describe the application, use and limitations of various types of detection and monitoring equipment utilized by the AHJ to include:
    (i) Combustible gas indicators
    (ii) Oxygen monitors
    (iii) Toxic gas detectors
    (iv) pH indicators
    (v) Radiation monitors
    (vi) Volatile organic compound (VOC) detectors
  (b) Describe the field test and operation of each detection device provided by the AHJ and interpret the readings based on local procedures.

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(c) Describe AHJ procedures for decontamination of personnel and equipment on completion of dive operations.
(d) Describe the AHJ procedure for identifying and obtaining the appropriate emergency response elements to support dive and dive surface support operations.

N **6.11.3.2 Identifying Potential Response Options.**

N **6.11.3.2.1** Given scenarios involving a potential contaminated water dive emergency response operation, the operations level responder assigned to contaminated water diving or dive surface support operations shall identify possible response options.

The operations level responder should be able to identify all response options offered by the AHJ for dive operations involving potentially contaminated water.

N **6.11.3.2.2** Given the personal protective equipment provided by the AHJ, the operations level responder assigned to perform contaminated water diving or dive surface support operations during emergency response shall select the personal protective equipment required to perform operations during contaminated water diving and dive surface support operations.

The operations level responder should be able to select — using all of the resources available to the responder including access to a hazardous materials technician, allied professional, or standard operating procedures — both dive and surface PPE as provided by the AHJ to perform operations during contaminated water dive operations.

N **6.11.4 Competencies — Implementing the Planned Response.**

N **6.11.4.1** Given scenarios involving a contaminated water dive operation, the operations level responder assigned to contaminated water diving or dive surface support operations during emergency response shall be able to complete the following tasks:

(1) Using the detection and monitoring devices provided by the AHJ for use during surface operations; demonstrate the field test and operation of each device and interpret the readings based on AHJ procedures.

The operations level responder must demonstrate operation of each detection and monitoring device provided by the AHJ for use during evaluation of potentially contaminated dive locations, and for continual operational use by surface support personnel.

(2) Demonstrate the establishment of the technical decontamination corridor in anticipation of diver egress from contaminated water in accordance with AHJ procedures.

The operations level responder must demonstrate establishment of a technical decontamination corridor capable of managing a potentially contaminated diver from exit of the water until removal of the diver's protective equipment.

(3) Demonstrate the ability to collect dive site water quality samples for analysis post dive, to assist with the evaluation of dive equipment contamination as required by the AHJ.

The operations level responder must demonstrate the ability to collect water quality samples at the dive location for subsequent analysis, as required by the policies of the AHJ.

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N **6.11.4.2** Given scenarios involving a contaminated water dive operation, the operations level responder certified by the AHJ to perform contaminated water diving during emergency response shall be able to complete the following tasks:

The operations level responder acting as a diver must be able to demonstrate the following skills as required for equipment and techniques.

(1) Demonstrate the ability to use diving dry suits utilized by the AHJ.
(2) Demonstrate the ability to use full facemask regulators utilized by the AHJ.
(3) Demonstrate the ability to use diving helmets utilized by the AHJ.
(4) Demonstrate the ability to relay pertinent hazard identification information from submerged containers or vessels, as possible given visibility conditions.

N **6.11.4.3** The operations level responder assigned to perform contaminated water surface support operations during emergency response shall demonstrate the ability to wear an appropriate combination of chemical protective clothing, respiratory protection, and personal flotation devices for the hazards identified in 6.11.2.2 and 6.11.2.3.

The operations level responder acting as surface support must be able to demonstrate the ability to wear the PPE used by the AHJ to include both hazardous materials protective equipment and personal floatation devices.

N **6.11.4.4** The operations level responder assigned to perform contaminated water surface support operations during emergency response shall demonstrate the AHJ procedures for technical decontamination.

The operations level responder acting as surface support must demonstrate the ability to perform technical decontamination of divers exiting potentially contaminated water, using the procedures and equipment provided by the AHJ.

N 6.11.5 Competencies — Evaluating Progress.

N **6.11.5.1** Given scenarios involving a contaminated water dive operation, the operations level responder assigned to contaminated water diving or dive surface support operations during emergency response shall be able to complete the following tasks:

The operations level responder must be able to complete the following evaluation tasks by performing an assessment of PPE and decontamination efficiency. The operations level responder can use all tools available as provided by the AHJ including but not limited to responder medical monitoring, detection and monitoring equipment, decontamination disclosure technologies, and related techniques.

(1) Evaluate the effectiveness of diver protective clothing
(2) Evaluate the effectiveness of the technical decontamination process

N 6.11.6 Competencies — Terminating the Incident.

N **6.11.6.1** Given scenarios involving a contaminated water dive operation, the operations level responder assigned to contaminated water diving or dive surface support operations during emergency response shall be able to complete the following tasks:

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(1) Describe the AHJ procedures for returning potentially contaminated dive equipment to service.

The operations level responder must describe the AHJ procedure to return potentially contaminated equipment into service (or to remove it from service), using AHJ approved techniques such as detection and monitoring, physical examination, subsequent laboratory testing, or other evaluation techniques.

(2) Describe the AHJ procedures for evaluating water and sediment quality samples post dive for potential contaminants, exposure analysis, and evaluation of dive equipment for contamination.

The operations level responder must describe the AHJ procedure to evaluate the quality of water from the dive site, if such an analysis is used by the AHJ.

(3) Describe the AHJ procedures for evaluating sediment samples for contamination.

The operations level responder must describe the AHJ procedure to evaluate the quality of sediment taken from the bottom at the dive site, if such an analysis is used by the AHJ.

(4) Describe the AHJ procedures for documenting dive site activities.

The operations level responder must describe the AHJ procedure to document dive activities, to include completion of dive logs, exposure reports, or other documentation required by the AHJ.

N 6.12 Mission-Specific Competencies — Evidence Collection.

N 6.12.1 General.

N 6.12.1.1 Introduction.

N **6.12.1.1.1** The operations level responder assigned to perform evidence collection at hazardous materials/WMD incidents shall be that person, competent at the operations level, who is assigned by the AHJ to collect evidence at hazardous materials/WMD incidents involving potential violations of criminal statutes or governmental regulations.

This mission-specific competency is designed to prepare the operations level responder to support law enforcement operations in performing evidence tasks at a crime scene involving hazardous materials. The competency is designed to prepare them to assist crime scene investigators during the performance of their jobs.

Additional guidance in evidence preservation and sampling can be obtained from the local office of the FBI's Weapons of Mass Destruction Coordinator, the local office of the Drug Enforcement Agency (DEA), state or local law enforcement, or government-sponsored training programs.

N **6.12.1.1.2** The operations level responder assigned to perform evidence collection at hazardous materials/WMD incidents shall possess the authority to collect evidence, as delegated by the AHJ, in accordance with governmental regulations.

Operations level responders who perform evidence collection must be authorized by the AHJ. The operations level responder should be familiar with the jurisdictional procedures for operation within

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a crime scene, which include investigative law enforcement leadership, search warrant requirements, rules of evidence, crime scene documentation, policies regarding photography, evidence custodial requirements, chain of custody, and specific requirements set forth by the prosecuting attorney.

N **6.12.1.1.3** The operations level responder assigned to perform evidence collection at hazardous materials/WMD incidents shall be trained to meet all competencies at the awareness level (*see Chapter 4*), all competencies at the operations level (*see Chapter 5*), all mission-specific competencies for PPE (*see Section 6.2*), and all competencies in this section.

N **6.12.1.1.4** The operations level responder assigned to perform evidence collection at hazardous materials/WMD incidents shall operate under the guidance of a hazardous materials technician, an allied professional, or standard operating procedures.

Although some of the mission-specific competencies in this section are taken from Chapter 7, Competencies for Hazardous Materials Technicians, the technical committee wants to state clearly that operations level responders with a mission-specific competency are not replacements for an HMT. Operations level responders with a mission-specific competency can perform some technician-level skills but do not have the broader skills and competencies required of an HMT, particularly regarding risk assessment and the selection of control options. The following two options are examples of how guidance can be provided to ensure that operations level responders do not go beyond their level of training and equipment:

- **Direct Guidance:** Operations level responders are working under the control of an HMT or allied professional who has the ability to (1) continuously assess and/or observe their actions and (2) provide immediate feedback. Guidance from an HMT or an allied professional can be provided through direct visual observation or through assessment reports communicated by the operations level responder to them.
- **Written Guidance:** Written standard operating procedures or similar guidance clearly state the "rules of engagement" for operations level responders with the mission-specific competency. Emphasis should be placed on the following:

  1. Tasks expected of operations level responders
  2. Tasks beyond the capability of operations level responders
  3. Required PPE and equipment to perform these expected tasks
  4. Procedures for ensuring coordination within the local ICS

N **6.12.1.1.5** The operations level responder assigned to perform evidence collection at hazardous materials/WMD incidents shall receive the additional training necessary to meet specific needs of the jurisdiction.

N **6.12.1.2 Goal.**

N **6.12.1.2.1** The goal of the competencies in this section shall be to provide the operations level responder assigned to perform evidence collection at hazardous materials/WMD incidents with the knowledge and skills to perform the following tasks in a safe and effective manner:

(1) Determine if the incident has a potential for being criminal in nature, and identify the agency that has investigative jurisdiction
(2) Identify unique aspects of criminal hazardous materials/WMD incidents
(3) Determine the response options to conduct evidence collection operations within the capabilities and competencies of available personnel, PPE, and response equipment
(4) Describe how the response options are within the legal authorities, capabilities, and competencies of available personnel, PPE, and response equipment

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(5) Implement the planned response to a hazardous materials/WMD incident involving potential violations of criminal statutes or governmental regulations by completing the following tasks under the guidance of law enforcement:
   (a) Secure the scene
   (b) Preserve evidence
   (c) Take public safety samples as needed for responder safety
   (d) Collect evidence
(6) Report and document evidence collection operations

N 6.12.2 Competencies — Analyzing the Incident.

Law enforcement jurisdiction, investigative guidelines, and investigative priorities are complex and dynamic. Specific jurisdictional situations should be identified with the responder's local or state law enforcement authorities and federal investigative agencies such as the FBI, DEA, U.S. Postal Inspection Service, and EPA.

Response agencies should understand that many criminal statutes are written such that the presence of actual hazardous materials is not required to charge a subject with a crime. Agencies should contact law enforcement for any threats encountered, whether actual or implied.

There have been cases of hazardous materials/WMD sent in letters and packages that contained explosive materials, explosive devices, chemicals, toxins, biological materials, and radioactive materials.

N **6.12.2.1 Determining If the Incident Is Criminal in Nature.** Given examples of the following hazardous materials/WMD incidents, the operations level responder shall describe clues for the presence of hazards that might be encountered in the incident associated with each of the following situations:

(1) Hazardous materials/WMD suspicious letter
(2) Hazardous materials/WMD suspicious package
(3) Hazardous materials/WMD illicit laboratory
(4) Release/attack with a WMD agent
(5) Environmental crimes

N **6.12.2.2 Identifying the Agency That Has Investigative Jurisdiction.** Given examples of hazardous materials/WMD incidents involving potential criminal intent, the operations level responder assigned to collect evidence shall describe the potential criminal violation and identify the agency having investigative jurisdiction and the incident response considerations associated with each of the following situations:

(1) Hazardous materials/WMD suspicious letter
(2) Hazardous materials/WMD suspicious package
(3) Hazardous materials/WMD illicit laboratory

Illicit laboratories manufacture illegal drugs, toxins, nontraditional chemical weapons, and biologic agents. Specific guidance on the products that might be encountered must be obtained from local or state law enforcement or federal agencies, based on current threats and trends. Personnel who respond to illicit laboratory incidents must meet the provisions of Section 6.9.

(4) Release/attack with a WMD agent

Identifying the products and methods that can be used during a WMD agent attack is complex. Special attention should be given to materials that are commonly found or acquired either in transportation or at fixed facilities, such as industrial chemicals and toxins.

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(5) Environmental crimes

Illegal disposal of either hazardous materials or hazardous waste is incident specific. The potential threat from chemical, biological, or radiological materials or waste materials must be assessed in cooperation with local or state and federal agencies.

N 6.12.3 Competencies — Planning the Response.

N **6.12.3.1 Identifying Unique Aspects of Criminal Hazardous Materials/WMD Incidents.** The operations level responder assigned to collect evidence shall describe the unique aspects associated with illicit laboratories, hazardous materials/WMD incidents, and environmental crimes by completing the following requirements:

When responding to hazardous materials/WMD incidents, the operations level responder should be observant for signs of criminal activity involving chemical, biological, radiological, or explosive materials or devices. The operations level responder should be familiar with the jurisdictional procedures for operation within a crime scene, including investigative law enforcement leadership, search warrant requirements, rules of evidence, crime scene documentation, policies regarding photography, evidence custodial requirements, chain of custody, and specific requirements set forth by the prosecuting attorney.

(1) Given an incident involving illicit laboratories, a hazardous materials/WMD incident, or an environmental crime, the operations level responder shall perform the following tasks:

(a) Describe the procedure for securing the scene

The operations level responder should follow local or state and federal jurisdictional procedures for crime scene security at the direction of law enforcement. These activities include full accountability and identification of all personnel in the crime scene, documentation of any items disturbed within the crime scene, and protection of evidence from potential damage or destruction.

(b) Describe the procedure for characterizing and preserving evidence at the scene

(c) Describe the procedure for documenting personnel and scene operations associated with the incident

Documentation procedures vary among law enforcement agencies. Specific guidance must be obtained to ensure that the documentation requirements of the law enforcement AHJ have been met.

(d) Describe the procedure for determining whether the operations level responders are within their legal authority to perform evidence collection tasks

It is very important for the operations level responder to coordinate all evidence collection and sampling tasks with the law enforcement AHJ. All evidentiary tasks are required to follow rules of evidence, Fourth Amendment guarantees, and judicial precedents. Current information involving judicial case law is available from the law enforcement AHJ, and it is absolutely critical that the operations level responder be aware of this information to avoid problems with inadmissible evidence.

(e) Describe the procedure for notifying the agency with investigative authority

Early notification of the agency with investigative authority is critical in initiating the investigative process. Personnel must know the local procedures used to make these notifications.

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(f) Describe the procedure for notifying hazardous device technician

(g) Identify the need to collect public safety samples for the protection of responders

Working with response partner agencies, the operations level responder should determine whether the sample to be collected is for public safety or for evidentiary purposes. Public safety samples should be identified in accordance with AHJ guidelines for hazmat sample collection.

(h) Identify potential evidentiary samples

The elements of the criminal offense will drive the creation of an evidence sampling plan, which will identify the items to be collected or sampled during crime scene operations. The law enforcement AHJ will be in contact with the prosecuting attorney's office to determine the elements that are required to prove the criminal offense.

(i) Identify applicable equipment for collecting evidence

The operations level responder should be familiar with any existing local or state and federal requirements for the selection of appropriate evidence collection equipment.

(j) Describe the procedures to protect evidence from secondary contamination

The operations level responder needs to ensure that all sampling containers and equipment are free of contamination. This could involve the use of sterile containers for the collection of biological materials, certified clean containers for chemicals and radiological materials, and blank samples. Blank samples are a collection of each type and lot of sampling equipment used during crime scene sampling operations, isolated in their clean or sterile packaging, and entered into evidence.

(k) Describe the AHJ documentation procedures for collection of evidence

Documentation procedures vary among law enforcement agencies. Specific guidance must be obtained to ensure that the documentation requirements of the law enforcement AHJ have been met.

(l) Describe evidentiary sampling techniques

Before sampling operations, a sampling plan will be developed by the criminal investigator in cooperation with the crime scene investigation team. This plan will identify specific sampling techniques required to obtain forensic evidence, ensure appropriate documentation, and maintain sample integrity. A crime scene investigation team could include a three-person sampling team: a sampler, an assistant, and a documenter.

(m) Describe field screening protocols for evidence to be collected

Field screening is a measure of certain characteristics used to ensure the safety of the sample, responders, the public, and laboratory personnel. The field screening must include, at a minimum, nondestructive testing to identify the presence of IEDs/EOD devices, radiological materials, flammable materials, toxic materials, strong oxidizers, and the corrosive properties of liquid samples.

(n) Describe evidence labeling and packaging procedures

The law enforcement AHJ, in cooperation with the receiving laboratory, is responsible for establishing the procedures for labeling hazardous materials/WMD evidence. The labeling system must be clear to

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all personnel sampling, collecting, and packaging evidence. Labeling of evidence packaging materials can be best performed before entry to the exclusion zone. Selection of packaging materials and procedures will be guided by the evidence sampling plan, in accordance with the law enforcement AHJ and in cooperation with the receiving laboratory.

(o) Describe evidence decontamination procedures

A hazard risk assessment should be performed to determine the method for decontamination of items of evidence brought from the exclusion zone. A separate decontamination line should be established for evidence decontamination at the entrance to the decontamination corridor. Evidence decontamination is designed to remove contamination from the exterior evidence packaging container only. At no time can the exterior evidence container be breached for the purposes of decontaminating the interior evidence packaging. Care must be taken to preserve the integrity of forensic evidence, such as fingerprints, during the decontamination process. Once the exterior evidence packaging is decontaminated, the evidence is moved following law enforcement AHJ procedures for chain of custody to an evidence custodian for documentation into the evidence chain.

(p) Describe packaging procedures for evidence transportation

Procedures for the safe external packaging and transportation of evidence are the responsibility of the law enforcement AHJ, in cooperation with the receiving laboratory and the operator of the transport vehicle. Packaging for transportation must ensure the safe transit of evidence, prevent release of hazardous material during transport, and follow applicable regulations or AHJ policy. Whenever possible, the external evidence container should fit within a standard bio-safety protection cabinet or chemical hood.

(q) Describe evidence chain-of-custody procedures

Chain of custody is the practice of maintaining positive visual or physical control over evidence from collection at a site until presentation in court. Each person encountering positive control over the evidence must be entered into the chain of custody documentation and as such is a candidate for subpoena to court. Chain-of-custody procedures are the responsibility of the law enforcement AHJ.

(2) Given an example of an illicit laboratory, the operations level responder assigned to collect evidence shall be able to perform the following tasks:

Illicit laboratories take several forms and involve numerous types of hazards. It is important for the operations level responder to understand that the potential for chemical, biological, radiological, and explosive materials is present at all illicit laboratories. Consultation with local or state and federal law enforcement about current intelligence, recent incidents, and local trends is critical for the operations level responder.

(a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident

Illicit laboratories are designed for the production of many different products, including illegal drugs such as methamphetamine, chemical modification such as distillation of pesticides, and biological toxins or pathogens. Operators of these illicit laboratories often have a vested interest in the protection of their product and evading law enforcement. There is a risk that the operator will be present in the laboratory and have access to weapons. The human element must be addressed by law enforcement tactical teams specifically trained to operate within a hazardous environment.

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The level of protection for the tactical team should be based on an assessment of the intelligence and information available on the intent of the laboratory, and it should include any protective clothing used by the operator, activity of animals in the laboratory, interviews with neighbors, and so forth. Additionally, there is a risk of antipersonnel devices (booby traps) around and in the laboratory. The operations level responder must leave clearance of potential antipersonnel devices to hazardous device technician or EOD personnel trained for these procedures.

Once the human and explosive hazards have been cleared, the operations level responder should conduct a hazard risk assessment to determine the potential harm from hazardous materials/WMD in the illicit laboratory. Decontamination procedures should be based on the results of the hazard risk assessment.

(b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, evidence packaging, and evidence transport containers

Selection of PPE and detection devices are based on assessment of the intelligence, warning signs, and detection clues. The detection and monitoring equipment selected must be capable of assisting in the performance of the hazard risk assessment and, at a minimum, should include a combustible gas indicator, oxygen level meter, photoionization meter, pH paper, and radiological monitoring equipment. The selection of sampling devices, packaging, and transport containers is predicated on the evidence sampling plan developed by the law enforcement AHJ in coordination with the receiving laboratory.

(c) Describe the sampling options associated with liquid sample and solid sample evidence collection

The decision on sampling techniques and collection tools will be guided by the evidence sampling plan. Tools that could be used to collect liquid samples include syringes, pipettes, coliwasa tubes, drum thieves, certified clean jars, and sterile vials. Tools that could be used to collect solid samples include swabs, scoops, spatulas, certified clean jars, and sterile vials.

(d) Describe the field screening protocols for collected evidence

Field screening is a measure used to determine certain characteristics used to ensure the safety of the sample, responders, the public, and laboratory personnel. The field screening must include, at a minimum, nondestructive testing to identify the presence of IEDs/EOD devices, radiological materials, flammable materials, toxic materials, strong oxidizers, and the corrosive properties of liquid samples.

(3) Given an example of an environmental crime, the operations level responder assigned to collect evidence shall be able to perform the following tasks:

(a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident

Environmental crime sites could involve the illegal use and disposal of hazardous materials and hazardous waste. Operators and/or owners of environmental crime sites might be evading law enforcement. There is a risk that the operator and/or owner will be present at the site and have access to weapons. The human element must be addressed by law enforcement personnel. The level of protection for the site entry should be based on an assessment of the intelligence and information on the intent of the environmental crime site. This information should include protective clothing used by the operator, activity of animals in the area, and interviews with neighbors and employees. Once the human and any

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EOD hazards have been cleared, the operations level responder should conduct a hazard risk assessment to determine the potential harm from hazardous materials/WMD within the environmental crime site. Decontamination procedures should be based on the results of the hazard risk assessment.

(b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, evidence packaging, and evidence transport containers

Selection of PPE and detection devices is based on assessment of the intelligence, warning signs, and detection clues. The detection and monitoring equipment selected must be capable of assisting in the performance of the hazard risk assessment, and at a minimum, it should include a combustible gas indicator, oxygen level meter, photoionization meter, pH paper, and radiological monitoring equipment. The selection of sampling devices, packaging, and transport containers is based on the evidence sampling plan developed by the law enforcement AHJ in coordination with the receiving laboratory.

(c) Describe the sampling options associated with the collection of liquid sample and solid sample evidence

The decision on sampling techniques and collection tools will be guided by the evidence sampling plan. Tools that could be used to collect liquid samples include syringes, pipettes, coliwasa tubes, drum thieves, certified clean jars, and sterile vials. Tools that could be used to collect solid samples include swabs, scoops, spatulas, certified clean jars, and sterile vials.

(d) Describe the field screening protocols for collected evidence

Field screening is a measure used to determine certain characteristics used to ensure the safety of the sample, responders, the public, and laboratory personnel. The field screening must include, at a minimum, nondestructive testing to identify the presence of IEDs/EOD devices, radiological materials, flammable materials, toxic materials, strong oxidizers, and the corrosive properties of liquid samples.

(4) Given an example of a hazardous materials/WMD suspicious letter, the operations level responder assigned to collect evidence shall be able to perform the following tasks:

(a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident

Hazmat/WMD suspicious letters have the potential to contain explosive devices, explosive materials, chemicals, biological materials, or radioactive materials. The operations level responder should participate in a threat credibility evaluation with local or state and federal law enforcement, hazardous materials response authorities, and public health officials to evaluate the articulated or implied threat from the suspicious letter. The threat credibility evaluation should include evaluation of the behavioral resolve of the originator of the letter, the technical feasibility that hazardous materials are present, and the operational practicality of successful delivery of hazardous materials in the letter.

Once the letter has been cleared for IED/EOD hazards, the operations level responder should conduct a hazard risk assessment. The assessment should include field screening to determine the potential harm from hazardous materials/WMD in the suspicious letter. In the presence of an articulated or implied threat, the operations level responder must ensure that the bulk of potentially hazardous materials found in the letter, as well as the envelope containing the letter, are packaged for law enforcement–supervised transport to a receiving laboratory. Decontamination procedures should be based on the results of the hazard risk assessment.

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(b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, evidence packaging, and evidence transport containers

Selection of PPE and detection devices is based on assessment of the intelligence, warning signs, and detection clues. The detection and monitoring equipment selected must be capable of assisting in the performance of the hazard risk assessment, and at a minimum should include a combustible gas indicator, oxygen level meter, photoionization meter, pH paper, and radiological monitoring equipment. The selection of sampling devices, packaging, and transport containers is predicated on the evidence sampling plan developed by the law enforcement AHJ in coordination with the receiving laboratory.

(c) Describe the sampling options associated with the collection of liquid sample and solid sample evidence

The decision on sampling techniques and collection tools will be guided by the evidence sampling plan. Tools that could be used to collect liquid samples include syringes, pipettes, certified clean jars, and sterile vials. Tools that could be used to collect solid samples include swabs, scoops, spatulas, certified clean jars, and sterile vials. The operations level responder should make every effort to document any text or graphics present on the letter or envelope containing the letter. This could include law enforcement–approved photographs, notes, or packaging the letter and envelope in clear packaging bags.

(d) Describe the field screening protocols for collected evidence

Field screening is a measure used to determine certain characteristics used to ensure the safety of the sample, responders, the public, and laboratory personnel. The field screening must include, at a minimum, nondestructive testing to identify the presence of IEDs/EOD devices, radiological materials, flammable materials, toxic materials, strong oxidizers, and the corrosive properties of liquid samples.

(5) Given an example of a hazardous materials/WMD suspicious package, the operations level responder assigned to collect evidence shall be able to perform the following tasks:

(a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident

Hazmat/WMD suspicious packages have the potential to contain explosive devices, explosive materials, chemicals, biological materials, or radioactive materials. The operations level responder should participate in a threat credibility evaluation with local or state and federal law enforcement, hazardous materials response authorities, and public health officials to evaluate the articulated or implied threat from the suspicious package. The threat credibility evaluation should include evaluation of the behavioral resolve of the originator of the package, the technical feasibility that hazardous materials are present, and the operational practicality of successful delivery of hazardous materials in the package.

Once the package has been cleared for IED/EOD hazards, the operations level responder should conduct a hazard risk assessment, to include field screening, to determine the potential harm from hazardous materials/WMD within the suspicious package. In the presence of an articulated or implied threat, the operations level responder must ensure that the bulk of potentially hazardous materials found within the package, as well as the outer package, are packaged for law enforcement supervised transport to a receiving laboratory. Decontamination procedures should be based on the results of the hazard risk assessment.

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(b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, evidence packaging, and evidence transport containers

Selection of PPE and detection devices is based on assessment of the intelligence, warning signs, and detection clues. The detection and monitoring equipment selected must be capable of assisting in the performance of the hazard risk assessment, and at a minimum should include a combustible gas indicator, oxygen level meter, photoionization meter, pH paper, and radiological monitoring equipment. The selection of sampling devices, packaging, and transport containers is predicated on the evidence sampling plan developed by the law enforcement AHJ in coordination with the receiving laboratory.

(c) Describe the sampling options associated with liquid sample and solid sample evidence

The decision on sampling techniques and collection tools will be guided by the evidence sampling plan. Tools that could be used to collect liquid samples include syringes, pipettes, certified clean jars, and sterile vials. Tools that could be used to collect solid samples include swabs, scoops, spatulas, certified clean jars, and sterile vials. The operations level responder should make every effort to document any text or graphics present on any materials within the package, and on the package itself, including law enforcement–approved photographs, notes, or packaging of any written materials found in the package in clear packaging bags.

(d) Describe the field screening protocols for collected evidence

Field screening is a measure to determine certain characteristics used to ensure the safety of the sample, responders, the public, and laboratory personnel. The field screening must include, at a minimum, nondestructive testing to identify the presence of IEDs/EOD devices, radiological materials, flammable materials, toxic materials, strong oxidizers, and the corrosive properties of liquid samples.

(6) Given an example of a release/attack involving a hazardous material/WMD agent, the operations level responder assigned to collect evidence shall be able to perform the following tasks:

(a) Describe the hazards, safety procedures, decontamination, and tactical guidelines for this type of incident

Potential attack scenarios involving hazardous materials/WMD include explosive devices, biological toxins, release or burning of toxic industrial chemicals, biological pathogens, radioactive sources, chemical warfare agents, or nuclear devices. In the event that the release/attack has already occurred, operations level responders should perform their duties as prescribed in the local emergency response plan. The operations level responder should participate in a threat credibility evaluation with local or state and federal law enforcement, hazardous materials response authorities, and public health officials to evaluate the articulated or implied threat from the release/attack. The threat credibility evaluation should include evaluation of the behavioral resolve of the originator of the release/attack, the technical feasibility that hazardous materials are present, and the operational practicality of successful delivery of hazardous materials during the release/attack.

Once the release/attack site has been cleared for IED/EOD hazards, the operations level responder should conduct a hazard risk assessment, including field screening to determine the potential harm from any hazardous materials/WMD involved in the release/attack. Decontamination procedures should be based on the results of the hazard risk assessment.

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(b) Describe the factors to be evaluated in selecting the PPE, sampling equipment, detection devices, evidence packaging, and evidence transport containers

Selection of PPE and detection devices is based on assessment of intelligence, warning signs, and detection clues. The detection and monitoring equipment selected must be capable of assisting in the performance of the hazard risk assessment and, at a minimum, should include a combustible gas indicator, oxygen level meter, photoionization meter, pH paper, and radiological monitoring equipment. The selection of sampling devices, packaging, and transport containers is predicated on the evidence sampling plan developed by the law enforcement AHJ in coordination with the receiving laboratory.

(c) Describe the sampling options associated with the collection of liquid sample and solid sample evidence

The decision on sampling techniques and collection tools will be guided by the evidence sampling plan. Tools that could be used to collect liquid samples include syringes, pipettes, certified clean jars, and sterile vials. Tools that could be used to collect solid samples include swabs, scoops, spatulas, certified clean jars, and sterile vials.

(d) Describe the field screening protocols for collected evidence

Field screening is a measure used to determine certain characteristics used to ensure the safety of the sample, responders, the public, and laboratory personnel. The field screening must include, at a minimum, nondestructive testing to identify the presence of IEDs/EOD devices, radiological materials, flammable materials, toxic materials, strong oxidizers, and the corrosive properties of liquid samples.

(7) Given examples of different types of potential criminal hazardous materials/WMD incidents, the operations level responder shall identify and describe the application, use, and limitations of the various types field screening tools that can be utilized for screening evidence for the following prior to collection:
   (a) Corrosivity
   (b) Flammability
   (c) Oxidizers
   (d) Radioactivity
   (e) Volatile organic compounds (VOC)
   (f) Fluorides

Refer to the mission-specific competencies in Section 6.7, Mission-Specific Competencies: Air Monitoring and Sampling.

(8) Describe the potential adverse impact of using destructive field screening techniques on evidence prior to collection

(9) Describe the procedures for maintaining the evidentiary integrity of any item removed from the scene

N **6.12.3.2 Selecting Personal Protective Equipment (PPE).** Given the PPE provided by the AHJ, the operations level responder assigned to evidence collection shall select the PPE required to support evidence collection at hazardous materials/WMD incidents based on local procedures (see Section 6.2).

N **6.12.4 Competencies — Implementing the Planned Response.**

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N **6.12.4.1 Implementing the Planned Response.** Given the incident action plan for a criminal incident involving hazardous materials/WMD, the operations level responder assigned to collect evidence shall implement selected response actions consistent with the emergency response plan or standard operating procedures by completing the following requirements:

(1) Demonstrate how to secure the scene and characterize and preserve evidence at the scene
(2) Demonstrate documentation of personnel and scene operations associated with the incident
(3) Determine whether responders are within their legal authority to perform evidence collection tasks
(4) Describe the procedure to notify the agency with investigative authority
(5) Describe the procedure to notify hazardous device technician
(6) Identify potential evidence to be collected
(7) Demonstrate procedures to protect evidence from secondary contamination
(8) Demonstrate field screening protocols for evidence prior to collection
(9) Demonstrate AHJ approved techniques to collect evidence utilizing the equipment provided
(10) Demonstrate evidence documentation procedures
(11) Demonstrate evidence labeling and packaging procedures
(12) Demonstrate evidence decontamination procedures
(13) Demonstrate packaging procedures for evidence transportation
(14) Describe chain-of-custody procedures for evidence

N **6.12.4.2** The operations level responder assigned to evidence collection shall describe local procedures for the technical decontamination process.

N 6.12.5 Competencies — Evaluation Progress. (Reserved)

N 6.12.6 Competencies — Terminating the Incident.

N **6.12.6.1 Reporting and Documenting Evidence Collection Operations.** Given a scenario involving a hazardous materials/WMD incident involving evidence collection operations and AHJ policies and procedures, the operations level responder assigned to perform evidence collection shall report and document the evidence collection operations as required by the AHJ by completing the following:

(1) Identify the reports and supporting documentation required by the AHJ pertaining to evidence collection operations

References Cited in Commentary

1. NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services,* National Fire Protection Association, Quincy MA, 2018.
2. NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies and CBRN Terrorism Incidents,* National Fire Protection Association, Quincy MA, 2016.
3. NFPA 1992, *Standard on Liquid Splash–Protective Ensembles and Clothing for Hazardous Materials Emergencies*, National Fire Protection Association, Quincy MA, 2018.
4. NFPA 1994, *Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents*, National Fire Protection Association, Quincy MA, 2018.
5. NFPA 1999, *Standard on Protective Clothing and Ensembles for Emergency Medical Operations,* National Fire Protection Association, Quincy MA, 2018.
6. *Chemical Weapons Improved Response Program Report*, U.S. Army Soldier and Biological Command (SBCCOM, now known as RDECOM), Aberdeen Proving Ground, MD.
7. NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents*, National Fire Protection Association, Quincy MA, 2018.

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7 Competencies for Hazardous Materials Technician

When the committee started work on the revisions on the 2018 version of NFPA 472, major changes were made to Chapter 7. The committee looked at the objectives for Chapter 7 and felt that the requirements were too challenging for a new technician. We found that many training programs did not meet the intent of the Chapter 7. We wanted to provide the objectives that matched what a technician needed to function at a basic level when they completed their training. In some cases, objectives were moved to Chapter 5, as the committee felt that all responders should have some basic level of understanding of various terms. This is true of some of the weapons of mass destruction (WMD) competencies, which were primarily covered by Chapter 5.

Other areas where Chapter 7 was modified were in monitoring and detection, chemistry, and product control. The committee wanted to make sure that a technician had the basic skills to respond to the most common incidents that a technician would face. Some of the more advanced skills that were occasionally used by a technician were moved to the technician advanced specialty chapters (19–24). To become a hazardous materials technician (HMT), one only has to meet the objectives of Chapter 7. The new chapters (19–23) are optional.

With this revision, the requirements to become a technician covered by Chapter 7 have been reduced. The committee has added the following chapters:

- Chapter 19: Competencies for Hazardous Materials Technicians with an Advanced Monitoring and Detection Specialty
- Chapter 20: Competencies for Hazardous Materials Technicians with a Consequence Analysis and Planning Specialty
- Chapter 21: Competencies for Hazardous Materials Technicians with an Advanced Chemical Risk Assessment and Analysis Specialty
- Chapter 22: Competencies for Hazardous Materials Technicians with an Advanced Product Control Specialty
- Chapter 23: Competencies for Hazardous Materials Technicians with a Weapons of Mass Destruction Specialty
- Chapter 24: Competencies for Hazardous Materials Technicians with an Advanced Decontamination Specialty

The new chapters (19–24) are for technicians who receive advanced training and would like to be certified at a higher level. As an example, not every response team has a need for advanced monitoring and detection capabilities. But if the AHJ has made a financial commitment for additional equipment, then training should be provided to some of the team members, who would have that specialty. The WMD objectives for all first responders are in Chapter 5, and for those technicians who need to have additional WMD skills are covered by the new Chapter 23. The desire of the committee was to make Chapter 7 meet the needs of the majority of the hazmat response teams, and to match the training that was being provided.

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7.1 General.

7.1.1 Introduction.

7.1.1.1 The hazardous materials technician shall be that person who responds to hazardous materials/WMD incidents using a risk-based response process to analyze a problem involving hazardous materials/WMD, plan a response to the problem, implement the planned response, evaluate progress of the planned response and adjust as needed, and assist in terminating the incident.

Δ **7.1.1.2** The hazardous materials technician shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, and all competencies of this chapter.

7.1.1.3* The hazardous materials technician shall receive additional training to meet applicable governmental occupational health and safety regulations.

A.7.1.1.3 Additional training sources might include, but are not limited to, local and state public health agencies and the Centers for Disease Control and Prevention (CDC). Additional training options include, but are not limited to, programs offered at the Center for Domestic Preparedness in Anniston, Alabama, and at the U.S. Army Dugway Proving Ground in Utah.

7.1.1.4 The hazardous materials technician shall be permitted to have additional competencies that are specific to the response mission, expected tasks, equipment, and training as determined by the AHJ.

> The HMT, in addition to basic competencies, could have specific mission requirements based on the employer's emergency response plan and standard operating procedures/guidelines. The intent of this statement is that the HMT must be properly trained and equipped for any mission to be undertaken as determined by the authority having jurisdiction (AHJ).

7.1.2 Goal.

7.1.2.1 The goal of the competencies in this chapter shall be to provide the hazardous materials technician with the knowledge and skills to perform the tasks in 7.1.2.2 in a safe manner.

7.1.2.2 In addition to being competent at both the awareness and the operations levels, the hazardous materials technician shall be able to perform the following tasks:

(1) Analyze a hazardous materials/WMD incident to determine the complexity of the problem and potential outcomes by completing the following tasks:

> The HMT is required in 7.1.2.2(1) to have an in-depth knowledge of containers and to be able to operate monitoring equipment to identify the presence and concentrations of hazardous materials. The HMT should be able to access and interpret a variety of resources for hazard and response information, as well as find ways to identify hazards based on all the on-scene indicators, such as product, container, environment, and signs and symptoms of victims. The HMT is expected to be able to predict more conclusively than the responder at the operations level how the hazardous materials/WMD (i.e., plume modeling, monitoring, and detection) behave when released and the type of harm.

(a) Survey the hazardous materials/WMD incident to:
  (i) Identify by name, specification, typical contents, and capacity of containers
  (ii) Classify hazardous materials/WMD, verify the presence of hazardous materials, and determine the concentrations of hazardous materials through the use of detection, monitoring, and sampling equipment

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The difference between the competency in 7.1.2.2(2)(a) and the corresponding competency at the operations level is that the HMT is expected to be able to use a risk-based decision process to identify and recommend response objectives. The higher level of knowledge and skills allows the HMT to evaluate and determine the proper course of action based on the facts, science, and circumstances to recommend to the incident commander (IC).

(b) Collect and interpret hazard and response information from printed and technical resources, computer databases, and monitoring equipment

The HMT is required to identify the options (offensive, defensive, or non-intervention) available to achieve the response objectives that have been established. This task is done by determining the type of harm that the product, container, and environment present and the time and resources required to perform the mission.

(c) Describe the type and extent of damage to containers

The HMT is required in 7.1.2.2(2)(c) to understand the uses, limitations, and selection procedures, per the manufacturer and the AHJ, to operate in personal protective equipment (PPE) because technicians are expected to be involved in offensive product control operations.

(d) Predict the likely behavior of released materials and their containers when multiple materials are involved

Selecting the appropriate type of decontamination (emergency vs. technical) and procedures is imperative for technician level responders based on the chemical and physical properties of the hazardous material/WMD.

(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, PPE, and response equipment by completing the following tasks:
(a) Describe the response objectives for hazardous materials/WMD incidents
(b) Describe the potential response options available by response objective
(c) Select the PPE required for a given action option
(d) Select a technical decontamination process to minimize the hazard
(e) Develop an incident action plan for a hazardous materials/WMD incident, including a site safety and control plan, consistent with the emergency response plan or standard operating procedures and within the capability of the available personnel, PPE, and response equipment

After the response objectives (offensive, defensive, or nonintervention) are identified in 7.1.2.2(2)(a), the incident action plan (IAP) developed in 7.1.2.2(2)(e) defines the strategy and tactics and identifies the personnel and equipment necessary to accomplish them.

According to 29 CFR 1910.120, Appendix C, site safety and control plans should address the following:

- Analysis of hazards on the site and a risk analysis of those hazards
- Site map or sketch
- Site work (control) zones
- Use of buddy system

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- Site communications
- Command post
- Standard operating procedures and safe work practices
- Medical assistance and triage area
- Other relevant topics

This plan should be a part of the employer's emergency response plan or an extension of it to the specific site.

(3)* Implement the planned response to favorably change the outcomes consistent with the standard operating procedures and site safety and control plan by completing the following tasks:

(a) Perform the duties of an assigned hazardous materials branch or group position within the AHJ incident management system (IMS)

The HMT is required in 7.1.2.2(3)(a) to be able to perform assigned roles in the incident management system (IMS). The incident command system (ICS) is part of the IMS, and the technician must know and understand the assigned roles and the chain of command to ensure accountability and safety. Additionally, at large events, the IMS could have a multiagency coordination entity that would be accessed by the on-scene ICS and support the needs of the incident. In most areas, this entity will be the local emergency operations center (EOC).

(b) Inspect, don, work in, and go through decontamination while wearing PPE

(c) Perform product control techniques including:

(i) Product control (confinement) of released materials — adsorption, adsorption, blanketing, damming, diking, dilution, dispersion, diversion, neutralization, retention, vapor dispersion, and vapor suppression

It should be noted that the first product control technique above should have been *absorption*, but due to an editing error it was listed as *adsorption*.

(ii) Product control (containment) from bulk or nonbulk pressure containers and closures, nonbulk liquid containers and closures, and bulk liquid containers and closures — patching, plugging, repositioning container, sealing closures, and remote valve shutoff of leaks

(iii) Overpack nonbulk and radioactive materials containers

(iv) Transfer of liquids from nonpressure containers

(v) Perform decontamination functions identified in the incident action plan (IAP)

The HMT is required in 7.1.2.2(3)(c) to be able to demonstrate their ability to select and use the appropriate equipment and to implement the tactical options identified in the IAP.

A.7.1.2.2(3) The following site safety and control plan considerations are from the NIMS *Site Safety and Control Plan* (formerly ICS 208 HM):

(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

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(8) Communication procedures
(9) Decontamination procedures
(10) Site safety and health plan

(4) Evaluate the progress of the planned response by completing the following tasks:
  (a) Evaluate the effectiveness of the control functions

This evaluation should answer the question, "Are the strategy and tactics that have been implemented accomplishing the incident objectives identified in 7.1.2.2(2)(a)?"

  (b) Evaluate the effectiveness of the decontamination process

(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

Occupational Safety and Health Administration (OSHA) regulation 29 CFR 1910.120(q) mandates incident debriefing, critique, reporting, and documentation [1]. While the technician might not have ultimate responsibility for ensuring the completion of these tasks, the technician could be required to provide information regarding actions taken and decisions made.

7.2 Competencies — Analyzing the Incident.

Δ **7.2.1 Surveying Hazardous Materials/WMD Incidents.** Given examples of hazardous materials/WMD incidents, the hazardous materials technician shall:

(1) Identify containers involved by name, specification, and typical contents by name, hazard class, and capacity
(2) Classify hazardous materials/WMD involved, verify the presence of hazardous materials and concentration of hazardous materials through detection, monitoring, and sampling by completing the requirements of 7.2.1.1 through 7.2.1.1.9

The HMT is required in 7.2.1 to be able to identify the characteristics of special containers that might indicate the presence of hazardous materials. The HMT is also expected to be able to conduct an analysis that identifies and classifies unknown materials based on the container and type of material that could be within. Special containers include high-pressure containers (identified by their rounded ends), cryogenic cargo tanks or cylinders, and casks for radioactive materials.

7.2.1.1 Identifying Containers and Contents.

N **7.2.1.1.1** Given examples of various containers for hazardous materials/WMD, the hazardous materials technician shall identify each container by name and specification and identify the typical contents by name and hazard class.

7.2.1.1.2 Given examples of the following railroad cars, the hazardous materials technician shall identify the container by name and specification and identify the typical contents by name and hazard class:

(1) Cryogenic liquid tank cars

Cryogenic tank cars in 7.2.1.1.2(1) transport low-pressure liquids, usually at 25 psi (172 kPa) or lower, that are refrigerated to −130°F (−90°C) or below. The cryogenic tank car is a tank within a tank. The space between the inner and outer tanks is filled with insulation and normally maintained under a vacuum.

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Cryogenic cars are distinguished by the absence of top fittings; the fittings are enclosed in cabinets at ground level either on both sides or at one end of the car. Among the materials that can be shipped in cryogenic tank cars are argon, ethylene, hydrogen, nitrogen, and oxygen.

(2) Nonpressure tank cars

Nonpressure tank cars, also known as general-service tank cars or acid-service tank cars, transport a variety of hazardous and nonhazardous materials at low pressures. Nonpressure tank cars transport hazardous materials, such as flammable and combustible liquids, flammable solids, oxidizers, organic peroxides and poisons, corrosive materials, and molten solids. They also transport nonhazardous materials, such as tallow, clay, slurry, corn syrup, and other food products. Tank test pressures for nonpressure tank cars range from 60 psi to 100 psi (413 kPa to 620 kPa). Capacities range from 4000 gal to 45,000 gal (15 m^3 to 170 m^3). The tanks are cylindrical with rounded heads. Newer, nonpressure tank cars have at least one manway to allow access to the car's interior. Some older nonpressure tank cars have at least one expansion dome with a manway. Fittings for loading and unloading, pressure and/or vacuum relief, gauging, and other purposes are visible at the top and/or bottom of the car.

(3) Pneumatically unloaded hopper cars

Charles Wright notes the following in the *Fire Protection Handbook®*:

Pneumatically unloaded covered hopper cars are covered hopper cars, which are unloaded through pressure differential, or pneumatics, applying air pressure. Even though the pressure is used only during unloading, tank test pressures for the car range from 20 psi to 80 psi (138 kPa to 551 kPa). Dry caustic soda is one commodity transported in this type of car. [2] p. 21–129

(4) Pressure tank cars

Δ **7.2.1.1.3** Given examples of the following intermodal tanks, the hazardous materials technician shall identify the container by name and specification and identify the typical contents by name and hazard class:

(1) Nonpressure intermodal tanks

The tanks in 7.2.1.1.3(1) are built to withstand maximum allowable working pressures (MAWP) of 25.4 psi to 100 psi (175 kPa to 6890 kPa). The tanks could be used to transport both nonhazardous and hazardous materials, including toxic, corrosive, and flammable materials. Internationally, an IM-101 portable tank is called an IMO Type 1 tank container.

Since 2003, construction and certification under U.S. Department of Transportation (DOT) Specification IM 101, DOT Specification IM 102, and DOT Specification 51 tanks are no longer authorized by DOT, but tank containers previously built to these specifications may continue to transport hazardous materials provided they conform to current DOT regulations for Specification UN portable tanks. They will continue to display the old specification markings, just like the international IMO-1, IMO-2, IMO-5, and IMO-7 specification markings for tank containers built to previous international standards.

Wright also notes the following:

> These tanks are designed to handle lower maximum allowable working pressures (MAWP) — that is, from 14.5 psi to 25.4 psi (100 kPa to 175 kPa). They transport materials such as liquor, alcohols, some corrosives, pesticides, insecticides, resins, industrial solvents, and flammables with flash points between 32°F and 140°F (0°C and 60°C). More often, they transport various nonregulated materials, such as food commodities. Internationally, an IM-102 tank is called an IMO Type 2 tank container. [2] p. 21–132

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(2) Pressure intermodal tank

Also known as DOT Specification 51 portable tanks, these containers are less common in transport. Designed to handle internal pressures ranging from 100 psi to 500 psi (690 kPa to 3450 kPa), they generally transport gases liquefied under pressure, such as LP-gas and anhydrous ammonia. They can also carry liquids, such as motor fuel antiknock compounds or aluminum alkyls. Internationally, they are called IMO Type 5 tank containers.

(3) Specialized intermodal tanks

These containers transport refrigerated liquid gases, such as liquefied argon, oxygen, helium, ethylene, and nitrogen, and they are built to DOT specifications for portable tanks intended for the transportation of refrigerated gases. The tanks consist of a tank within a tank with insulation between the inner and outer tanks. The space between the tanks is normally maintained under a vacuum. Internationally, they are called IMO Type 7 tank containers.

(4) Cryogenic intermodal tanks
(5) Tube modules

These containers transport nonliquefied gases such as helium, nitrogen, and oxygen in high-pressure 3 ton cylinders mounted within a full- or half-height ISO frame. This rigid bulk packaging consists of several horizontal seamless steel cylinders, from 9 in. to 48 in. (229 mm to 1219 mm) in diameter, that are permanently mounted inside an open frame with a boxlike compartment at one end enclosing the loading and unloading fittings and safety devices. Service pressures range from 3000 psi to 5000 psi (20,670 kPa to 34,450 kPa).

7.2.1.1.4 Given examples of the following cargo tanks, the hazardous materials technician shall identify the container by name and specification and identify the typical contents by name and hazard class:

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

The shape of the vehicle can offer clues to its cargo in an emergency. Often the shape is the only key to identifying the cargo of a trailer truck at an accident scene. Exhibit I.7.1 shows different shapes of road trailers for quick reference.

7.2.1.1.5 Given examples of the following facility storage tanks, the hazardous materials technician shall identify the container by name and identify the typical contents by name and hazard class:

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

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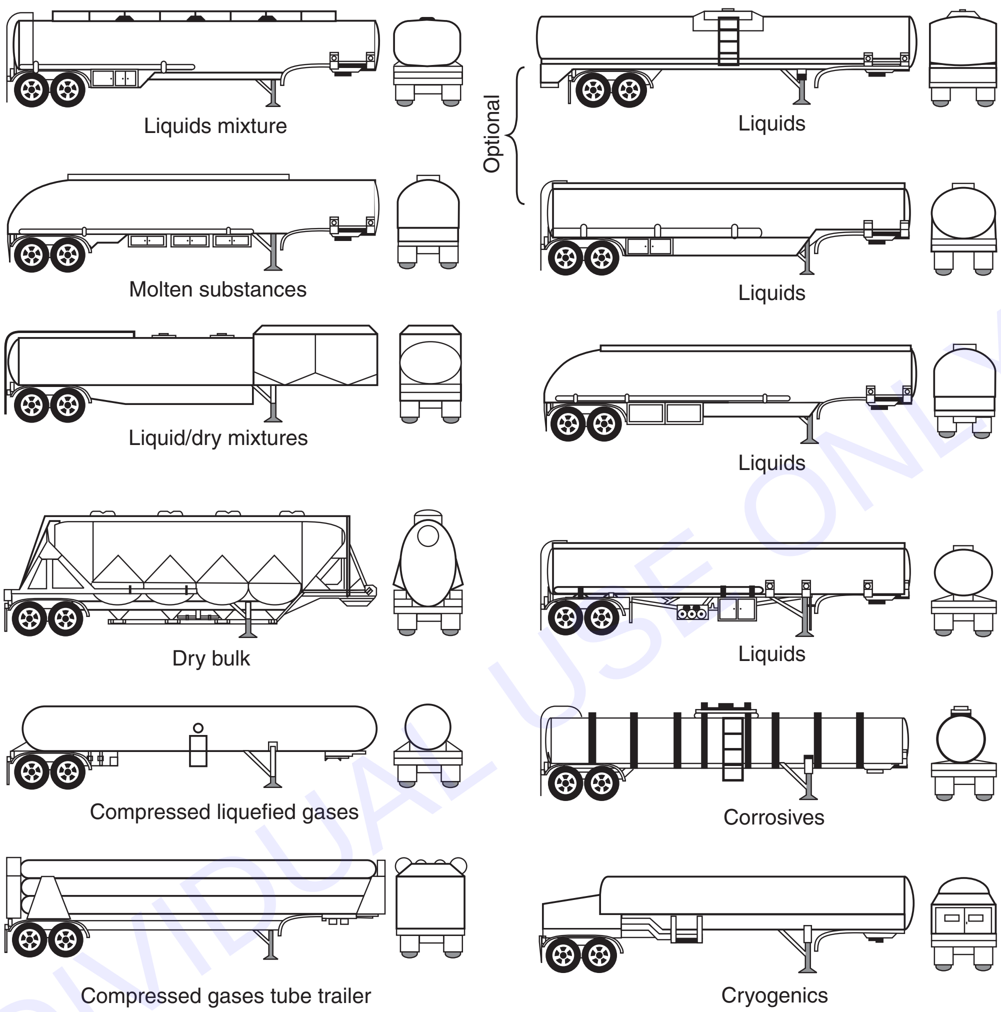
EXHIBIT I.7.1

The shapes of the most common vehicles are illustrated.



7.2.1.1.6 Given examples of the following nonbulk packaging, the hazardous materials technician shall identify the package by name and identify the typical contents by name and hazard class:

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

The specifications for packaging are defined in Title 49 CFR Part 178 [3]. To understand the risk posed by packaging, the HMT needs to be able to anticipate the hazards of materials shipped in different nonbulk packaging.

7.2.1.1.7 Given examples of the following radioactive materials packages, the hazardous materials technician shall identify the container/package by name and identify the typical contents by name:

(1) Excepted

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Excepted packaging in 7.2.1.1.7(1) is used to transport material with extremely low levels of radioactivity. Excepted packages range from a product's fiberboard box to a sturdy wooden or steel crate. Typical shipments in excepted packages include limited quantities of materials, instruments, and articles such as smoke detectors or limited quantity (exempt) button sources. Excepted packagings are excepted (excluded) from specific packaging, labeling, and shipping paper requirements; they are, however, required to have the letters "UN" and the appropriate four-digit UN identification number marked on the outside of the package.

(2) Industrial

Industrial packaging in 7.2.1.1.7(2) is used to transport material that presents a limited hazard to the public and environment. Examples of material transported in industrial packages include contaminated equipment and radioactive waste solidified in materials such as concrete. Most low-level waste is shipped for disposal in industrial packaging. Industrial packages are grouped into three categories (IP-1, IP-2, IP-3), based on the strength of the package.

(3) Type A

Type A packages in 7.2.1.1.7(3) have an inner containment vessel made of glass, plastic, or metal, and the packing material is made of polyethylene, rubber, or vermiculite. Examples of materials transported in Type A packages include radiopharmaceuticals, portable nuclear density gauges, and low-level radioactive waste. Type A packages containing non-life-endangering amounts of radioactive material are identified with the words Type A on the package and also on the shipping papers.

(4) Type B

Type B packaging in 7.2.1.1.7(4) is used to transport material with radioactivity levels higher than those allowed in Type A packages, such as spent fuel, radiography sources, and high-level radioactive waste. Limits on activity contained in Type B packages are provided in 49 CFR Part 173.431 [4]. Type B packages range from small drums [55 gal (208 L)] to heavily shielded steel casks that sometimes weigh more than 100 tons. Type B packages are identified with the words Type B on the package and also on the shipping papers.

(5) Type C

Type C packages in 7.2.1.1.7(5) are used for high-activity materials (including plutonium) transported by aircraft. They are designed to withstand severe accident conditions associated with air transport without loss of containment or significant increase in external radiation levels. The Type C package performance requirements are significantly more stringent than those for Type B packages. Type C packages are not authorized for domestic use but are authorized for international shipments of radioactive material. The fact that they are not authorized for domestic use is why one does not hear much about them in the United States. The *Emergency Response Guidebook* (ERG) includes information on Type C because it is more of an international document [5].

Regulations require that both Type B and Type C packages be marked with a trefoil symbol to ensure that the package can be positively identified as carrying radioactive material after a severe accident. The trefoil symbol must be resistant to the effects of both fire and water.

Performance requirements for Type C packages include those applicable to Type B packages, with enhancements on some tests that are significantly more stringent than those for Type B packages. For example, a 200 mi (322 km) per hour impact onto an unyielding target is required instead of the 30 ft (9 m) drop test required of a Type B package; a 60-minute retest instead of the 30-minute test for Type B packages; and a 650 ft (198 m) immersion test instead of the 50 ft (15 m) test required for Type B package. These stringent tests are expected to result in package designs that will survive more severe aircraft accidents than Type B package designs.

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7.2.1.1.8 Given examples of the following packaging, the hazardous materials technician shall identify the package by name and identify the typical contents by name and hazard class:

(1) Intermediate bulk container (IBC)
(2) Ton container

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

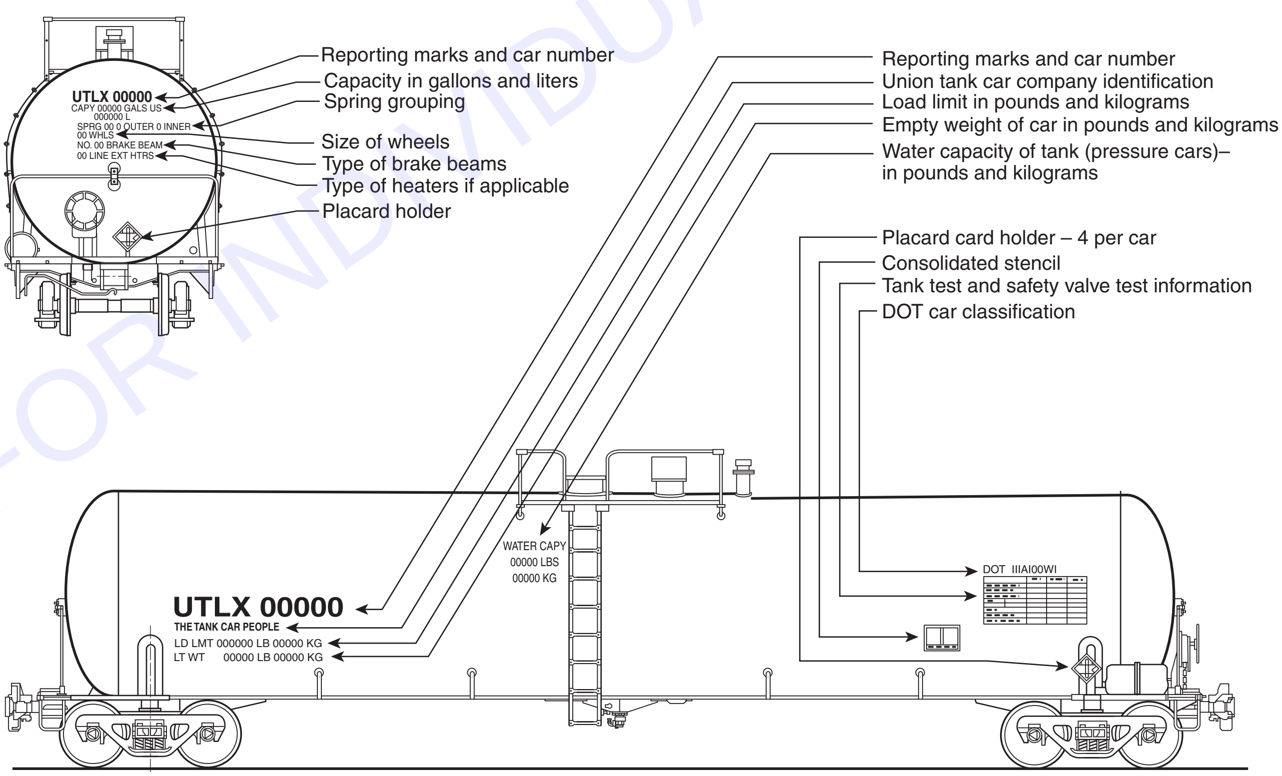
Facility containers are often marked with their capacities, and transportation containers are required to be marked with their capacities.

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

(1) Cargo tanks

A data plate and a specification plate must be affixed to cargo tanks. These plates provide the volume and/or weight of the container, which the HMT is required in 7.2.1.1.10 to know.

EXHIBIT I.7.2



This illustration identifies sample DOT markings and their locations on a tank car. (Courtesy of Union Tank Car Company)

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(2) Tank cars

Tank cars in 7.2.1.1.10(2) must be marked by DOT, which requires that tank cars have standardized markings. Exhibit I.7.2 shows an example of tank car markings.

(3) Tank containers

DOT also requires that tank containers have standardized markings as shown in Exhibit I.7.3.

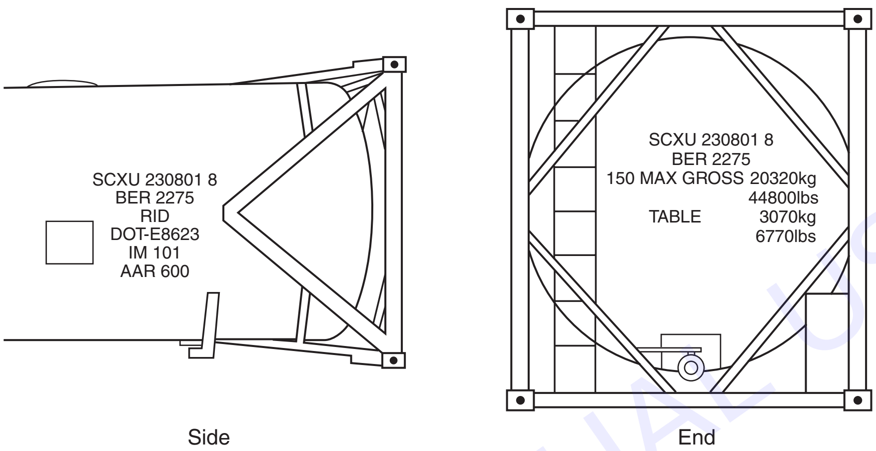

EXHIBIT I.7.3

Tank container standardized markings are illustrated.

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

(1) Cryogenic liquid tank
(2) Nonpressure tank (general service or low-pressure tank)
(3) Pressure tank

7.2.1.2* Detection, Monitoring, and Sampling. Given a hazardous materials/WMD incident with released identified and unidentified hazardous materials, an assignment in an IAP, policies and procedures, and approved resources, detection and monitoring equipment, and PPE, the hazardous materials technician shall, through detection, monitoring, and sampling, classify hazardous materials/WMD by the basic categories; verify the presence of hazardous material; determine the concentration of hazardous materials in the atmosphere; collect samples of solids, liquids, and gases; and read, interpret, record, and communicate the results of detection and monitoring equipment by completing the following tasks:

(1) Select equipment for detection, monitoring, and sampling solids, liquids, and gases suitable for the hazardous materials/WMD present at the incident within the capabilities and competencies of available personnel, approved resources including detection, monitoring, and sampling equipment, and PPE in accordance with the AHJ's policies and procedures.

The technician level responder is required in 7.2.1.2 to be able to identify unknown materials in the event that a container's shipping papers, placards, safety data sheet (SDS), or other identifying items have been destroyed or unavailable.

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(a) Identify the basic hazard categories and their definitions — for example, biological, corrosivity, energy (explosivity, radioactivity, reactivity), flammability, oxygen concentration, thermal (heat and cold), and toxicity.
(b) Describe monitoring technologies.
(c) Describe the types of detection and monitoring equipment including colorimetric (e.g., tubes, chips, papers, strips, reagents), electrochemical cells (e.g., toxic gas sensors), flammable gas/LEL, noncontact thermal detection device, oxygen concentration, photoionization detector (PID), biological detection (e.g., immunoassays, protein tests), and radiation detection and monitoring including the following:
   (i) Application, capabilities, and limitations
   (ii) Application of ionization potential (ip) when using a PID
   (iii) Procedures operating the equipment, including field testing, safety precautions, and action levels
(d) Describe the process for classifying basic hazard categories of identified solid and liquid materials and unidentified contaminants in the atmosphere.
(e) Describe the following processes for radioactive materials:
   (i) Determine radiation dose rates from radioactive material labels.
   (ii) Determine background, rate, and dose.
   (iii) Determine if a radioactive materials container is leaking/breached by comparing meter readings to the Transportation Index (TI).
(f) Describe the process for monitoring lighter-than-air gases and vapors, heavier-than-air gases and vapors in a confined area, and heavier-than-air gases and vapors in an unconfined area.
(g) Describe the methods for collecting samples of solids, liquids, and gases.
(h) Describe the procedures for reading, interpreting, recording, and communicating test results of detection and monitoring equipment.
(i) Describe the field maintenance and testing procedures for detection and monitoring equipment.
(j) Describe the procedures for decontaminating detection, monitoring, and sampling equipment according to manufacturer's recommendations or AHJ policies and procedures.
(k) Describe the procedures for maintaining detection, monitoring, and sampling equipment according to manufacturers' specifications or local policies and procedures.

(2) Using the selected detection and monitoring equipment [colorimetric (e.g., tubes, chips, papers, strips, reagents), electrochemical cells (e.g., toxic gas sensors), flammable gas/LEL, noncontact thermal detection device, oxygen concentration, photoionization detector (PID), biological detection (if provided by the AHJ), radiation detection monitoring devices (e.g., a contamination measuring instrument or instruments able to measure alpha, beta, and gamma radiation, pancake Geiger-Mueller), exposure rate instrument (e.g., instruments able to measure a range of exposure rate), dosimetry devices (e.g., personnel radiation monitors/devices), perform the following detection, monitoring, and sampling tasks following safety procedures, avoiding or minimizing hazards, and protecting exposures and personnel:
(a) Field test the detection, monitoring, and sampling equipment to be used according the manufacturers' specification and local policies and procedures including the following:
   (i) Functional (i.e., bump) test
   (ii) Calibration
   (iii) Other required tests

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(b) Classify hazardous materials by basic hazard categories.
(c) Verify the presence of hazardous materials.
(d) Determine the concentration of hazardous materials in the atmosphere.
(e) Collect samples of solids, liquids, and gases.
(f) Monitor, read, interpret, record, and communicate readings from the equipment.
(g) Decontaminate detection, monitoring, and sampling equipment.
(h) Report and document detection, monitoring, and sampling activities.

A.7.2.1.2 Suggested materials to identify can include the most commonly released materials that are identified annually on several lists, such as those from the federal EPA or the California Environmental Protection Agency (Cal/EPA).

Hazardous materials response teams should develop protocols for monitoring during operations at hazardous materials/WMD incidents. A variety of monitoring equipment is available, and response teams must determine what is appropriate based on the on-scene indicators, such as product, container, environment, and signs and symptoms of victims. The response teams must also understand the uses and limitations, field maintenance, calibration, and selection procedures as per the AHJ's emergency response plan.

Corrosivity is measured by determining the pH of a material (0–14). This task can be done using reagent papers. Care must be taken in the use of color-indicating detectors when used in an atmosphere or liquid with bleaching characteristics.

Combustible gas indicators (CGI) can be used to determine the presence of flammable vapors of hydrocarbon products. Certain instruments are designed to monitor methane vapors specifically; they measure the flammable vapors as a percentage of the lower explosive limit (LEL). Flash point instruments are also available for field use. The instruments allow the responder to determine the flammability of an unknown material fairly accurately and the class of flammable or combustible with which they are dealing. Many CGIs are combination instruments; they can measure oxygen content and several toxic substances as well as combustible gas vapors (see Exhibit I.7.4).

The ability of a substance to oxidize is a measure of its propensity to yield oxygen. Oxygen is released easily, especially when heated, and it accelerates the burning of combustible materials. The more readily a material gives up its oxygen molecule, the greater the hazard it presents, which is the case with oxidizing agents. Oxidizer paper can be used to test for the presence of oxidizers, and an oxygen meter detector can be used to test for oxygen-enriched or deficient atmospheres.

Equipment used to monitor oxygen concentrations generally measures a range of 0 percent to 25 percent oxygen in air (see Exhibit I.7.5). Some models of oxygen meters contain an alarm that sounds if the oxygen level drops below 19.5 percent, which is the minimum permissible percentage of oxygen as established by OSHA. For work in areas with oxygen measurements below this level, the responder must have a supplied-air respirator.

Pathogenicity is the virulence of a pathogen. Virulence refers to how ill an individual may become. The presence of pathogens such as viruses, bacteria, and fungi can be determined only in the laboratory. There are arguably several methods to determine the presence and identity on the scene. However, the "gold standard" continues to be a laboratory capable of identifying pathogens. In the United States, this is a Laboratory Response Network facility certified by the Centers for Disease Control and Prevention (CDC). On-scene tentative methods include, with varying success, biological immunoassay indicators, DNA fluoroscopy, and polymerase chain reaction (PCR) handheld detectors. Proper sampling, collection techniques, and evidence preservation and control must be observed.

EXHIBIT I.7.4

Carbon monoxide is one of the substances that can be tested for by using this combination instrument. (Courtesy of RAE Systems by Honeywell)

EXHIBIT I.7.5

An oxygen meter measures the amount of oxygen in the atmosphere. (Courtesy of Draeger Safety, Inc.)

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A variety of instruments can be used to determine the radioactivity hazards described in 7.2.1.2(1)(a). Ideally, the HMT should be able to identify alpha, beta, gamma, and neutron radioactivity.

Many instruments are designed to measure radiation levels and track accumulated radiation dose. Others are designed to detect and measure radioactive contamination. Some instruments are designed to do both. It is rare to find a single instrument that will detect all four types of radiation. For example, a common "pancake" Geiger-Mueller (GM) detector can distinguish alpha, beta, and gamma radiation but not neutron radiation. Conversely, because of the design of most neutron detectors, they are not capable of detecting alpha and beta radiation. Exhibit I.7.6 shows a pancake GM detector and Exhibit I.7.7 shows a neutron detector. Radiation survey meters are available to detect alpha, beta, gamma, and neutron radiation.

EXHIBIT I.7.6

Photo shows an example of a pancake GM detector.

EXHIBIT I.7.7

Photo shows an example of a neutron detector. (Courtesy of Mirion Technologies, Inc.)

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Several types of instruments can be used to measure toxic exposures such as photoionization detectors (PID) (see Exhibit I.7.8), flame ionization detectors, infrared spectrophotometers, and detector tubes (see Exhibit I.7.9). Some of these instruments are designed to measure specific chemicals, such as hydrogen sulfide, and some may measure more than one chemical (see Exhibit I.7.10). Detector tubes, which allow responders to evaluate potential hazards quickly, operate by drawing an air sample through a small glass tube. This process causes the material inside the tube to change color, indicating the concentration of the material in the air.

EXHIBIT I.7.8

A PID is used to measure the amount of toxic vapors that may be present. (Courtesy of RAE Systems by Honeywell)

EXHIBIT I.7.9

Photo shows an example of typical detector tubes. (Courtesy of RAE Systems by Honeywell)

EXHIBIT I.7.10

Colorimetric detector tubes are glass sampling tubes used to test for specific toxic materials. (Courtesy of Draeger Safety, Inc.)

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The HMT must understand that with advances in technology and developments in usability and functionality, monitoring and sampling devices and techniques will evolve and change. It is incumbent on the AHJ and the technician to remain current and knowledgeable of these evolutions and changes. The items associated with 7.2.1.2(2) represent the most up-to-date available at the time this handbook was printed. The technician needs only to be proficient in the use of the equipment supplied by the AHJ. However, the technician must be well informed about all of the technologies to know what may be available for a specific purpose.

A radioactive isotope identifier or radiation isotope identification device (RIID) is a type of radiation detection instrument capable of identifying gamma-emitting isotopes. Many also include a dose rate measurement feature, and some may also be equipped with neutron detection capability. In addition to giving the user the name of the gamma-emitting isotope (Co-60, Ir-192, etc.), many RIID devices will tell the user what the material is commonly used for (e.g., medical, industrial, natural).

Closer Look

Responders who operate monitoring equipment must know how to field calibrate it to get accurate readings and must be able to perform field maintenance per the manufacturer's manual.

Radioactive material packages may require special labels in addition to any package marking required. The labels alert people, particularly handlers, that the package contains radioactive material and that the package may require special handling and storage controls. On vehicles, the labels might not be easily accessible, and the vehicle may not require placarding. Additionally, some radioactive material packages do not require labels. Bulk packages containing large volumes of low-level radioactive material may not require labels, although vehicle placards may be required. There are five labels for packages containing radioactive materials:

(1) Radioactive White I
(2) Radioactive Yellow II
(3) Radioactive Yellow III
(4) Fissile
(5) Empty

Commercial carriers who transport radioactive materials by air (e.g., FedEx) follow International Air Transport Association (IATA) rules. The IATA regulations are at least as restrictive as DOT regulations and, in some cases, may be more restrictive for certain materials. Limited quantities of radioactive material shipped by air will bear a label with the UN identification as shown in Exhibit I.7.11. Limited quantities of radioactive material bearing this label will have external contact radiation levels of 0.5 mrem/hour (0.005 mSv/hour) or less.

EXHIBIT I.7.11

Examples shown are for two types of labels: a) Radioactive II label and b) cargo aircraft label. [Courtesy of Kaspri/Shutterstock (top); Courtesy of Pavel Masychev/Shutterstock (bottom)]

The Radioactive White I label (see Exhibit I.7.12) is attached to packages with external contact radiation levels of 0.5 mrem/hour (0.005 mSv/hour) or less. The Radioactive Yellow II label (see Exhibit I.7.13) is attached to packages with external contact radiation levels of greater than 0.5 mrem/hour (0.005 mSv/hour) to no more than 50 mrem/hour (0.5 mSv/hour). The maximum allowable transport index for this label is 1.

EXHIBIT I.7.12

Example of a Radioactive White I label. (Source: Department of Energy Transportation Emergency Preparedness Program)

EXHIBIT I.7.13

Example of a Radioactive Yellow II label. (Source: Department of Energy Transportation Emergency Preparedness Program)

The Radioactive Yellow III label (see Exhibit I.7.14) is attached to packages with external contact radiation levels of greater than 50 mrem/hour (0.5 mSv/hour) to a maximum of 200 mrem/hour (2 mSv/hour). The maximum allowable transport index for this label is 10.

The Fissile label (see Exhibit I.7.15) is applied to packages that contain fissile materials. The criticality safety index (CSI) for each package is noted on the label. The CSI is displayed on the label to assist the shipper in controlling how many fissile packages can be grouped together on a conveyance. When applicable, the Fissile label appears adjacent to the radioactive material label (e.g., White I, Yellow II, etc.).

The Empty label (see Exhibit I.7.16) is applied to packages that have been emptied of their contents as far as practical but may still

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Closer Look ***(Continued)***

EXHIBIT I.7.14

Example of a Radioactive Yellow III label. (Source: Department of Energy Transportation Emergency Preparedness Program)

EXHIBIT I.7.16

Example of a Radioactive Empty label. (Source: Department of Energy Transportation Emergency Preparedness Program)

EXHIBIT I.7.15

Example of a Fissile label. (Source: Department of Energy Transportation Emergency Preparedness Program)

contain regulated amounts of internal contamination and minimal radiation levels detectable outside the package. Packages bearing this label have external contact radiation levels of 0.5 mrem/hour (0.005 mSv/hour) or less.

The labels used for radioactive material in 7.2.1.2(1)(e) give responders information about the external level of radiation hazard a material presents. The category of label used is based on the package's external radiation dose rate or the material contained within the package. The Radioactive White I label is used for packages with the lowest level external radiation hazard; Radioactive Yellow II label, with two vertical bars, is used for the next highest level; and Radioactive Yellow III label is used on packages with the highest level of external radiation hazard. The appropriate radioactive label must appear on two (opposing) sides of the package. On vehicles, these labels might not be easily visible, and the vehicle may not require placarding. If labeled radioactive material packages are on a conveyance, they will appear on the shipping papers.

7.2.2 Collecting and Interpreting Hazard and Response Information. Given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, access to approved reference sources (technical resources, computer databases, and results of monitoring equipment), and approved tools and equipment access to approved resources (technical resources, computer databases, and results of monitoring equipment), and approved tools and equipment, the hazardous materials technician shall collect, interpret, and communicate hazard and response information not available from the current edition of the ERG or an SDS and shall meet the requirements of 7.2.2.1 through 7.2.2.5.

At the operations level, the responder must be able to collect hazard and response information from sources that, in general, are readily available, such as the ERG or SDSs. At this level, however, the technician responder is required in 7.2.2 to be able to collect and interpret information from a number of sources. Technician level responders must understand the importance of using multiple resources for gathering hazard and response information. HMTs should collect information from a variety of resources, compare that information, and then make decisions based on this comparison.

Δ **7.2.2.1*** Identify and explain the types, advantages, and limitations of hazard and response information available from each of the following resources:

(1) Hazardous materials databases
(2) Monitoring equipment

Monitoring equipment in 7.2.2.1(2) provides information about the hazards that are present. The responder should not rely on a single means of monitoring at any incident because the equipment could be affected by unknown materials and give a false reading. Technician level responders should have a sound understanding of the instruments they are using and recognize the value of not relying on a single source for determining the level of hazard present.

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A.7.2.2.1 For example, the significance of high concentrations of three airborne hazardous materials/WMD readings at scenarios relative to the hazards and harmful effects of the hazardous materials/WMD on the responders and the general public should be known.

(3) Reference manuals
(4) Technical information centers (i.e., CHEMTREC/CANUTEC/SETIQ and governmental authorities)

Technical information centers, such as CHEMTREC, can provide the responder with valuable information during hazardous materials incidents, and the HMT's knowledge of the assistance that is available from these sources is important. Using its database, CHEMTREC can provide initial response information on more than 1 million product-specific SDSs. CHEMTREC can put the responder at the scene in contact with the shipper to help the responder identify the materials involved in an incident using waybill numbers and other sources. CHEMTREC also can help the responder contact manufacturers and other technical specialists. If needed, CHEMTREC can activate its emergency response mutual aid network, composed of more than 250 emergency response teams from chemical companies and private contractors that can respond to the scene of an incident and help those on site.

(5) Technical information specialists

Technical information specialists in 7.2.2.1(5) can be a valuable asset to the responder. The HMT may want to keep a directory of individuals who are able to provide technical assistance. However, the responder must remember that no individual is likely to have all the answers. For example, there are chemists who specialize in formulating perfumes and chemists who specialize in formulating explosives. Depending on the type of incident the responder is involved in, the assistance of one would be more appropriate than the assistance of the other.

Developing a network of people with technical knowledge is one of the most important things a responder can do. Because incidents differ, responders cannot rely on finding books or databases that address all the possibilities.

Many databases are available. The Computer-Aided Management of Emergency Operations (CAMEO) is probably the most widely used and is available for both Windows and Macintosh platforms. Other public-domain databases are also available, including the Oil and Hazardous Materials Technical Assistance Database (OHM/TADS), Registry of Toxic Effects of Chemical Substances (RTECS), and Chemical Hazard Response Information System (CHRIS). Each database presents information differently and concentrates on different areas. Technician level responders should understand the variances among them and use the databases that are the most appropriate for handling a specific incident.

Δ **7.2.2.2** Describe the following hazard and response terms including chemical and physical properties, radiation, exposure; the significance in the risk analysis process; and application of hazard and response:

(1) Air reactivity

Materials that are potentially air-reactive can ignite if they are exposed to air. The potential for container failure due to overpressurization exists.

(2) Autorefrigeration

Autorefrigeration is a phenomenon that occurs during the rapid release (boiling) of a liquefied gas that causes it to temporarily remain in a liquid state through rapid cooling. This situation could lead a technician to falsely assume product elimination until the product resumes boiling and its subsequent release.

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(3) Boiling point

The boiling point is the temperature at which the transition from liquid to gas occurs. At this temperature, the vapor pressure of a liquid equals the surrounding atmospheric pressure so that the liquid rapidly becomes a vapor. Flammable materials with low boiling points generally present greater problems than those with high boiling points. For example, the boiling point of acetone is 133°F (56°C), and the boiling points for jet fuels range from 400°F to 550°F (204°C to 288°C).

(4) Catalyst

Catalysts are used to control the rate of a chemical reaction by either speeding it up or slowing it down. If used improperly, catalysts can speed up a reaction and cause failure of a container that cannot withstand either the pressure or the heat buildup.

(5) Chemical change
(6) Chemical interactions

The chemical interaction of materials in a container can result in a buildup of heat that, in turn, causes an increase in pressure. The combined materials could be more corrosive than the material the container was originally designed to withstand, and the container might fail.

(7) Compound, mixture

Compounds have a tendency to break down into their component parts, sometimes in an explosive manner. If the compound nitroglycerine is contaminated, for example, it can decompose explosively when heated or shocked.

(8) Concentration

When dealing with corrosives, the amount of acid or base is compared with the amount of water present. Concentrated acids are not the same as strong acids. A high concentration of a weak acid and a low concentration of a strong acid are both possible.

(9) Corrosive (acids and bases/alkaline)

Corrosives (acids and bases/alkalines) can cause the pressure within a container to rise, particularly if they become contaminated. The increased pressure can exceed the design load.

(10) Critical temperature

Critical temperature relates to the process of liquefying gases. The critical temperature is the minimum temperature at which a gas can be liquefied no matter how much pressure is applied.

A gas cannot be liquefied above its critical temperature. The lower the critical temperature, the less pressure is required to bring a gas to its liquid state. If a liquefied gas container exceeds its critical temperature, the liquid converts instantaneously to gas, which can cause the container to fail violently.

(11) Cryogenic liquid heat transfer processes (conduction, convection, radiation, and direct contact)
(12) Liquid heat transfer processes; conduction, convection, radiation, and direct contact (e.g., with cryogenic)

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Because cryogenic liquids are kept at temperatures below −130°F (−90°C), cryogenic liquid spills vaporize rapidly when exposed to the higher ambient temperatures of the atmosphere outside the tank. Expansion ratios for common cryogenics range from 560 to 1445 to 1.

(13) Decomposition temperature
(14) Dose

Radiation dose is the amount of radiation energy deposited in the body. Radiation dose rate is a measure of the rate at which radiation energy is deposited in the body. Radiation dose rate is often measured in exposure per unit of time (e.g., mrem/hour). These measurements are similar to the speedometer and odometer in a car. The speedometer measures the rate of speed, like a dose rate; the odometer measures the total distance traveled, like the total dose received.

Radiation dose is usually measured in millirem (mrem), and radiation dose rate is usually measured in millirem per hour. In the United States, the annual average radiation dose per person from all sources is about 620 mrem. However, receiving far more than that in a given year (largely due to medical procedures) is not uncommon. Workers at nuclear facilities are allowed up to 5,000 mrem of radiation exposure each year.

(15) Dose response

Dose–response relationship is the biological reaction caused by the dose in the body. This can relate to chemical, biological, or radiological doses. The degree of harm is directly related to the dose (time and amount) and its impact on bodily functions.

(16) Endothermic
(17) Evaporization rate
(18) Exothermic
(19) Expansion ratio
(20) Half-life

The term half-life refers to the time it takes for one-half of the radioactive atoms in a sample to decay to another form. Some radioactive materials decay rapidly, with half-lives of seconds, hours, or days. Some radioactive materials have half-lives of billions of years. For example, a radioactive form of technetium commonly used in medical diagnostic studies has a half-life of 6 hours. Thorium-232, radioactive material found in many foreign-made lantern mantles, however, has a half-life of 14 billion years.

(21) Inhibitor

Inhibitors are added to products to control their chemical reaction with other products. For example, an inhibitor is added to a monomer, such as ethylene, to keep it from polymerizing when the material is shipped. If the inhibitor is not added or escapes during an incident, the material will begin to polymerize, which creates a very dangerous situation. The final result may be a violent rupture of the container.

(22) Maximum safe storage temperature (MSST)

The maximum safe storage temperature (MSST) is the temperature at which organic peroxides should be stored to ensure that they do not reach the self-accelerating decomposition temperature. The maximum safe storage temperature for organic peroxides should not be exceeded.

(23) Melting point and freezing point

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The melting point is the temperature at which a solid becomes a liquid. Materials with low melting points present problems because they easily become liquid and spread more readily. The reverse is also true, however. If the temperature of a liquid can be lowered, the responder might be able to convert it to a solid.

(24) Miscibility
(25) Odor and odor threshold
(26) Organic and inorganic

Organic materials are derived from materials that are living or were once living, such as plants or decayed products, and they contain chains of two or more carbon atoms. An example of an organic material is methane (CH_4). Inorganic materials lack carbon chains, but they can contain a carbon atom. An example of an inorganic material that contains a carbon atom is carbon dioxide (CO_2). Knowledge of whether a material is organic or inorganic can be helpful in choosing the proper instrumentation. Some organic materials are reactive with oxidizers. In addition, inorganic acids are generally stronger than organic acids at the same concentration. Organic acids are generally flammable, and as a rule, they are also toxic and explosive acids.

(27) pH
(28) Physical change
(29) Radioactivity

The process of an unstable (radioactive) atom-emitting radiation is called radioactivity. Radioactive atoms can be generated through nuclear processes, but they also exist naturally in things such as uranium ore, thorium rock, and some forms of potassium. When a radioactive atom goes through the process of radioactivity, also called radioactive decay, the atom changes to another type of atom. In fact, a radioactive atom can change from one element to another element during the decay process. For example, the element uranium eventually changes to lead through radioactive decay. The length of time for this stabilizing process can take from a fraction of a second to billions of years, depending on the particular type of atom.

When radioactive material is transported, the level and type of radioactivity determines the type of packaging the radioactive material needs. The greater the level of radioactivity, the greater and more robust the packaging requirements (i.e., the greater the radiological hazard, the stronger the package).

(30) Reactivity

Chemical reactivity describes a substance's propensity to release energy or undergo change. Some materials are self-reactive or can polymerize. Others undergo violent reactions if they come in contact with other materials. Substances that are air-reactive ignite or release energy when exposed to air. Organic peroxides are examples of highly reactive materials. Other examples are corrosives, radioactive materials, oxidizing materials, pyrophoric substances, explosives, and water-reactive materials.

Water reactivity describes the sensitivity of a material to water without the addition of heat or confinement. The more sensitive materials release heat or flammable or toxic gases. Some materials even react explosively when they are exposed to water. Examples of water-reactive substances are sulfuric acid and sodium and aluminum chloride.

(31) Relative density
(32) Self-accelerating decomposition temperature (SADT)

Once an organic peroxide exceeds the MSST, it can reach the self-accelerating decomposition temperature (SADT). Once the organic peroxide reaches the SADT, there is no intervention possible to stop the decomposition.

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(33) Solubility

The ability of a substance to form a solution with water can be important when determining control methods. For example, gasoline is insoluble, while anhydrous ammonia is soluble.

(34) Solution and slurry

A solution is a mixture in which all of the ingredients are dissolved completely. It is a homogeneous mixture of the molecules, atoms, or ions of two or more substances. A slurry is a pourable mixture of a solid and a liquid.

(35) Strength

The word *strength* describes the concentration of a solution. In corrosives, strength refers to the degree of ionization of the acid or base in water. Hydrochloric acid is a strong acid, for example, and acetic acid is a weak acid.

(36) Sublimation

In sublimation, a substance passes directly from the solid state to the vapor state without passing through the liquid state. Solids such as dry ice and naphthalene (used in mothballs) are two examples. An increase in temperature increases the rate of sublimation. During an incident, a responder should assess the toxicity and flammability of the vapors of any spilled material that sublimes. The opposite of sublimation is deposition.

(37) Temperature of product

The temperature of a product influences the measures taken to control an incident that involves that product. A product's temperature may also present hazards. An incident involving molten sulfur, for example, raises a different set of concerns than one involving a cryogenic material such as liquefied natural gas.

(38) Volatility

Volatility describes the ease with which a liquid or solid can pass into the vapor state. The higher a material's volatility, the greater its rate of evaporation. Vapor pressure is a measure of a liquid's propensity to evaporate. Thus, the higher a liquid's vapor pressure, the more volatile it is. During an incident, a volatile material disperses in air and expands the endangered area.

(39) Viscosity

Viscosity, a measure of the thickness of a liquid, determines how easily it flows. Liquids with high viscosity, such as heavy oils, must be heated to increase their fluidity. Liquids that are more viscous tend to flow more slowly, while those that are less viscous spread more easily. During an incident, liquids that are less viscous are likely to flow away from a leaking container, expanding the endangered area.

7.2.2.3 Identify the signs and symptoms, and target organ effects of exposure to hazardous materials/WMD.

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The responder at this level is required to be able to use various references to determine what effect various chemicals have on target organs. For example, *Emergency Care for Hazardous Materials Exposures* is a good resource for signs and symptoms and notes the chemicals that may have caused the effects [6].

7.2.2.4* Identify hazardous and response information to be communicated.

Δ **A.7.2.2.4** The selection of scenarios to test the knowledge and ability to identify exposure symptoms should include the following:

(1) Select materials common to the jurisdiction.
(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.

7.2.2.5 Collect and interpret hazardous and response information.

• **7.2.3* Describing the Condition of the Container Involved in the Incident.** Given an incident involving hazardous materials/WMD; an assignment in an IAP; policies and procedures; identity of material(s) involved and the hazards including results of detection, monitoring, and sampling; a container with required markings; and approved resources, the hazardous materials technician shall identify the container and its closures, identify the damage to the container and its closures, identify the stress(es) on the container, describe the level of risk associated with the damage and stress(es), and communicate this information by completing the related requirements of 7.2.3.1 through 7.2.3.3.

A.7.2.3 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

N **7.2.3.1** Identify the basic design and construction features, including closures for bulk, intermediate bulk, and nonbulk containers; facilities containers; radioactive materials containers; and piping and pipelines.

N **7.2.3.2** Identify the typical types of damage for bulk, intermediate bulk, and nonbulk containers; facilities containers; radioactive materials containers; and piping and pipelines and the levels of risk associated with the damage.

(1) Describe types of stress(es)
(2) Identify methods for determining the pressure and quantity of lading remaining in containers and indicators of an increase in container pressure

N **7.2.3.3** Assess the condition of the container and its contents following safety procedures, avoiding and minimizing hazards, and protecting exposures and personnel.

(1) Identify the type of damage to the container and its closures and level of risk associated with the damage
(2) Identify the stress(es) on the container
(3) Communicate the results of the assessment

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7.2.4 Predicting Likely Behavior of Materials and Their Containers Where Multiple Materials Are Involved. Given an incident involving multiple hazardous materials/WMD; an assignment in an IAP; policies and procedures; physical and chemical properties of the materials involved; results of detection, monitoring, and sampling; condition of the container [damage and stress(es)]; surrounding conditions; and approved reference sources, the hazardous materials technician shall identify the likely behavior of the hazardous material/WMD involved, identify the reactivity issues and hazards of the combined materials, and communicate a description of the likely behavior by meeting the following requirements:

(1) Identify resources that indicate the reactivity issues of mixing various hazardous materials/WMD
(2) Identify the impact of the following fire and safety features on the behavior of the products during an incident at a bulk liquid facility and explain the significance in the analysis process:

  (1) Fire protection systems

> Fire protection systems allow responders to apply re-extinguishing agents sooner and to control an incident in its initial stages, thus reducing the threat to adjoining containers.

  (2) Monitoring and detection systems

> Monitoring and detection systems permit early notification of potential problems and allow responders to initiate control actions while an incident is still relatively small, thereby limiting the threat to other containers.

  (3) Pressure relief and vacuum relief protection

> Pressure relief devices need to be capable of operating freely to keep the tank from failing violently. Vacuum relief devices also need to be operable to keep the tank from imploding.

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

> Dikes and other impoundment features are designed to contain spilled product and minimize the exposure to adjoining tanks. See NFPA 30, *Flammable and Combustible Liquids Code,* for information about diking requirements. [7]

  (5) Tank spacing

> Adequate tank spacing minimizes the hazard to uninvolved tanks. See NFPA 30 for information about tank spacing requirements.

  (6) Transfer operations

> Transferring a product from one tank to another may minimize the danger to surrounding containers.

(3) Identify the impact of the following fire and safety features on the behavior of the products during an incident at a bulk gas facility and explain the significance in the analysis process:

  (1) Fire protection systems
  (2) Monitoring and detection systems
  (3) Pressure relief protection
  (4) Transfer operations

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Δ **7.2.5 Estimating the Likely Size of an Endangered Area.** Given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, the likely behavior of the container and its contents, and approved resources and equipment, the hazardous materials technician shall use approved resources and equipment; measure and predict concentrations of materials within the endangered area; identify the physical, health, and safety hazards within the endangered area; identify the areas of potential harm in the endangered area; estimate the potential outcomes within the endangered area; and communicate the potential outcomes by completing the following requirements:

7.2.5.1 Identify resources for dispersion pattern prediction and modeling, including computers, monitoring equipment, or specialists in the field.

The responder is required to be able to identify resources that help predict dispersion patterns. These resources include the weather service; computer models; industrial facilities; colleges or universities; county, state, or federal agencies such as health departments; environmental protection agencies; and the U.S. Coast Guard, among others. Responders must be able to predict dispersion patterns to determine which areas are likely to become endangered by a spill.

7.2.5.2 Identify the methods for measuring and predicting concentrations of materials within the endangered area to determine public protective response options and the areas to be protected.

N **7.2.5.3** Identify the methods for identifying the physical, safety, and health hazards within the endangered area.

7.2.5.4 Describe the following health hazard terms and exposure values, and explain the significance in the analysis process:

(1) Counts per minute (cpm) and kilocounts per minute (kcpm)

Counts per minute and kilocounts per minute are measurements of radioactivity.

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

The term *immediately dangerous to life or health* (IDLH) is defined by the U.S. National Institute for Occupational Safety and Health (NIOSH) as exposure to airborne contaminants that is "likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment."

(3) Incapacitating concentration 50 percent
(4) Incubation period

Incubation period is the latency between exposure to a pathogen and onset of symptoms.

(5) Infectious dose

An infectious dose is the amount of a pathogen necessary to manifest its pathogenicity. It is dependent on pathogenic variables as well as host variables such as health, gender, predisposition, and several others.

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(6) Lethal concentrations (LC_{50})

The lethal concentrations (LC_{50}) is the median lethal concentration of a hazardous material. The term is defined as the concentration of a material in air that, on the basis of laboratory tests (inhalation route), is expected to kill 50 percent of a group of test animals when administered in a specific time period.

(7) Lethal dose (LD_{50})

The lethal dose (LD_{50}) of a substance is a single dose that causes the death of 50 percent of a group of test animals exposed to it by any route other than inhalation.

(8) Parts per billion (ppb)

Parts per billion (ppb) denotes one particle of a given substance for every 999,999,999 other particles. This is roughly equivalent to one drop of ink in a lane of a public swimming pool, one second per 32 years, or one part in 109.

(9) Parts per million (ppm)
(10) Permissible exposure limit (PEL)

Permissible exposure limit (PEL) is a term OSHA uses in its health standards covering exposures to hazardous chemicals. This limit is similar to the threshold limit value time-weighted average (TLV-TWA) established by the American Conference of Governmental Industrial Hygienists (ACGIH). PEL, which generally relates to legally enforceable TLV limits, is the maximum concentration, averaged over 8 hours, to which 95 percent of healthy adults can be repeatedly exposed for 8 hours per day, 40 hours per week.

(11) Radiation absorbed dose (rad)
(12) Roentgen equivalent man (rem), millirem (mrem), microrem (µrem)

Radiation is often measured in units of roentgen (r), rad (radiation absorbed dose), and rem (roentgen equivalent man). For all practical purposes, these units are all equal. Radiation dose (dose to the human body) is measured in the traditional unit of rem. Because one rem of radiation is a fairly large amount of radiation, the prefix x micro (µ) or milli (m) is often used. Micro means one one-millionth (1/1,000,000) and milli means one one-thousandth (1/1,000). In other words, there are 1,000,000 microrem in one rem, or 1000 millirem (mrem) in one rem. A typical radiation dose from a medical x-ray is about 40 mrem (e.g., thoracic spine x-ray). The SI unit for radiation dose equivalence is the sievert, which is equal to 100 rem. According to the National Council on Radiation Protection (NCRP), the average person is exposed to a dose of approximately 620 mrem per year from both manmade and natural sources [8].

(13) Sievert, millisievert (mSv), microsivert (µSv)
(14) Threshold limit value ceiling (TLV-C)

The threshold limit value ceiling (TLV-C) is the maximum concentration to which a healthy adult can be exposed without risk of injury. This limit is comparable to the IDLH, and exposures to higher concentrations should not occur.

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

The threshold limit value short-term exposure limit (TLV-STEL) is the maximum average concentration, averaged over a 15-minute period, to which healthy adults can be safely exposed for up to 15 minutes continuously. Exposure should not occur more than four times a day with at least 1 hour between exposures.

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

The TLV-TWA is the maximum concentration, averaged over 8 hours, to which a healthy adult can be repeatedly exposed for 8 hours per day, 40 hours per week.

Δ **7.2.5.5** Identify methods for determining the areas of potential harm within the endangered area.

An estimate is a series of predictions that attempts to provide an overall picture of potential outcomes. Responders are required to assess the information gathered during analysis and predict the outcome based on that assessment.

According to the National Fire Academy's (NFA) *Initial Response to Hazardous Materials Incidents, Course II: Concept and Implementation,* it is necessary to break an incident into the following three components:

- The product
- The container
- The environment [9]

Each of these components can then be broken into three subgroups of damage, hazard, and vulnerability risk. In addition, incidents could have the following three elements that can occur separately or in conjunction with one another:

- A spill
- A leak
- A fire

The estimate identifies the relationships between the three components of an incident and the three elements of an incident.

The NFA course states, "An estimate is made by analyzing the physical, cognitive, and technical information that has been gathered. Then, by breaking the incident into the components dealing with product, container, environment and their respective sub-groups, a conclusion can be drawn . . . [a] conclusion with some measure of quantifiable accuracy that suggests what the full impact(s) of the relationships will be."

It is important for HMTs to understand that this analysis continues throughout an incident. As new information is gathered, old estimates should be verified or new estimates made. Predictions, which should be based on worst-case scenarios, allow the responder to develop an overall estimate of the incident's potential outcomes.

Incident commanders should keep in mind that the safety of both emergency personnel and the public is their primary objective. There might be times when the most prudent action is no action (nonintervention), and the establishment of an appropriate evacuation area is the best possible course to take.

Δ **7.2.5.6*** Identify methods for determining the outcomes within an endangered area.

• **A.7.2.5.6** The process for estimating the potential outcomes within an endangered area at a hazardous materials/WMD 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.
•

Δ **7.2.5.7** Given a hazardous materials/WMD release and the corresponding instrument monitoring readings, the hazardous materials technician shall determine the applicable public protective response options and the areas to be protected.

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7.3 Competencies — Planning the Response.

7.3.1 Identifying Response Objectives and Options.

7.3.1.1 Given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis including incident-related information, life safety risks, environmental risks, and property risks; available resources; and policies and procedures, the hazardous materials technician shall develop and recommend to the incident commander (IC) or hazardous materials officer response objectives and options by completing the following requirements:

(1) Describe the considerations for identifying response objectives (defensive, offensive, and nonintervention)

In Chapter 5 and Chapter 6, the operations level responder is required to determine the appropriate response objectives for responders at that level based on training and equipment. The response objectives for the HMT are expanded to include additional control options and protective actions. In *Fire Protection Handbook*, Wright notes the following:

> The first task in planning the response is to determine the response objectives (strategy) based on the estimated outcomes. The response objectives, based on the stage of incident, are the strategic goals for stopping the event now occurring or keeping future events from occurring.
>
> Two basic principles apply to these decisions:
>
> **1.** One cannot influence events that have already happened or change the outcomes of those events.
> **2.** The earlier that the event sequence can be interrupted, the more acceptable the loss.
>
> The following steps should be taken when determining response objectives:
>
> **1.** Estimate the exposures that could be saved. The level of response and the acceptable risk associated with a response is based on the exposures that can be saved. The number of exposures that could be saved is based on the estimated outcomes minus the exposures already lost.
> **2.** Determine the response objectives. The response objectives, based on the stage of the incident, are the strategic goals for stopping the event now occurring or keeping future events from occurring. Decisions should focus on changing the actions of the stressors, the containment system, and the hazardous material. [2] p. 13–137

The National Incident Management System (NIMS) ICS model specifies that the IC will develop response objectives that in turn drive response strategies and tactics. The HMT can recommend strategies to the IC based on an evaluation of the hazards and risk and vulnerability assessment. Incident objectives should reflect the actions to be taken to bring the incident to a successful conclusion, and may be included in the IAP and reflected in the site safety plan. See Exhibit 1.7.17.

(2) Describe the considerations for identifying the possible response options to accomplish a given response objective

Because they can conduct offensive operations, HMTs can take actions that are not available to the responder at the operations level without mission-specific training. Exhibit I.7.18 shows a sample Response Objective Analysis Form, which helps the HMT identify the options available to accomplish response objectives. The responder should note that many of the options available can be used either offensively or defensively. For example, the size of the endangered area may be changed defensively by placing barriers around the endangered area to contain a spill or offensively by entering the hot zone and plugging the leak. The HMT may also choose defensive operations as the most prudent method of dealing with an incident.

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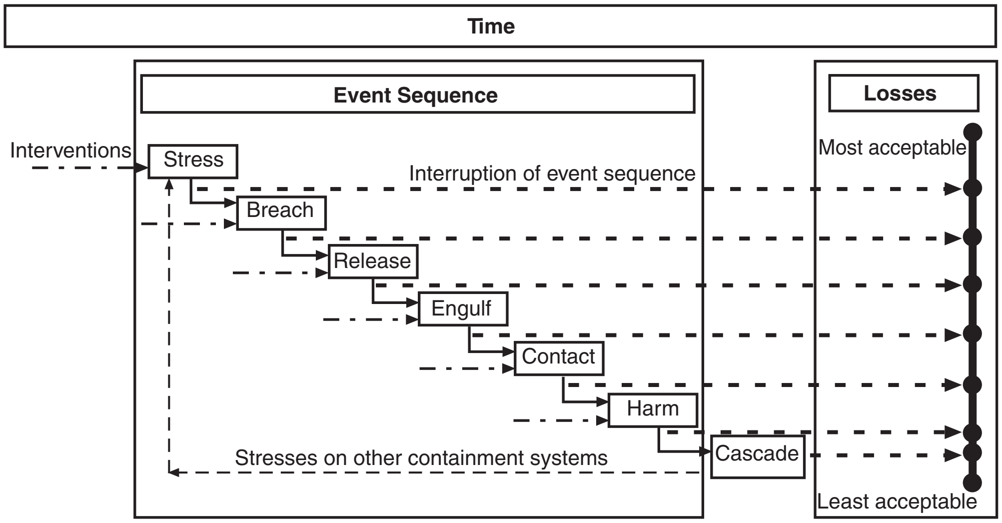

EXHIBIT I.7.17

This chart depicts the relationship between the sequence of events and potential losses.

N **7.3.2 Selecting Personal Protective Equipment PPE.** Given a hazardous materials/WMD incident, results of the incident analysis, response objectives and options for the incident, approved references, and policies and procedures, the hazardous materials technician shall select the PPE required for the specified response option(s) by completing the following requirements:

N **7.3.2.1** Identify types of PPE available for response based on NFPA standards and classifications levels, the OSHA/EPA levels of PPE (A, B, C, D) and the advantages of using certified PPE.

Levels of protection are described in 29 CFR 1910.120, Appendix B, "General Description and Discussion of the Levels of Protection and Protective Gear" [1]. Technicians are also advised to read A.6.2.3.1(1) in NFPA 472, which identifies the need to use protective clothing from a performance-based application. Additionally, the performance-based requirements for hazardous materials/WMD response are identified in NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies,* and NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents* [10, 11].

Responders who have not been adequately trained to select and use PPE should not be permitted to wear such equipment at a hazardous materials incident. Training in the selection and use of PPE should be thorough and frequent enough for the responder to become fully familiar with the equipment's limitations. Responders should be trained to select, don, operate, test, clean, maintain, and care for the clothing that they may need to use at an incident.

During an incident, responders may have to change the level of protection they are wearing from high to low, or vice versa. This decision is made by the IC, based on evaluation of the hazards to personnel present at the scene.

N **7.3.2.2** Describe the types of PPE available for the following hazards:

(1) Thermal
(2) Radiological
(3) Asphyxiating
(4) Chemical
(5) Etiological
(6) Mechanical

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EXHIBIT I.7.18

Response Objective Analysis Form	Containment System ID
	Material

Event Sequence

Stress	Breach	Release	Engulf	Contact	Harm

Response Objectives

Change Applied Stresses	Change Breach Size	Change Quantity Release	Change Size of Danger Zone	Change Exposures Contacted	Change Severity of Harm

Sample Response Options

Move stressor Move stressed system Shield stressed system	Chill contents Limit stress levels Activate venting devices Mechanical repair	Change container position Minimize pressure differential Cap off breach Remove contents	Barriers Dikes and dams Adsorbents Absorbents Diluents Reactants Overpack	Provide sheltering Begin evacuation Personal protective equipment	Rinse off contaminant Increase distance from source Provide shielding Provide prompt medical attention

This response objective analysis worksheet is used for identifying response options in a hazardous materials incident by response objective. (Source: Adapted from Ludwig Benner's Textbook for Use in the Study of Hazardous Materials Emergencies)

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N **7.3.2.3** Identify the factors to be considered in selecting PPE for the following specified action options:

(1) In selecting chemical-protective clothing (CPC)

One type of chemical-protective clothing (CPC) cannot satisfy all protection needs for every hazardous materials incident. Based on a hazard analysis and risk assessment, the primary considerations required in selecting the proper PPE should focus on the known hazards, the specific tasks to be performed, the compliance with instructions and limitations as provided by the manufacturer, and the potential for exposure, especially through degradation, penetration, and permeation. An option now becoming more popular with many hazardous materials teams is the use of disposable or "limited" use suits.

(2) Significance of degradation, penetration, and permeation on the selection of protective clothing

Degradation of CPC can be either chemical or physical. The result of degradation is an increased likelihood that a hazardous material will permeate and penetrate the garments, thus endangering the health of the responder.

Chemical degradation can be minimized by avoiding unnecessary contact with chemicals and by undergoing effective decontamination procedures. The choice of CPC is important. The garments a responder wears should be chosen based on their compatibility with the chemicals involved in an incident and breakthrough times consistent with their expected use.

Protective clothing can also degrade physically, such as might occur when the garment rubs against a rough surface. CPC wearers should recognize the physical limitations of their garments and make every effort to avoid circumstances that may cause the material to be damaged physically.

NFPA 1991 and NFPA 1994 contain criteria for abrasion or tear testing and for manufacturers' certification of CPC. When purchasing CPC, the responder should ascertain whether the garments are certified to the appropriate NFPA CPC standard.

Penetration is the movement of a material through a suit's closures, which include zippers, buttonholes, seams, flaps, and other design features of CPC. Hazardous materials can also penetrate CPC through cracks or tears in the suit's fabric.

Protection against penetration is vital. A regular and routine program of inspection can help uncover conditions that could lead to penetration. CPC must also be stored properly, maintained regularly, and tested to ensure that it can still provide the proper level of protection. NFPA 1991 and NFPA 1992, *Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies*, provide criteria for testing CPC for penetration resistance and for manufacturer's certification of CPC [12].

Different fabrics have different resistance levels to chemical permeation and will absorb chemicals over a period of time. NFPA 1991 and NFPA 1994 provide guidelines for manufacturer permeation testing and certification. CPC technologies are constantly changing, and it is essential that technicians stay abreast of these changes that will reduce inherent hazards of CPC and provide adequate protection.

NFPA 1991 requires the manufacturer to provide documentation on a garment's permeation resistance for 3 hours against at least the following chemicals:

- Acetone
- Acetonitrile
- Anhydrous ammonia
- Carbon disulfide
- Chlorine
- Dichloromethane
- Diethyl amine*
- Dimethyl formamide

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- Ethyl acetate
- Hexane*
- Nitrobenzene
- Sodium hydroxide*
- Sulfuric acid*
- Tetrachloroethylene*
- Tetrahydrofuran*
- Toluene*

*NFPA 1994 requires that the manufacturer provide documentation on a garment's permeation resistance for 1 hour with these chemicals.

Before buying CPC, the HMT should make sure that the garment meets, and has been certified as meeting, the appropriate standard. When choosing CPC, the HMT must be sure that the garment is compatible with the type of material to which it is going to be exposed. In any event, the wearer is advised to use extreme caution. Available data do not cover every situation the responder may encounter.

(3) Indications of material degradation of protective clothing

Indications of material degradation that the HMT is required to know are as follows:

- Stiffness or excess pliability
- Tears, cuts, or abrasions
- Damage to zippers or other closures

(4) Different designs of liquid splash-protective ensembles and vapor-protective ensembles and their advantages and disadvantages

Type 1 protection is a fully encapsulating, airtight vapor-protective suit with self-contained breathing apparatus (SCBA) worn inside it. This protection offers responders the maximum level of protection. Challenges that might be encountered include potential heat exposure, communications, visibility, and mobility.

Type 2 protection is a nonencapsulating suit with SCBA worn on the outside. This protection provides more comfort and mobility and allows air bottles to be exchanged easier. The face shield serves as an effective barrier against chemical permeation for respiratory protection depending on compatibility.

Type 3 protection is a supplied air respirator (SAR) with encapsulation suits. This protection provides positive pressure using an airline hose for extended operations. Limitations include the length of the hose line, up to 300 ft (91.4 m), which can become a potential tripping hazard, restrict maneuverability, and require an emergency air source, such as an SCBA or escape pack.

(5) Types, advantages, and disadvantages of cooling measures used for personnel who are wearing PPE

CPC can cause wearers to suffer increased heat stress. Thus, it is important for responders to be monitored closely while working in CPC.

Some CPC garments have temperature control features. Some have air-cooling systems that require an air line and large quantities of breathable air. Others incorporate water-cooling systems that require an ice supply or refrigeration units and a pump. This adds additional weight and bulk to the suit. Users should conduct a thorough evaluation of such units to make sure they are appropriate for the intended use.

There are also vests that can hold coolant packs. This requires a supply of the frozen coolant packs or an ice source at the scene. The vests add more weight to the CPC.

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N **7.3.2.4** Identify the effects of physiological and psychological stresses on users of PPE.

Specialized protective clothing, particularly fully encapsulating garments, increases the stress a responder can feel when working at a hazardous materials incident. Persons wearing CPC usually experience a loss of dexterity and mobility. The higher the level of protection is, the greater this loss. The responder's visibility is also restricted, and his or her communication is affected. In addition, wearing CPC increases the likelihood of heat stress and heat injury. Reductions in dexterity, mobility, visibility, and communication, in turn, create additional physical and mental stresses.

Familiarity with wearing and working in the garment reduces any mental anxiety associated with garment wear. Thus, frequent drills are essential. The HMT's awareness of these additional stresses is important, and he or she should receive adequate rest and rehabilitation before, during, and after suit wear. This list is not all-inclusive, and users should check manufacturers' recommendations for the inspection of CPC. Drinking fluids such as water before donning CPC reduces some of the effects of excess heat.

N **7.3.2.5** Identify the process for inspecting, testing, and maintenance of PPE.

Δ **7.3.3 Selecting Decontamination Procedures.** Given a hazardous materials/WMD incident, results of the incident analysis, response objectives and options for the incident, available resources, and policies and procedures, the hazardous materials technician shall select the decontamination procedure for a given response action, the equipment required to implement that procedure by completing the following requirements:

(1) Describe the application, advantages, and limitations of each of the following decontamination methods:

Two basic ways to decontaminate something are physical and chemical. Physical methods manually separate the chemical from the material being decontaminated by scrubbing or washing the material, or both. Physical decontamination is often easier than chemical decontamination, but it may not completely remove all the contaminants. Chemical methods involve adding another chemical that changes the physical or chemical properties of one chemical into another or into a form that facilitates its removal. Unfortunately, the chemical process involved could introduce other hazards. Care must be taken to collect all the contamination that has been removed by either method and to dispose of it properly.

(a) Absorption

Absorption is the process by which materials hold liquids. Many types of commercial absorbents are available. Sand or soil can also be used for this purpose, although they are more suited for decontaminating equipment or the area surrounding a spill than they are for decontaminating personnel. Absorbents are often readily available, but they must be disposed of properly because the absorbent substance retains the properties of the material absorbed.

(b) Adsorption

Adsorption is a chemical method of decontamination involving the interaction of a hazardous liquid and a solid sorbent surface. Examples of adsorbents are activated charcoal, silica or aluminum gel, fuller's earth, and other clays. Adsorption produces heat and can cause spontaneous combustion. Adsorbents must be disposed of properly.

(c) Chemical degradation

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Chemical degradation is a natural breakdown of contaminants as they age. An example of chemical degradation is the evaporation of a flammable liquid spill. The decontamination of an oil spill on a beach because of manual (pressure washer) or natural (wave action) action is an example of physical degradation. Either of the two methods has limitations, depending on factors such as the location of the spill and the toxicity of the material. In some cases, however, these methods are the most practical.

(d) Dilution

Dilution, which simply reduces the concentration of a contaminant, is best used on materials that are soluble or miscible in water, such as chlorine and ammonia. An advantage of dilution is that solutes, especially water, are generally available in large quantities. A disadvantage is the necessary collection and disposal of runoff.

(e) Disinfection
(f) Evaporation

In some cases, responders allow a hazardous material to evaporate, particularly if the vapors do not present a hazard. A small spill of gasoline, for example, can be allowed to evaporate as long as it does not present a vapor problem. Evaporation is an easy operation and requires minimal personnel. This method is not as effective on porous surfaces as it is on nonporous surfaces, however, and it could take quite a while, depending on the quantity of the chemical involved.

(g) Isolation and disposal

Disposal is the direct removal of a contaminant from a carrier. An example of this method is the removal of a contaminated object from a piece of equipment. This type of decontamination may not entirely remove all contamination.

(h) Neutralization

Neutralizers alter a contaminant chemically so that the resulting chemical is harmless. For example, the addition of soda ash to an acidic solution can increase the pH, making it a chemically harmless substance. Many neutralizing chemicals present hazards of their own, however, and should only be used by HMTs who are fully aware of the consequences. One advantage of neutralizers is that by rendering the remaining material harmless, they reduce the problem of disposal.

(i) Solidification

Commercial products are available that cause certain liquids to solidify. One advantage of solidification is that it allows responders to confine a small spill relatively quickly. As with other decontaminants, however, the resulting solid must be disposed of properly when the incident is over.

(j) Sterilization
(k) Vacuuming

Vacuuming causes materials, either liquid or solid, to collect into containers. The equipment being used must be appropriate for the material being vacuumed. If the material is corrosive or flammable, for example, specialized equipment is needed.

(l) Washing

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A very effective decontamination process for many materials involves washing the contaminated person, building, or equipment. Materials that are not soluble in water, such as oil-based contaminants, can be washed with detergent solutions. Washing equipment, protective clothing, and personnel is one of the easiest methods of decontamination. However, collecting and properly disposing of runoff is necessary.

(2) Identify reference sources for determining applicable decontamination methods, and identify how to access those resources in a hazardous materials/WMD incident

Among the sources of technical information about decontamination an HMT is required to know are CHEMTREC, CANUTEC, SETIQ, SDSs, product manufacturers, the National Response Center, and local or regional poison control centers.

(3) Identify equipment required to implement each of the decontamination methods

Δ **7.3.4 Developing a Plan of Action.** Given a hazardous materials/WMD incident, an assignment in an IAP, results of the incident analysis, response objectives and options for the given incident, available resources, and policies and procedures, the hazardous materials technician shall prepare an action including site safety and a control plan, safety briefing materials, and pre-entry activities; identify atmospheric and physical safety hazards when incident involved a confined space; and preserve evidence and take public safety samples at the incident consistent with the AHJ policies and procedures and within the capability of available personnel, PPE, and response equipment for that incident by completing the following requirements:

Wright notes the following in *Fire Protection Handbook*:

> After selecting the response option for a hazardous material incident, a plan of action including safety and health considerations should be developed. This plan of action describes the response objectives and options and the personnel and equipment required to accomplish the objectives. The plan provides a permanent record of the decisions made at the incident. An organization's standard operating procedures provide the basis of this plan of action. Input from all segments of community is considered in developing the plan. Based on the specific incident conditions, the standard operating procedures are modified without having to write an entire plan for each incident.
>
> A plan of action also outlines the safety and health procedures to protect responders and the public from the potential hazards at an incident. These procedures should address incident management, communications protocol (both internal and external), control zones for incident security, personal protective equipment use, decontamination procedures, and documentation. They also include designation of a safety sector and a safety officer, emergency medical care procedures, environmental monitoring, emergency procedures, and personnel monitoring.
>
> Components for a typical plan of action would include the following:
>
> 1. Site description
> 2. Entry objectives
> 3. On-scene organization and coordination
> 4. On-scene control
> 5. Hazard evaluation
> 6. Personal protective equipment
> 7. On-scene work assignments
> 8. Communications procedures
> 9. Decontamination procedures
> 10. On-scene safety and health considerations including designation of the safety officer, emergency medical care procedures, environmental monitoring, emergency procedures, and personnel monitoring [2] p. 13-141

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This competency became necessary after the promulgation of the OSHA regulations on confined space operations. The HMT should become very familiar with the OSHA regulations. Failure to comply could lead to penalties, including substantial fines.

Responders are required to follow organizational standard operating procedures for collecting evidence. A typical evidence collection kit includes marker pen, ties, ruler, camera, quick-slitter, flashlight, drop cloths, plastic bags, liquid/biological/air sampling packages, and log collection sheets. All evidence collected should be documented on the evidence collection form and formally turned over to law enforcement personnel using a chain of custody process. Proper protective clothing and equipment should be worn during the collection process, and hazardous materials should be stored in appropriate containers. For additional information on evidence collection and preservation, refer to the mission-specific competencies for Section 6.5.

(1) Identify the components of an IAP and subplans
(2) Identify the components of a safety briefing
(3) Identify pre-entry activities to be performed

Initially, activities for overall site safety must be performed. The HMT needs to determine the identification of the safety officer, the hazard control zones, an escape route, a designated withdrawal signal, and the identification of safe locations for personnel and equipment uphill and upwind.

Prior to entry, a safety briefing should be held for both the entry and backup teams to ensure that everyone understands the potential health and safety hazards, the objectives of the entry operations, and the specific tasks and procedures. This time should also be used to confirm designated radio channels, hand and verbal emergency signals, requirements for protective clothing, and the location and layout of the decontamination area. The entry team should not be permitted to enter the hot zone until the backup team is in place and the technical decontamination area is fully operational. All responders should remain alert and mindful of any unsafe practices or potentially dangerous conditions.

(4) Identify the components of a site safety and control plan
(5) Identify safety considerations to be included

N **7.3.4.1** Describe the difference between control, confinement, containment, and extinguishment.

Δ **7.3.4.2** Describe the purpose of, procedures for, required tools and equipment for, and safety precautions for following techniques for hazardous materials/WMD (product) control:

(1) Absorption
(2) Adsorption
(3) Blanketing
(4) Damming
(5) Diking
(6) Dilution
(7) Dispersion
(8) Diversion
(9) Neutralization

The technique of neutralization is the process by which another chemical is applied to the original spill to form a less harmful by-product through an energetic exothermic reaction, which can produce toxic and flammable vapors. Advantages include the considerable reduction in the release of harmful vapors, and the by-product of the reaction can be disposed of at less cost and effort.

Pump sprayers work well in the mixing and application of neutralizing agents. Acid neutralization routinely involves the use of a weak base, such as soda ash/sodium carbonate.

The most commonly used buffer is baking soda/sodium bicarbonate, which can react with both acids and bases, preventing extreme pH swings. Vinegar is the most common and least expensive weak acid.

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(10) Overpacking

The technique of overpacking is a physical method of containment by placing a leaking or damaged container, drum, or vessel inside a larger, specially constructed container to confine any further release of product. Even though the container should be at least temporarily repaired before being placed inside of the overpack, it is important that overpack containers be compatible with the released materials.

Common sizes of both steel and polyethylene liquid overpacks include 5, 15, 30, 55, and 85 gal (19, 57, 114, 208, and 322 L). Compressed gas cylinder coffins, such as those designed to handle 150 lb (68 kg) chlorine cylinders, have been introduced recently.

Several considerations must be taken into account as the leaking container is prepared to be overpacked. Not only could the container have become weakened from whatever impact caused the breach, but the actual physical act required to move it may involve mechanical equipment. A forklift or hoist may be used to prevent related injuries because of the sheer size and weight of the containers, which could range from 100 lb to 1000 lb (45.4 kg to 454 kg).

(11) Patching

Patches are used to repair leaks, holes, rips, gashes, or tears in container shells, piping systems, and valves by placing them over the breach and holding them in place to stop the flow. Considering the specific conditions, container pressure and chemical compatibility are important when determining the appropriate patching device. Whether homemade or commercial, patching devices include pipe sleeve patches, chain thumb screws, chlorine bonnets, inflatable drums, container sleeves, bags, toggle bolt compression patches, gasket patches, glued patches, and epoxy putties.

(12) Plugging

The process of plugging involves inserting, driving, or screwing a chemically compatible object into the breach of a container to reduce or temporarily stop the flow. Cracks around the plug should be filled to ensure a good seal, although the compounds used should only be considered a temporary repair, taking into account the strength of the material, the size of the hole, and the potential internal pressure.

Different plugs include those constructed of wood, rubber, metal drift pins (like those found in the Chlorine B and C kits), and solid metal pins. Even simple devices, which include boiler plugs, screws, golf tees, wooden wedges, and cones, can be most effective. Rubber, plastic, and wooden plugs, which are designed to be driven, must be constructed of softer material so that their shape can be modified to fill in a rough and jagged breach. As a safety precaution, the reason for the release must be identified before controlling the failure to prevent the potential for a more violent rupture from overpressurization, which can cause such devices to become lethal projectiles.

(13) Pressure isolation and reduction (isolation of valves, pumps, or energy sources)
(14) Retention
(15) Remote valve shutoff
(16) Sealing closures
(17) Vapor dispersion
(18) Vapor suppression

7.3.4.3 Describe the atmospheric physical safety hazards associated with hazardous materials/WMD incidents involving confined spaces.

Δ **7.3.4.4** Identify the procedures, equipment, and safety precautions for preserving and collecting legal evidence at hazardous materials/WMD incidents.

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7.4 Competencies — Implementing the Planned Response.

Δ **7.4.1* Performing Incident Command Duties.** Given the emergency response plan or standard operating procedures and a scenario involving a hazardous materials/WMD incident, the hazardous materials technician shall demonstrate the duties of an assigned function in the hazardous materials group within the incident command system and shall identify the role of the hazardous materials technician during hazardous materials/WMD incidents.

(1) Identify the various positions in the hazardous materials group within the incident command system (ICS) and describe the main functions
(2) Identify the role of the hazardous materials technician during hazardous materials/WMD incidents

The emergency response plan is the link between the community's response plans and the operational personnel who are expected to implement those plans. Emergency response plans incorporate standard operating procedures, which should identify the type of response appropriate to a particular type of incident, as well as site-specific procedures. The emergency response plan should also address alerting procedures, response and coordination procedures, personnel, the command structure, communications, and training.

A.7.4.1 The functions within the hazardous materials group or branch can include the following:

(1) Hazardous materials branch director/group supervisor
(2) Assistant safety officer — hazardous materials
(3) Site access control leader
(4) Decontamination leader
(5) Technical specialist — hazardous materials leader
(6) Safe refuge area manager

Δ **7.4.2 Using Personal Protective Equipment (PPE).** Given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, results of the incident analysis, response objectives and options for the incident, and PPE ensembles as identified in the IAP, the hazardous materials technician shall inspect, don, work in, go through decontamination while wearing, and doff PPE provided by the AHJ, and shall complete the following requirements:

In addition to the following tasks, the HMT must also demonstrate the ability to record the use, repair, and testing of CPC according to the manufacturer's specifications and recommendations. The HMT must also be able to describe the maintenance, testing, inspection, and storage procedures for PPE provided by the AHJ according to the manufacturer's specifications and recommendations.

(1) Describe safety for personnel wearing PPE, including buddy systems, backup systems, accountability systems, safety briefings, and evacuation/escape procedures

The safety procedures in 7.4.2(1) include the obvious considerations of keeping the individuals cool and protected from heat exposure, the prevention of dehydration, medical monitoring, and stringent accounting for time spent on air and in the suit. Three additional concerns that could affect the safety of individuals working a hot zone include visibility, mobility, and communications.

The lack of peripheral vision significantly alters the responder's visibility through not only the SCBA but also the window of the encapsulating Level A or Level B suits. If the suit is too large, the face shield might need to be held close to the mask for the individual to look around. The fogging up of the window is another concern, especially when the use of a hand towel from inside the suit to wipe it off or the application of antifog spray is not effective.

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Mobility and dexterity are compromised each time the responder dons an additional layer of protection. Performing relatively simple tasks, such as operating detection and monitoring equipment, becomes more challenging when wearing nitrile, silver shield, or butyl rubber gloves, for example. Also, until the relief valve releases internal pressure, Level A suits inflate with exhaled air, creating a ballooning effect, which can compromise both mobility and visibility.

A responder can be difficult to understand when speaking through an SCBA to a partner or over handheld radios. Communicating becomes even more challenging when a chemical-protective suit is worn. Throat or bone mikes are the most effective means of communication among responders as long as the background noise in the surrounding environment is conductive. Otherwise, standard hand signals and easily recognizable motions and gestures could be the extent of communications exchanged between two individuals in Level A or Level B suits.

(2) Inspect, don, work in, and doff PPE provided by the AHJ

Because personnel wearing vapor-protective clothing might experience a loss of mobility, dexterity, vision, and communications capability, closely monitoring them is important. Backup personnel wearing the same level of protective clothing must be available, and hand signals should be established to aid in communications. Personnel must also be monitored for the effects of heat, and a proper rehabilitation program should be in place to replenish fluids and allow for rest and recovery.

HMTs are required to practice donning and doffing CPC to become proficient. One of the more effective ways to evaluate an HMT's ability to don and doff the protective clothing provided is to conduct training exercises that require putting on the PPE and to conduct simulated control activities, followed by simulated decontamination.

Because some types of CPC are very costly, using garments that are no longer adequate for emergency response solely for training purposes is advisable. Hazmat training suits that are less expensive are also available, and these allow cost-effective training in the use of totally encapsulating suits.

(3) Go through the process of being decontaminated (emergency and technical) while wearing PPE

(4) Maintain and store PPE following instructions provided by the manufacturer

•

N **7.4.3 Performing Product Control Techniques.** Given the selected product control technique and the tools and equipment, PPE, and control agents and equipment provided by the AHJ at a hazardous materials/WMD incident, the hazardous materials technician shall confine/contain the release from bulk or nonbulk pressure containers/closures, nonbulk liquid containers/closures, and bulk liquid containers/closures, following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards, by completing the following requirements:

N **7.4.3.1 Product Control.** Given a hazardous materials/WMD incident with release of product; an assignment in an IAP; results of the incident analysis; policies and procedures for product control; response objectives and options for the incident; and approved tools, equipment, control agents, and PPE; the hazardous materials technician shall perform the control techniques by completing the following requirements *[following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards]*:

(1) Identify and implement product control techniques to confine released hazardous materials/WMD including:

(a) Absorption
(b) Adsorption
(c) Damming
(d) Diking
(e) Dilution
(f) Diversion

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(g) Retention
(h) Vapor dispersion
(i) Vapor suppression

The purpose of the competency in 7.4.3.1(1) is to allow the HMT to demonstrate the ability to choose the appropriate equipment and methods to control releases in various situations. The equipment necessary to conduct the operations in 7.4.3.1(1) could vary, depending on the type of material that is leaking and the physical properties of the damaged area, valve, or plug. For example, nonsparking tools should be used when working with flammable liquids or gases. And in some cases, special tools may be needed for certain valves. Such situations should be identified during pre-incident planning.

(2) Identify the application and purpose of, advantages and limitations of, procedures for, required tools and equipment for, and safety precautions for each of the control techniques for confining released materials
(3) Identify the procedures for controlling releases from the packaging/flammable liquid and flammable gas releases using techniques, including hose handling, nozzle, patterns, and attack operations
(4) Identify the characteristics, applicability, and use of Class B foams or agents, the required equipment for application of the foam or agent to control the spill or fire by application of the foam(s) or agent(s)

N **7.4.3.2 Controlling Leaks from Containers.**

N **7.4.3.2.1** Given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; three scenarios including a leak from a bulk or nonbulk pressure container or its closures, a leak from a nonbulk liquid container or its closures, and a leak from a bulk liquid container or its closures; policies and procedures for controlling leaks from containers and/or their closures; and approved tools, equipment, and PPE; the hazardous materials technician shall control leaks from the containers and their closures, monitoring for hazards as necessary, by completing the following requirements *[following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards]*:

(1) Identify the product control techniques to contain leaking hazardous materials/WMD including:
  (a) Patching
  (b) Plugging
  (c) Repositioning the container
  (d) Sealing closures
  (e) Remote valve shutoff
(2) Identify types of containers, the closures, and ways the containers and closures develop leaks
(3) Operate remote control/emergency shutoff devices to reduce or stop the flow of hazardous material from MC-306/DOT-406, MC-407/DOT-407, and MC-331 cargo tanks and intermodal tanks containing flammable liquids or gases or fixed facility containers
(4) Given the fittings on a pressure container and using tools and equipment provided by the AHJ, contain the leaks by the following methods:
  (a) Close valves that are open
  (b) Replace or tighten loose plugs
  (c) Replace missing plugs

N **7.4.3.2.2** Given a 55 gal (208 L) drum and applicable tools and materials, contain the following types of leaks:
(1) Bung leak
(2) Chime leak

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(3) Forklift puncture
(4) Nail puncture

N 7.4.3.3 Overpacking Nonbulk and Radioactive Materials Containers.

N 7.4.3.3.1 Given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; a loaded damaged or leaking container; a suitable overpack container; policies and procedures; and approved tools, equipment, and PPE; the hazardous materials technician shall place the damaged or leaking nonbulk or radioactive materials container is placed into a suitable overpack and the overpack is closed, marked, and labeled by completing the following requirements: *[following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards]*:

(1) Identify ways nonbulk and radioactive materials containers are damaged
(2) Identify hazards associated with overpacking damaged or leaking nonbulk and radioactive materials containers
(3) Identify methods for overpacking damaged or leaking nonbulk and radioactive materials containers including tools and equipment required
(4) Identify markings and labels required for overpack containers

Transportation regulations require an overpack to be marked with the word "OVERPACK," unless the specification markings on the inside packages are visible or the packages inside the overpack are not required to be specification packages. The overpack must also be marked with the proper shipping name, identification number, and orientation arrows (when applicable) and be labeled as required for the radioactive material contained therein, unless the markings and labels for the radioactive material in the overpack are visible.

(5) Identify methods for decontaminating tools and equipment used for overpacking damaged or leaking nonbulk and radioactive materials containers

Equipment decontamination involves removing radiological contamination from equipment. Not all equipment can be decontaminated (e.g., straps, porous material, equipment with inaccessible areas). If equipment needs to be decontaminated, consider the following methods:

- Wipe down handheld equipment with a damp, absorbent cloth
- Use a nonabrasive wash solution on large pieces of equipment

Be aware that all solid and liquid waste generated during decontamination will need to be controlled, properly packaged, and stored for eventual disposal in accordance with applicable regulations. There is no one perfect solution to decontamination that will account for every possible variable. The important thing to remember is to choose a decontamination method most appropriate for the highest hazard and risk to personnel present at the scene.

(6) Identify equipment and maintenance procedures

The recommendations on maintenance, inspection, calibration, bump tests, cleaning, and warm-up periods are provided by the manufacturer and are required in 7.4.3.3.1(6) to be followed. External influences can also affect the quality of the readings given by instruments, such as extreme temperatures, altitude, and barometric pressure (oxygen monitors); radio frequencies, power lines, transformers, dust, and high humidity (PIDs); and limited shelf-life, response time from chemical to chemical, and the lack of tube interchangeability (colorimetric indicator or detector tubes). Weak batteries and electromagnetic fields can give false positive readings (radiation monitors). Not all flame ionization detectors (FID)/organic vapor analyzers (OVA) or halogen leak detectors are intrinsically safe. Prior to use, pH papers should be moistened with deionized water if possible.

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All of these instruments are tools used to assist responders in determining the identification of hazardous substances, their approximate location and perimeter, and the estimated quantity of product. The results should always be confirmed with other equipment.

N **7.4.3.3.2** Given a 55 gal (208 L) drum and an overpack drum, demonstrate the ability to place the 55 gal (208 L) drum into the overpack drum using the following methods:

When conducting overpacking operations manually, responders must take care to lift and move the drum properly to avoid back strain and injuries to hands or feet.

(1) Rolling slide-in

The method in 7.4.3.3.2(1) involves lying the drum on its side. Rollers are put underneath the drum, and the drum is rolled into the overpack drum. Items that can be used as rollers include lengths of pipe and other rounded materials.

(2) Slide-in

The slide-in method involves laying a leaking drum on its side and sliding it into an overpack drum.

(3) Slip-over

The slip-over method involves placing the overpack drum over the top of the leaking drum and manually rotating it upright. A device called a "drum up-ender" is available commercially to assist with this type of operation.

N **7.4.3.4 Liquid Product Transfer.**

N **7.4.3.4.1** Given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; a leaking nonpressure container and a recovery container; policies and procedures for transferring liquids from leaking nonpressure containers; and approved tools, equipment, and PPE; the hazardous materials technician shall monitor for hazards, ground and bond the containers, transfer the liquid product from the leaking container to the recovery container, suppress vapors as necessary, decontaminate tools and equipment, and inspect and maintain tools and equipment by completing performing the following requirements: *[following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards]*:

(1) Select a compatible recovery container
(2) Monitor for hazards
(3) Transfer liquid product
(4) Grounding and bonding the containers
(5) Perform vapor suppression
(6) Select the required tools and equipment and their proper use for transferring liquid product
(7) Decontaminate tools and equipment
(8) Inspect and maintain tools and equipment for transferring liquid product
(9) 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 and AHJ policies and procedures
(10) Identify three considerations for assessing a leak or spill inside a confined space without entering the area

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Transfer operations are complex and can be hazardous. The HMT should be very cautious when considering this type of operation. Usually transfer operations are conducted by a technician with a tank car specialty, cargo tank specialty, or intermodal tank specialty (see Chapters 12, 13, and 14 of NFPA 472); by a specialty cleanup company; or by personnel from the shipper or manufacturer.

As Hildebrand and Noll point out in *Handling Gasoline Tank Truck Emergencies: Guidelines and Procedures*, the most common methods of product transfer for MC-306/DOT-406 cargo tanks are vacuum pumps, vehicles with power take-off (PTO) pumps, or air-driven portable pumps [13]. This statement is true for most nonpressure cargo tanks.

Transfer operations involving pressure tanks present additional hazards and should be undertaken only by personnel with the necessary technician specialty training and skills.

N **7.4.3.4.2** 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.

N **7.4.3.4.3** Identify three considerations for assessing a leak or spill inside a confined space without entering the area.

7.4.4* Performing Decontamination Operations Identified in the Incident Action Plan. Given a hazardous materials/WMD incident requiring decontamination; an assignment in an IAP; results of the incident analysis; policies and procedures; and approved PPE, tools, and equipment; the hazardous materials technician shall implement, evaluate the effectiveness of, and terminate the following decontamination operations as assigned:

(1) Technical decontamination operations in support of entry operations
(2) Technical decontamination operations involving ambulatory and nonambulatory victims
(3) Mass decontamination operations involving ambulatory and nonambulatory victims

• **A.7.4.4** The decontamination processes identified in the incident action plan might be technical decontamination, mass decontamination, or both, depending on the circumstances of the incident. See 3.3.16.3 and 3.3.16.4.

7.5 Competencies — Evaluating Progress.

7.5.1 Evaluating the Effectiveness of the Control Functions. Given a hazardous materials/WMD incident, an assignment in an IAP, current incident conditions, response options and actions taken, and approved communication equipment, the hazardous materials technician shall compare the actual behavior of the material and container to that predicted, determine the effectiveness of response options and actions in accomplishing response objectives, make modifications to the response options and actions as necessary, and communicate the results by completing the following requirements:

All responders should understand why their efforts must be evaluated. If the HMTs are not making progress, the plan must be reevaluated to determine why progress is not being made. To decide whether the actions undertaken at an incident are effective and the objectives are being achieved, the responder must determine whether the incident is stabilizing or increasing in intensity. The HMTs have no reason to remain in the immediate vicinity of an incident when nothing can be done to mitigate it, and the situation might be about to deteriorate. If flames are impinging on an LP-Gas vessel in the vapor space, for example, and the necessary volume of water to cool it is not available, prudent action would be to withdraw to a safe distance.

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(1) Identify procedures for evaluating whether the response options and actions are effective in accomplishing the response objectives
(2) Identify resources for identifying improving, static, or deteriorating conditions
(3) Identify approved communication procedures and communication equipment
(4) Identify the process for modifying response options and actions

7.5.2 Evaluating the Effectiveness of the Decontamination Process. Given an incident action plan for a scenario involving a hazardous materials/WMD incident, the hazardous materials technician shall evaluate the effectiveness of any decontamination procedures identified in the incident action plan.

7.6 Competencies — Terminating the Incident.

Δ **7.6.1 Assisting in the Debriefing and Critiques.** Given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, operational observations of activities (incident information), and approved forms for documentation and reporting, the hazardous materials technician shall communicate operational observations (incident information) at debriefings and critiques and complete, forward, and file required reports, records, and supporting documents by completing the following requirements:

A debriefing is an opportunity to gather specific information from all operational personnel regarding positive, negative, and unique aspects of the response. The time should be used to determine whether strategic goals were achieved and which tasks were performed by whom, when, and how, to establish an effective incident sequence.

(1) Describe the purpose, regulatory issues, elements, and procedures for conducting debriefings and critiques
(2) Describe documentation and reporting requirements according to the AHJ
(3) Identify approved forms and procedures for completing required reports, records, and supporting documentation
(4) Describe the importance of and procedures for filing documents and maintaining records

•

Key topics should include specifics on HMTs involved in the response to the incident, what their objectives and tasks entailed, when the objectives were accomplished, the extent to which the objectives were successful, the injuries sustained, and the subsequent treatment provided.

The debriefing focuses on gathering information, so the meeting should be conducted as soon after the incident as possible so that the details will be recalled simply and clearly. The debriefing does not have to be conducted at the same time with everyone in a specific location, but it should involve all participants. The information compiled during the discussion is the most beneficial to the modification of future responses.

Hazardous materials incidents are fairly rare in most communities, with the exception of large industrial cities, so a debriefing is very helpful to document all the actions taken to control the incident.

An effective critique requires direction, participation, and solutions. The information acquired during a critique must remain focused, maintain forward momentum, and last only 1 to 2 hours to retain the appropriate quality and effectiveness. Participants must feel comfortable to share openly with the group deficiencies they observed in the response system. The critique must be portrayed as a positive event and conducted to get the most honest input from the responders. This opportunity is to identify shortcomings and deficiencies in operations, procedures, training, and site plans, while offering constructive recommendations and refraining from individual blame and criticism.

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Because a critique focuses on many levels of a response, representatives who were on the scene participating in the operations or command functions are the most beneficial to include. The individuals responsible for training, revising standard operating procedures and emergency response plans, and acquiring available resources should also be present to capture any necessary modifications. To make the critique session a positive, nonthreatening learning experience, the critique leader must be a respected individual, preferably with counseling and/or arbitrator skills, who remains a neutral party, especially for the critiques of sensitive incidents.

An effective critique provides an opportunity for those involved on the scene of a hazardous materials incident to identify and correct flaws and shortcomings. The critique also encourages suggestions and recommendations for improving future emergency response and for preventing a recurrence. Valuable information can be derived from the discussions, including lessons learned, which have, in later cases, prevented related injuries and fatalities. By waiting several days to conduct the critique, the emotional stress from the incident should have subsided, creating a more relaxed and productive atmosphere as well as allowing time to gather relevant information from investigations and company reports.

A negative connotation is generally associated with the concept of a critique session, so a concerted effort must be made to address and emphasize those tasks that were performed well, including teamwork, safe operating procedures, and an effective response in which the IAP objectives were met.

Because of the infrequency of hazardous materials incidents, the timely completion and circulation of the critique among all the personnel of the organizations involved in the incident is essential. The critique report should focus on positive actions but should not ignore or discount areas where improvement is obviously needed. To acquire knowledge from a good critique report is better than to acquire it from a tragic experience at the next incident scene.

Some of this same information can be obtained by reading critiques from other hazardous materials teams' operations. All hazardous materials teams can benefit from publishing critiques in any of the national emergency services magazines.

Whether an exposure is the result of direct or cross-contamination, entry into unauthorized zones, donning improper PPE, or a PPE failure, the exposure must be reported to the medical director for evaluation and review to determine appropriate actions, treatments, testing, screening, and so forth. A copy of the incident report should be maintained in the individual's medical records because years may pass between the initial exposure and the development of related chronic effects. OSHA requires that exposure and medical records be maintained for at least 30 years after the end of employment and that, on request, these records must be made available to all affected employees and their representatives.

References Cited in Commentary

1. Title 29, Code of Federal Regulations, Part 1910, U.S. Government Publishing Office, Washington, DC.
2. Cote, A., ed., *Fire Protection Handbook,* 20th ed., National Fire Protection Association, Quincy, MA, 2008.
3. Title 49, Code of Federal Regulations, Part 178, U.S. Government Publishing Office, Washington, DC.
4. Title 49, Code of Federal Regulations, Part 173, U.S. Government Publishing Office, Washington, DC.
5. *Emergency Response Guidebook* (ERG). Office of Hazardous Materials Initiatives and Training, PHH-50, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, 1200 New Jersey Avenue, SE East Building, 2nd Floor, Washington, DC, 2012.
6. Bronstein, A., *Emergency Care for Hazardous Materials Exposures,* 2nd ed., Mosby Yearbook, St. Louis, MO, 1994.

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7. NFPA 30, *Flammable and Combustible Liquids Code,* National Fire Protection Association, Quincy, MA, 2012.
8. *Ionizing Radiation Exposure of the Population of the United States,* Report No. 160, the National Council on Radiation Protection and Measurements (NCRP), Bethesda, MD, 2009.
9. National Fire Academy, *Initial Response to Hazardous Materials Incidents, Course II: Concept and Implementation,* Emmitsburg, MD.
10. NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies,* National Fire Protection Association, Quincy, MA, 2013.
11. NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents,* National Fire Protection Association, Quincy, MA, 2012.
12. NFPA 1992, *Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies*, National Fire Protection Association, Quincy, MA, 2012.
13. Hildebrand, M., and G. Noll, *Handling Gasoline Tank Truck Emergencies: Guidelines and Procedures,* Fire Protection Publications, Stillwater, OK, 1991.

Additional References

Benner, L., *Textbook for Use in the Study of Hazardous Materials Emergencies*, 2nd ed., Lufred Industries Inc., Oakton, VA, 1978.

Bretherick, L., *Handbook of Reactive Chemical Hazards*, Butterworths, Boston, MA, 1995.

Bowen, J., *Emergency Management of Hazardous Materials Incidents*, National Fire Protection Association, Quincy, MA, 1995.

Hawley's Condensed Chemical Dictionary, Van Nostrand Reinhold Co., New York, NY, 1996.

Lewis, Sr., R., *Hazardous Chemicals Desk Reference*, Van Nostrand Reinhold Co., New York, NY, 1996.

Sax, I., *Dangerous Properties of Industrial Materials*, Van Nostrand Reinhold Co., New York, NY, 1996.

Colonna, G. R., *Fire Protection Guide to Hazardous Materials*, 14th ed., National Fire Protection Association, Quincy, MA, 2010.

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8 Competencies for Incident Commanders

The incident commander (IC) is the manager/supervisor with jurisdictional responsibility for the incident and for all incident activities, even when assigned to others. As with all emergency responders who respond to a hazardous materials incident, the IC should be trained, at a minimum, in all awareness competencies (see Chapter 4), core operations competencies (see Chapter 5), and other mission-specific competencies relevant to the tasks they will perform (see Chapter 8). These competencies include skills for managing the resources and overall operation of the incident. Several planning and management competencies that the IC should have are identical to some of those at the technician level; however, the IC is not required to be competent in the skills for mitigating the release that a technician would be. (See Exhibit I.8.1).

Although the term *incident commander* (*IC*) is used throughout this chapter and in many sections of this document, it is important to recognize that per National Incident Management System (NIMS), the command element may be a single command IC, a unified command element, or an area command. The single command IC is the most common, but any one of the three command elements may exist based on the scope of the incident.

Regardless of the level of the incident or the personnel operating at the incident, the IC must be trained and competent, in accordance with 8.1.1, in the appropriate incident management system emergency operations plan; the risks of operating at the scene; the capabilities of local, state, and federal resources; and the importance of decontamination.

The technical committee recognized that, in complex incidents involving the response of hazardous materials technicians (HMTs) or specialist employees, the IC would use their expertise in formulating response objectives, action options, and the plan of action. The IC relies on the hazardous materials officer (see Chapter 10 of NFPA 472) to supervise the team directly and provide appropriate technical information.

The IC is required to understand the types of resources that are available and the types of information each can provide. For example, the IC is not expected to have an in-depth knowledge of computer databases but should know the type of information that can be accessed in each of the major databases included in the hazardous materials response plan.

Similarly, the IC is not expected to be able to operate the various monitoring equipment used in the analysis of a hazardous materials incident, but he or she should be able to understand the functions and limitations of the monitoring methods. The IC should be able to apply the results of air monitoring and detection in making and/or approving decisions pertaining to control zones, selection of personal protective equipment (PPE), public protection, and other related issues.

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EXHIBIT I.8.1

An incident command system enables the incident commander to manage the efforts of many specialists, including those trained in safety and EMS. (Courtesy of BenDC/iStock/Thinkstock)

8.1 General.

8.1.1 Introduction.

8.1.1.1 The incident commander (IC) at hazardous materials/WMD incidents shall be that person responsible for all incident activities, including the development of strategies and tactics and the ordering and release of resources as designated by the AHJ.

Δ **8.1.1.2** The incident commander shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, and all competencies in this chapter.

8.1.1.3 The incident commander shall receive any additional training necessary to meet applicable governmental response and occupational health and safety regulations.

8.1.1.4 The incident commander shall receive any additional training necessary to meet specific needs of the jurisdiction.

8.1.2 Goal.

8.1.2.1 The goal of the competencies in this chapter shall be to provide the incident commander with the knowledge and skills to perform the tasks in 8.1.2.2 in a safe manner.

Δ **8.1.2.2** In addition to being competent at the awareness and all competencies at the operations levels, the incident commander shall be able to perform the following tasks:

(1) Analyze a hazardous materials/WMD incident to determine the complexity of the problem and potential outcomes by completing the following tasks:

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

(2) Plan response operations within the capabilities and competencies of available personnel, PPE, and response equipment by completing the following tasks:

   (a) Identify the response objectives for hazardous materials/WMD incidents
   (b) Identify the potential response options (defensive, offensive, and nonintervention) available by response objective

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(c) Approve the level of PPE required for a given action option

(d)* Develop an incident action plan (IAP), including a site safety and control plan, consistent with the emergency response plan or standard operating procedures and within the capability of available personnel, PPE, and response equipment

A.8.1.2.2(2)(d) The following site safety and control plan considerations are from the EPA *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

(3) Implement a response to change the outcome favorably and to be consistent with the emergency response plan or standard operating procedures by completing the following tasks:

(a) Implement an incident command system, including the specified procedures for identification, notification, and utilization of nonlocal resources (e.g., governmental personnel)

(b) Direct resources (private, governmental, and others) with task assignments and on-scene activities and provide management overview, technical review, and logistical support to those resources

(c) Provide a focal point for information transfer to media and local elected officials through the incident command system structure

(4) Evaluate the progress of the planned response to ensure that the response objectives are met in a safe, effective, and efficient manner, and adjust the IAP as needed

(5) Terminate the emergency phase of the incident by completing the following tasks:

(a) Transfer command (control) when appropriate
(b) Conduct an incident debriefing
(c) Conduct a multiagency critique
(d) Report and document the hazardous materials/WMD incident and submit the report to the designated entity

8.2 Competencies — Analyzing the Incident.

8.2.1 Collecting and Interpreting Hazard and Response Information.

8.2.1.1 Given access to printed and technical resources, computer databases, and detection and monitoring equipment, the incident commander shall ensure the collection and interpretation of hazard and response information not available from the current edition of the ERG or an SDS.

8.2.1.2 Given access to printed and technical resources, computer databases, and monitoring equipment, 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) Hazardous materials databases
(2) Detection and monitoring equipment

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(3) Reference manuals
(4) Technical information centers
(5) Technical information specialists

8.2.2 Estimating Potential Outcomes. Given scenarios involving hazardous materials/WMD incidents, 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 complete the following tasks:

(1) Identify the steps for estimating the outcomes within an endangered area of a hazardous materials/WMD incident

The IC must determine pertinent factors relating to the nature and type of the incident, what materials/containers are involved, and environmental influences to estimate the incident outcome. Types of incidents can involve spills, leaks, fires, odors, and other hazards. Product/container factors include physical/chemical properties, hazards, quantities involved, type of container, stress or damage, and safety features, among others. Environmental factors include what is at risk (i.e., people, environment, infrastructure, property), exterior versus interior operations, weather conditions, control/protective systems, air-handling systems, and terrain. All of these factors must be evaluated before the IC can make informed and valid decisions and develop an incident action plan.

(2) Describe the following toxicological terms and exposure values, and explain their significance in the analysis process:

(a) Counts per minute (cpm) and kilocounts per minute (kcpm)
(b) Immediately dangerous to life and health (IDLH) value
(c) Infectious dose
(d) Lethal concentrations (LC_{50})
(e) Lethal dose (LD_{50})
(f) Parts per billion (ppb)
(g) Parts per million (ppm)
(h) Permissible exposure limit (PEL)
(i) Radiation absorbed dose (rad)
(j) Roentgen equivalent man (rem), millirem (mrem), microrem (μrem)
(k) Threshold limit value ceiling (TLV-C)
(l) Threshold limit value short-term exposure limit (TLV-STEL)
(m) Threshold limit value time-weighted average (TLV-TWA)

The IC must have a level of knowledge beyond that required at the core operations level to understand clearly the potential hazards of the products that may be involved in a hazardous materials incident. See the commentary following 7.2.5.4 of NFPA 472 for an explanation of each preceding term.

(n) Other toxicological terms or exposure values as determined by the AHJ

(3)* Identify two methods for predicting the areas of potential harm within the endangered area of a hazardous materials/WMD incident

Predicting the areas of potential harm in the endangered area involves determining the potential concentrations of the hazardous material that has been released. This prediction includes the toxicity of the concentrations and the length of time that persons in the endangered area would be exposed.

A.8.2.2(3) Methods for predicting areas of potential harm can include use of the DOT *Emergency Response Guidebook* table, Initial Isolation and Protective Action Distance; computer dispersion models; and portable and fixed air-monitoring systems.

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

It is important to determine specific meteorological conditions to mitigate the effects of hazardous materials. Weather conditions such as wind speed, wind direction, temperature, humidity, precipitation, dew point, and barometric pressure affect the incident and plume modeling. Many radios have channels dedicated specifically to weather forecasts. Other sources of weather information include weather apps on mobile devices, local dispatch, the Weather Channel on cable or satellite connections, local airport weather information, local weather phone recordings, portable weather stations, smart phone applications, and modem satellite technology on hazardous materials (hazmat) units.

(5) 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)

Acute toxicity refers to the sudden, severe onset of symptoms due to an exposure. The effects of delayed toxicity might not develop for hours or longer after an exposure. In some instances, such as biological exposures, symptoms might not appear for several days.

(b) Dose response

The chemical, biological, or radiological dose relationship refers to the response produced in the human body. The relationship is one of cause and effect. The magnitude of the body's response depends on the concentration of the exposure at the site, the material, and the dose administered.

(c) Local and systemic effects

Local effects are those in which a toxic substance comes in direct contact with skin or other tissue. Systemic effects occur when a toxic product has contacted either the entire body or a specific system or organ.

(d) Routes of exposure

Routes of exposure, sometimes referred to as routes of entry, include the following:

- *Inhalation:* The process by which irritants or toxins enter the body through the lungs as a result of the respiratory process
- *Ingestion:* The process of consuming contaminated food or water
- *Absorption:* The process by which hazardous materials are absorbed into the body through the skin or eyes
- *Injection:* The process by which a toxic substance is introduced directly into the blood by a needle, cannula, or some other mechanical means

(e) Synergistic effects

Synergistic effects occur when the combined effect of two or more chemicals is greater than the sum of the effect of each agent alone.

(6)* Describe the health risks associated with the following:

(a) Biological agents and biological toxins
(b) Blood agents

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(c) Choking agents
(d) Irritants (riot control agents)
(e) Nerve agents
(f) Radiological materials
(g) Vesicants (blister agents)

Δ **A.8.2.2(6)** Some examples are shown in Table A.8.2.2(6)(a) and Table A.8.2.2(6)(b).

Δ ***TABLE A.8.2.2(6)(a)*** *Examples of Health Risks Associated with Chemical Agents*

Common Name of Chemical Agent	*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: health hazard, F: flammability hazard, R: reactivity hazard.

*NFPA 704.

Δ ***TABLE A.8.2.2(6)(b)*** *Examples of Health Risks Associated with Biological Agents and Toxins*

Common Name of Biological Agent or Toxin	*Latency Period*	*Fatal?*
Anthrax	1–5 days	Yes
Mycotoxin	2–4 hours	Often
Plague	1–3 days	Yes
Ricin	18–24 days	Yes
Viral hemorrhagic fevers	4–21 days	Yes
Smallpox	7–17 days	Yes

8.3 Competencies — Planning the Response.

8.3.1 Identifying Response Objectives. Given an analysis of a hazardous materials/WMD incident, the incident commander shall be able to describe the steps for determining response objectives (defensive, offensive, and nonintervention).

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Response objectives can include modifying the stress applied to the container, changing the size of the breach, changing the quantity being released, changing the size of the endangered area, reducing exposures by moving people away from the hot zone, and reducing the level of harm. These objectives can be met by implementing defensive, offensive, or nonintervention strategies. Applying risk-based principles, the potential loss and exposures might be reduced if actions can be safely taken to terminate the incident in a shorter period of time.

8.3.2 Identifying the Potential Response Options. Given scenarios involving hazardous materials/WMD, the incident commander shall identify the possible response options (defensive, offensive, and nonintervention) by response objective for each problem and shall complete the following tasks:

The IC should be familiar with the competencies listed in 8.3.2(1) and (2).

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

Many of the response options can be used either offensively or defensively. For example, the size of the endangered area could be changed using a defensive strategy by placing barriers around the endangered area to contain a spill. An offensive strategy would be to enter the hot zone and plug the leak.

The IC might choose defensive operations as the most prudent method of dealing with an incident. For example, diking or blanketing a liquid spill of diesel fuel can often be accomplished easily. Transferring that same product from a damaged tank truck to another tank truck, however, would require specialized training and equipment that the technician level responder might not have. This task could be best completed by one of the new responder levels, such as a technician with a tank car specialty. Other operations, such as vent and burn techniques, should be attempted only by technicians with a tank car specialty (see Chapter 12 in NFPA 472).

(2) Identify the purpose of each of the following techniques for hazardous materials control:

(a) Absorption
(b) Adsorption
(c) Blanketing/covering
(d) Contamination isolation
(e) Damming
(f) Diking
(g) Dilution
(h) Dispersion
(i) Diversion
(j) Fire suppression
(K) Neutralization
(l) Overpacking
(m) Patching
(n) Plugging
(o) Pressure isolation and reduction (flaring; venting; vent and burn; isolation of valves, pumps, or energy sources)
(p) Retention
(q) Solidification
(r) Transfer

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Some of the methods listed here for controlling an incident require a high degree of specialized training and the use of sophisticated technical equipment. The IC must be familiar with the purposes of these techniques but does not necessarily have to be able to perform the more technical methods personally. Refer to 7.3.5.1 to review the items listed above.

(s) Vapor control (dispersion, suppression)

8.3.3 Approving the Level of PPE. Given scenarios involving hazardous materials/WMD with known and unknown hazardous materials/WMD, the incident commander shall approve the PPE for the response options specified in the IAP in each situation and shall complete the following tasks:

The difference between this competency for the IC and the similar competency for the HMT is important. At this level, the IC is expected to approve the PPE chosen. Based on their advanced training, the HMT and the hazardous materials officer are expected to be more knowledgeable in selecting the appropriate personal protective clothing, which the IC must then approve.

(1) Identify the four levels of chemical protection (EPA/OSHA) and describe the equipment required for each level and the conditions under which each level is used

The four levels of chemical protection and the equipment required are as follows:

- **Level A:** The highest available level of respiratory, skin, and eye protection. This level requires a fully encapsulating suit constructed of material that is compatible with the substances involved and self-contained breathing apparatus.
- **Level B:** The same level of respiratory protection but less skin protection than Level A. This level is the minimum recommended for initial site entries where the hazards have not yet been identified. This level requires chemical-resistant clothing and self-contained breathing apparatus.
- **Level C:** The same level of skin protection as Level B but a lower level of respiratory protection. This level requires chemical-resistant clothing and air purifying respirator.
- **Level D:** No respiratory protection and minimal skin protection. This level requires normal work clothes.

(2) Describe the following terms and explain their impact and significance on the selection of chemical-protective clothing:

(a) Degradation

Degradation of chemical-protective clothing (CPC) can be either chemical or physical. The result of degradation is an increased likelihood that a hazardous material will permeate and penetrate the garments and endanger the health of the responder. Chemical degradation can be minimized by avoiding unnecessary contact with chemicals and by undergoing effective decontamination procedures. The garments a responder wears should be chosen based on their compatibility with the chemicals involved in an incident and with breakthrough times consistent with their expected use. Protective clothing can also degrade physically; for example, damage might result from the garment rubbing against a rough surface.

(b) Penetration

Penetration is the movement of a hazardous material through a suit's closures. Closures include zippers, buttonholes, seams, flaps, and other design features of CPC. Hazardous materials can penetrate

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CPC through cracks or tears in the suit's fabric. Protection against such material penetration is vital. A regular and routine program of protective garment inspection can help uncover conditions that could lead to penetration. CPC must also be stored properly to avoid creating weak spots along seams or folds in the garment and other avenues for penetration.

(c) Permeation

Different fabrics have different resistance levels to chemical permeation, and all fabrics absorb chemicals over a period of time. NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies, and CBRN Terrorism Incidents,* and NFPA 1992, *Standard on Liquid Splash–Protective Ensembles and Clothing for Hazardous Materials Emergencies,* provide guidelines for manufacturer permeation testing and certification [1, 2].

(3) Describe three safety considerations for personnel working in vapor-protective, liquid splash–protective, and high temperature–protective clothing

It takes practice to work efficiently while wearing protective clothing. Because personnel wearing vapor-protective clothing could experience a loss of dexterity, vision, and communications capability, monitoring these individuals closely is important. Backup personnel wearing the same level of protective clothing must be available to assist the entry team in an emergency, and hand signals should be established to aid in communications. All responding personnel must also be monitored for the effects of heat at the scene. A proper on-scene rehabilitation program should be in place to replenish fluids and allow for rest and recovery for all individuals responding to an incident, but especially for those wearing protective garments for hot zone and warm zone work.

(4) Identify the physiological and psychological stresses that can affect users of PPE

Personal protective clothing, particularly fully encapsulating garments, increases the stress a responder may feel when working at a hazardous materials incident. Persons wearing CPC usually experience a loss of mobility and restricted visibility and communications. The higher the level of protection afforded by the garments, the greater these hindrances can be. Wearing CPC also increases the likelihood of heat stress and heat exhaustion in both fit and unfit individuals. Although fit individuals usually are able to work under conditions of extreme heat and physical exertion for long periods of time without adverse medical problems, a limit still exists to any person's endurance. Medical monitoring for all personnel in protective clothing at the scene is strongly recommended.

8.3.4 Developing an Incident Action Plan (IAP). Given scenarios involving hazardous materials/WMD incidents, the incident commander shall develop an IAP, including site safety and control plan, consistent with the emergency response plan or standard operating procedures and within the capability of the available personnel, PPE, and response equipment, and shall complete the tasks in 8.3.4.1 through 8.3.4.5.5.

An incident action plan describes the response objectives and any options to achieving those objectives. The basis for the plan is both the organization's standard operating procedures and the local emergency response plan. Safety and health considerations, necessary personnel, and control equipment should be listed in the plan for each objective. The plan provides a permanent record of the incident and can be the outline for the incident critique.

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8.3.4.1 The incident commander shall identify the steps for developing an IAP.

In accordance with 8.3.4.1, the following components must be considered when developing an incident action plan:

- Site restrictions
- Entry objectives
- On-scene organization and control
- Selection of PPE
- Hazard evaluation
- Communications procedures
- Emergency procedures and personnel accountability
- Emergency medical care arrangements
- Rehabilitation plan
- Decontamination procedures
- On-scene work assignments (branches)
- Debriefing and critiquing of the incident once it is concluded

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

The evaluation is intended to reduce or prevent contamination of the public directly exposed to the hazardous material(s). If members of the public at the scene are safe in their locations, and the structures where they are can be protected from contamination (closing windows and doors, turning off ventilation systems that may draw in air from outside, and so forth), the preferable response is to leave these individuals in place until the incident can be controlled. Even after hazardous materials responders have notified the public at the scene that they are to stay in their present location, reassurances of their safety and updates on the progress of the incident from hazardous materials responders are necessary to reduce any anxiety.

Δ **8.3.4.3** Given the emergency response plan or standard operating procedures, the incident commander shall identify the entity that 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 protective action (evacuation or shelter in-place)
(9) Provide fire suppression services
(10) Provide on-scene medical triage, treatment, and transport
(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 operations-level hazard control services
(16) Provide technician-level hazard mitigation services
(17) Provide environmental remedial action (cleanup) services

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(18) Provide environmental monitoring
(19) Implement on-site accountability
(20) Provide on-site responder identification
(21) Provide incident scene security
(22) Provide incident or crime scene investigation
(23) Provide evidence collection and sampling

The Emergency Planning and Community Right-to-Know Act requires local emergency planning committees (LEPCs) to develop local plans for emergency response to hazardous materials incidents [3]. The IC must understand the local emergency response plan, which should address the actions listed in 8.3.4.3 and those agencies responsible. Emergency response agencies should also develop their own standard operating procedures based on their roles in the local emergency plan. These procedures should address the actions listed in 8.3.4.3, indicate who is responsible for these actions both inside and outside the agency, and relate how each task will be accomplished.

8.3.4.4 The incident commander shall identify the process for determining the effectiveness of a response option based on the potential outcomes.

Before a response option (or combination of response options) is selected, the potential outcome of the sequence of events should be reviewed by prioritizing the response options based on their effect on the outcomes. A worksheet, such as the one shown in Exhibit I.8.2, can be used to estimate the outcomes in an emergency as well as the amount of what can be saved. An alternative action plan should be formulated in case the first action plan fails to achieve the desired outcomes. Constant evaluation is necessary during the course of an incident to prevent unsafe or ineffective operations and to assess subsequent options.

Estimating Loss and Salvageable Amount Worksheet

Exposures	Estimated Exposed	Estimated Type of Harm	Estimated Outcomes	Amount Already Lost	Amount That Could Be Saved
People	#	Deaths	#		
		Injuries	#		
Property	$	Damage	$		
Environment	$	Damage	$		

EXHIBIT I.8.2

This worksheet is used for estimating loss and salvageable amounts. (Source: Fire Protection Handbook®, 20th edition, Figure 13.8.11)

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

The following practices should be considered to ensure safe operations at a hazardous materials incident scene:

- The IC and hazardous materials responders have met all of the appropriate level competencies in NFPA 472.
- Activities that present a significant risk to the safety of members are limited to situations where the potential exists to save endangered lives.
- No risk to the safety of members is acceptable when saving lives or property is not possible.
- All personnel working in the warm zone or hot zone are under the supervision of a hazardous materials branch officer.
- Personnel accountability procedures are used.

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- A hazardous materials branch safety officer is designated and operating.
- Communications are established on one simple radio channel that is not used by anyone close enough to interfere. Hand signals are available as a backup if radios fail.
- Appropriate protective clothing and protective equipment are used whenever the responder may have the risk of being exposed to hazardous materials.
- A rapid intervention crew consisting of at least two responders is available for rescue of a member or team if necessary. Responders are operating in the hot zone in teams of two or more.
- All responders are monitored before they can proceed to work in PPE in accordance with AHJ policies and procedures.
- Hazardous materials responders are aware of clues indicating that the incident may be a chemical, biological, nuclear, or explosives incident. Efforts are made to notice secondary devices or attempts to disguise the true nature of the incident if terrorism is suspected.

The following practices should be considered to ensure safe operations at a hazardous materials incident scene:

- The IC and hazardous materials responders have met all of the appropriate level competencies in NFPA 472.
- Activities that present a significant risk to the safety of members are limited to situations where the potential exists to save endangered lives.
- No risk to the safety of members is acceptable when saving lives or property is not possible.
- All personnel working in the warm zone or hot zone are under the supervision of a hazardous materials branch officer.
- Personnel accountability procedures are used.
- A rest and rehabilitation area is completed and ready for first responders to finish their assignment.
- A hazardous materials branch safety officer is designated and operating.
- Communications are established on one simple radio channel that is not used by anyone close enough to interfere. Hand signals are available as a backup if radios fail.
- Appropriate protective clothing and protective equipment are used whenever the responder is exposed or potentially exposed to hazardous materials.
- A rapid intervention crew consisting of at least two responders is available for rescue of a member or team if necessary. Responders are operating in the hot zone in teams of two or more.
- All responders are monitored before they can proceed to work in PPE in accordance with the guidelines found in Supplement 5 of this handbook.
- Hazardous materials responders are aware of clues indicating that the incident may be a chemical, biological, nuclear, or explosives incident. Efforts are made to notice secondary devices or attempts to disguise the true nature of the incident if terrorism is suspected.

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

8.3.4.5.2 The incident commander shall identify the procedures for presenting a safety briefing prior to allowing personnel to work on a hazardous materials/WMD incident.

8.3.4.5.3* The incident commander shall identify at least three safety precautions associated with search and rescue missions at hazardous materials/WMD incidents.

A.8.3.4.5.3 Safety precautions should include the following:

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

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8.3.4.5.4 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) Disinfection
(6) Evaporation
(7) Isolation and disposal
(8) Neutralization
(9) Solidification
(10) Sterilization
(11) Vacuuming
(12) Washing

8.3.4.5.5* The incident commander shall identify the atmospheric and physical safety hazards associated with hazardous materials/WMD incidents involving confined spaces.

Paragraph 8.3.4.5.5 was added in response to Occupational Health and Safety Administration (OSHA) regulations on confined space operations [4]. The IC should become very familiar with OSHA and other federal regulations. Failure to comply has led to several substantial fines.

A.8.3.4.5.5 Safety hazards associated with confined spaces could include the following:

(1) Atmospheric hazards
  (a) Oxygen-deficient atmosphere
  (b) Oxygen-enriched atmosphere
  (c) Flammable and explosive atmospheres
  (d) Toxic atmosphere
(2) Physical hazards
  (a) Engulfment hazards
  (b) Falls and slips
  (c) Electrical hazards
  (d) Structural hazards
  (e) Mechanical hazards

8.4 Competencies — Implementing the Planned Response.

Δ **8.4.1 Implementing an Incident Command System.** Given a copy of the emergency response plan and annexes related to hazardous materials/WMD, the incident commander shall identify the requirements of the plan, including the procedures for notification and utilization of nonlocal resources (governmental personnel), by completing the following requirements:

(1) Identify the role of the command element during a hazardous materials/WMD incident

The role of the IC can change as the incident moves from the emergency phase to the post-emergency phase, where cleanup, recovery, and restoration services are required. One of the responsibilities of the IC is to ensure that the necessary notifications are made so that there is a seamless transfer of command from the emergency phase IC to those agencies responsible for the management and coordination of post-emergency cleanup and recovery operations.

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(2) Describe the concept of unified command and its application and use at a hazardous materials/WMD incident

(3) Identify the duties and responsibilities of the following hazardous materials branch/group functions within the incident command system:

(a) Decontamination
(b) Entry (backup)
(c) Hazardous materials branch director or group supervisor
(d) Hazardous materials safety
(e) Information and research

The competency required by 8.4.1(3) is a good example of a competency required of the IC that is not required of the technician. According to this requirement, the IC must be familiar with and able to control and organize all phases of the complete emergency operation, not only mitigation procedures. This "big picture" strategic approach is necessary to ensure smooth and efficient interaction between different agencies, responder skill levels, and duties at the scene. Mitigation is only one vital part of that big picture.

(4) Identify the steps for implementing the emergency response plans required under Title III Emergency Planning and Community Right-to-Know Act (EPCRA) of the Superfund Amendments and Reauthorization Act (SARA) Section 303, or other state and emergency response planning legislation

Normally, emergency response plans are set in motion when someone notifies an emergency operations center that an incident has occurred. The emergency response plan then identifies the type of resources that are to be dispatched and determines whether additional entities should be notified. The IC should understand this process and be aware of which officials and/or agencies must be notified for each type or level of incident reported.

(5) Given the emergency response planning documents, identify the elements of each of the documents.

Title III of the Superfund Amendments and Reauthorization Act (SARA) requires that an emergency plan contain certain elements [3]. These issues must be addressed in the planning process. The emergency plan must focus on the following items if they are not covered elsewhere:

- Pre-emergency planning and coordination with outside parties
- Personnel roles, lines of authority, training, and communications
- Emergency recognition and prevention
- Safe distances and places of refuge
- Site security and control
- Evacuation routes and procedures
- Decontamination
- Emergency medical treatment and first aid
- Emergency alert and response procedures
- Critique response and follow-up
- PPE and emergency equipment

If the standard operating procedures for the hazardous materials response team cover these elements adequately, as is sometimes the case, they do not need to be included in the emergency plan.

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(6) Identify the elements of the incident management system/incident command system (IMS/ICS) necessary to coordinate response activities at hazardous materials/WMD incidents

Several different models for hazardous materials incident command systems are available, some of which are presented in other sections of this handbook. NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety,* contains additional information [5]. Each system generally has the same components, even though they may use different titles. For example, hazardous materials branch officers and hazardous materials group supervisors generally perform the same functions. Basically, they are responsible for implementing the incident action plan that deals with operations intended to control the hazardous materials portion of an incident.

Generally, the five primary functional areas within the incident management system are as follows:

1. Incident command
2. Operations
3. Planning
4. Logistics
5. Finance

A public information officer, liaison officer, and an incident safety officer are usually included. For hazardous materials incidents, additional functions are identified, including the hazardous materials officer, hazardous materials safety officer, decontamination unit leader, rehabilitation unit leader, information research and resources unit leader, and entry/reconnaissance unit leader.

The IC's familiarity with the incident management system established in the local emergency response plan, and ability to implement it promptly and appropriately, is extremely important.

(7) Identify the primary government agencies and identify the scope of the regulatory authority (including the regulations) pertaining to the production, transportation, storage, and use of hazardous materials and the disposal of hazardous wastes

The IC is required to know which agencies could become involved in a hazardous materials incident and must be able to identify their regulatory authority. The local emergency response plan should identify these agencies and delineate their roles, authority, and functions for each incident type and response level.

(8) Identify the governmental agencies and resources that can offer assistance during a hazardous materials/WMD incident and identify their role and the type of assistance or resources that might be available

Some federal government agencies provide response or technical assistance to local authorities in specific cases:

- The U.S. Coast Guard maintains a specialized team of regional responders trained to deal with hazardous materials incidents. The Coast Guard staffs three strategically located national strike teams that are trained and equipped to respond to major oil spills and chemical releases in U.S. waters. (See Exhibit I.8.3.)
- The U.S. Environmental Protection Agency has a response component called the environmental response team (ERT). The ERT is a group of scientists and engineers who are trained in sampling and analysis, hazard assessment, cleanup techniques, and other technical support.
- The Federal Bureau of Investigation (FBI) has a WMD Coordinator in each of its 56 field offices. The WMD Coordinator is the liaison for the Hazmat Officer to the FBI and can contact FBI Evidence Response Teams, FBI Hazardous Materials Response Teams, and other FBI assets that may be of assistance.

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EXHIBIT I.8.3

The U.S. Coast Guard can provide assistance at hazardous materials incidents. (Courtesy of FEMA/Bob McMillan)

In addition, many state and local governments and private industries can provide technical assistance.

- Each state has a National Guard Bureau (NGB) Civil Support Team (CST) that is well trained and equipped to support local municipal agencies in identifying hazardous materials and managing the incident. The federal NGB has developed additional capabilities domestically to support state and local incident needs as well.
- Locally, hazardous materials response teams from other municipalities or private industry can also be good resources for large incidents or for identifying specific hazardous material(s) that cannot be identified at the scene through other methods.

The private sector also has many resources available to emergency responders, and their services range from providing technical advice and assisting with on-scene monitoring to providing specialized equipment. In most areas, private sector companies that provide cleanup and disposal services are available. Some of these companies even stage equipment in an area and fly personnel to the scene when a hazardous materials incident occurs.

CHEMTREC/CANUTEC/SETIQ can put responders in touch with private sector resources if they are unfamiliar with any in their area.

The IC must know how to get specialized assistance when it is needed and must be familiar with the type of assistance available from each resource. These resources, both public and private, should be identified in the local emergency response plan. In situations involving services that must be contracted in advance, arrangements should be addressed during the pre-incident planning phase to avoid complications during an actual emergency.

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8.4.2* Directing Resources (Private and Governmental). Given a scenario involving a hazardous materials/WMD 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.

A.8.4.2 Criteria and factors should include the following:

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

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8.4.3 Providing a Focal Point for Information Transfer to the Media and Elected Officials. Given a scenario involving a hazardous materials/WMD incident, the incident commander shall identify information to be provided to the media and governmental officials and shall complete the following tasks:

(1) Identify the local policy for providing information to the media

> In accordance with 8.4.3(1), the emergency response plan and/or an agency's standard operating procedures should establish a procedure for providing information to the media, which can then inform the public. If the public is not to panic, people must receive accurate information. The media can also help responders alert the public to possible evacuations or any other protective actions that may be necessary. In addition, the media can announce the locations of evacuation centers and phone numbers to check on the welfare of friends or family.

(2) Identify the responsibilities of the public information officer and the liaison officer at a hazardous materials/WMD incident

> The public information officer (PIO) should:
>
> - Function as a part of the IC's staff to serve as spokesperson at an incident.
> - Have training and experience in public information and media relations.
> - Establish a press area in a safe location and regularly provide the media with accurate information about the incident.
> - Provide escorts for members of the media, or identify safe areas into which the media can go unescorted if they are allowed to move about. Certain areas might be inaccessible to the press because of hazards.

(3) Describe the concept of a joint information center (JIC) and its application and use at a hazardous materials/WMD incident

8.5 Competencies — Evaluating Progress.

8.5.1 Evaluating Progress of the Incident Action Plan (IAP). Given scenarios involving hazardous materials/WMD incidents, the incident commander shall evaluate the progress of the IAP to determine whether the efforts are accomplishing the response objectives and shall complete the following tasks:

(1) Identify the procedures for evaluating whether the response options are effective in accomplishing the objectives

> To determine whether the actions at an incident are effective and the objectives are being met, responders must determine whether the incident is stabilizing or increasing in intensity. Feedback allows responders to modify either their strategic goals or the options undertaken. This feedback should include information on the effectiveness of personnel, personal protective clothing and equipment, control zones, decontamination procedures, and action options.

(2) Identify the steps for comparing actual behavior of the material and the container to that predicted in the analysis process

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When comparing actual behavior to predicted behavior, the IC should determine whether events at an incident are happening as predicted, are occurring out of sequence, or are different from expectations. The IC should also determine whether events expected as part of the mitigation, response, or overall plan are occurring as anticipated. This evaluation process should continue until the incident is ended so that no "surprises" occur during the cleanup or overhaul phase.

(3) Determine the effectiveness of the following:
   (a) Control, containment, or confinement operations
   (b) Decontamination process
   (c) Established control zones

This competency is intended to allow the IC to show that he or she can analyze an incident to determine the effectiveness of the chosen action options in achieving the strategic goals. The competencies covered in 8.5.1(1) and 8.5.1(2) provide the basis for this analysis.

   (d) Personnel being used
   (e) PPE
(4) Make modifications to the IAP as necessary

8.5.2* Transferring Command and Control During the Response Phase and the Post-Response Phase. Given a scenario involving a hazardous materials/WMD incident, the emergency response plan, and standard operating procedures, the incident commander shall be able to identify the steps to take to transfer command and control of the incident.

A.8.5.2 The appropriate steps to transfer command and control of the incident include the following:

(1) Command can be transferred only to an individual who is on-scene.
(2) Fully brief the incoming command and control person on the details of the incident, including response objectives and priorities, resources committed, unmet needs, and safety issues.

Transferring authority at an incident means transferring command, or the role of IC, from one person to another. The process should be identified in the incident management system's standard operating procedures. Authority might be transferred from one officer to another officer of higher rank or, in the case of some agencies, from one person to another person with a higher authority and more responsibility.

Authority is also sometimes transferred when the emergency phase has ended and a nonemergency phase begins, as when cleanup and remediation activities must continue at the site. In such cases, some local, state, or federal agency is likely to be chosen to manage this phase. Whatever the case, procedures should be developed to identify who may be responsible for overseeing the operations in 8.6.1.

8.6 Competencies — Terminating the Incident.

The steps involved in terminating the emergency phase of an incident are transferring command, debriefing, critiquing the incident, and managing after-action activities. The incident debriefing involves gathering information from response personnel. This information should then be used to develop a

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chronological report of emergency activities. The critique is a review of the incident and is intended to identify and document lessons learned. It should allow the participants to review response activities and determine what worked well and what did not. The critique should be a positive process that allows responders to modify response procedures if problems are identified. After-action activities include analyzing the information gathered during the debriefing and the critique, documenting that analysis, and following up as necessary to ensure that any recommendations made to improve emergency operations are implemented.

8.6.1 Terminating Response Operations. Given a scenario involving a hazardous materials/WMD incident in which the IAP objectives have been achieved, the hazardous materials incident commander shall describe the steps taken to terminate the incident consistent with the emergency response plan and/or standard operating procedures and shall complete the following tasks:

(1) Identify the steps required for terminating the hazardous materials/WMD incident
(2) Identify the procedures for transferring command to the AHJ having responsibility for post-emergency response operations (PERO)

8.6.2 Conducting a Debriefing. Given scenarios involving a hazardous materials/WMD incident, the incident commander shall conduct a debriefing of the incident and shall complete the following tasks:

The incident debriefing in 8.6.2 is not a critique; it is gathering information intended to provide an overall summary of the activities of each branch, sector, or division during an incident. The objectives of a debriefing are to identify who responded, what they did, when they did it, and how effective their actions were. The debriefing should also document injuries suffered, note the type of treatment given, and indicate whether medical follow-up is needed. Equipment that has been damaged should be reported, and unsafe conditions should be noted. Responders need to be told what materials they were exposed to, warned of symptoms those materials might produce, and advised on decontamination procedures that they should undergo. These procedures likely include showering and washing or disposing of clothing.

(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/WMD incident

8.6.3 Conducting a Post-Incident Critique. Given details of a scenario involving a multiagency hazardous materials/WMD incident, the incident commander shall conduct a critique of the incident and shall complete the following tasks:

Ideally, the ICs of the responding authorities should conduct an initial meeting to specify which personnel should be involved in the critique to ensure that all responding agencies or groups are represented properly.

(1) Describe the 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/WMD 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

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Notes recorded throughout the critique session can become the basis for writing a post-critique report. This document should be clear and concise and should include observations and conclusions presented by the participants during the critique and comments offered during the debriefing.

An after-action report is another document comprising relevant aspects of the critique. The first few pages need cover only an overview of the events, including the nature of the problem, the actions necessary to correct the problem, and the projected time frame to implement the necessary changes, plus designation of a responsible party to ensure that corrective actions are observed and implemented. Lessons learned should be listed and eventually incorporated into the existing emergency response plans as modifications and improvements. Recommendations for improvement should be listed at the end of the report. A semiannual review date should be selected to make sure that action items have been addressed.

8.6.4 Reporting and Documenting the Hazardous Materials/WMD Incident. Given a scenario involving a hazardous materials/WMD incident, the incident commander shall demonstrate the ability to report and document the incident consistent with governmental requirements and shall complete the following tasks:

(1) Identify the reporting requirements of the governmental agencies

The IC is required to know the reporting requirements necessary to deal with a hazardous materials incident. In many cases, the responsibility for reporting the incident to specific government agencies is outlined in an agency's, jurisdiction's, or organization's standard operating procedures. However, the IC must ensure that the proper agencies are notified and that the proper reports are completed.

(2) Identify the requirements for compiling incident reports, filing documents, and maintaining records as defined in the emergency response plan and/or standard operating procedures

Questions about an incident might not arise until someone files a claim some time after the incident is over. If information documenting the incident is unavailable, this lapse could have serious ramifications for all personnel involved. Thus, both documenting information about personnel training and exposure and keeping incident and critique reports on file are critical to ensuring that answers to questions that might arise about the handling of an incident can be answered efficiently, accurately, and appropriately. Typically, the IC is asked to explain the operations undertaken and the use of personnel during the incident, as well as why certain decisions were made or not made.

(3) Identify the steps in keeping an activity log and exposure records for hazardous materials/WMD incidents

The IC should assign someone to maintain a record of incident events, which will be helpful in completing the incident analysis and conducting the critique. Personnel exposure records should also be maintained as required by federal and, in many cases, state law. The IC should assign someone to gather the necessary information about the type of exposure to which personnel were subjected, the exposure level and the length of the exposure, the type of personal protective clothing and equipment personnel were using, and the type of decontamination personnel underwent. Any on-scene medical assistance that personnel received should also be documented.

(4) Identify the procedures required for legal documentation and chain of custody and continuity described in the standard operating procedures or the emergency response plan

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References Cited in Commentary

1. NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies, and CBRN Terrorism Incidents* National Fire Protection Association, Quincy, MA, 2016.
2. NFPA 1992, *Standard on Liquid Splash–Protective Ensembles and Clothing for Hazardous Materials Emergencies,* National Fire Protection Association, Quincy, MA, 2012.
3. Superfund Amendments and Reauthorization Act (SARA) of 1986, Title III, Emergency Planning and Community Right-to-know Act of 1986, (42 U.S.C. § 11001, et seq.), U.S. Government Publishing Office, Washington, DC.
4. Title 29, Code of Federal Regulations, Part 1910.146, "Permit-Required Confined Spaces," U.S. Government Publishing Office, Washington, DC.
5. NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety* National Fire Protection Association, Quincy, MA, 2014.

Additional Reference

Cote, A., ed., *Fire Protection Handbook®*, 20th ed., National Fire Protection Association, Quincy, MA, 2008.

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9 Competencies for Specialist Employees

In the 1997 edition of NFPA 472, the title *off-site specialist employee* was changed to *private sector specialist employee*. The 2008 edition of the standard brought another change to *specialist employee*. The technical committee made these changes to more accurately describe the potential duties of these employees.

Specialist employees are not just assigned to respond to off-site hazardous materials incidents. They respond to incidents within their facility, within and outside their assigned work area, and outside their facility. In many cases, specialist employees are part of the emergency response team for the company.

As shown in Exhibit I.9.1, specialist employees must wear the appropriate protective clothing and breathing apparatus, just as those in the public sector must do when responding to a similar level of emergency.

This chapter outlines the actions and conditions in which other employees are allowed to perform tasks without meeting any of the competency levels described in this chapter. For example, consider a chemical technician who is responsible for a piece of machinery that combines several chemicals (raw materials) into a new product for the company to market. If one of the chemicals is a hazardous material that spills or releases, the chemical technician is allowed to take some simple actions to mitigate the incident, such as turning off a valve. However, the employee must inform the incident management structure of an emergency before taking any actions, have adequate personal protective equipment (PPE), have training in both use of the PPE and the procedures needed for mitigation, and break off all actions when the emergency response team arrives.

Specialist employees are also sent to off-site hazardous materials incidents to provide incident commanders with technical advice or assistance. Among the companies these individuals represent are chemical manufacturers, transportation companies, users of products, and container manufacturers.

All competencies for specialist employees at every level apply to the individuals' areas of specialization and include only the chemicals and containers to which the individual is expected to respond. The specialist employee must perform all activities in a manner consistent with the organization's emergency response plan and standard operating procedures and with the available resources.

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EXHIBIT I.9.1

As employees of the facility, these employees are familiar with the physical surroundings and hazards associated with the specific facility. (Source: Southeast Missourian)

9.1 General.

9.1.1 Introduction.

9.1.1.1 This chapter shall address competencies for the following specialist employees:

(1) Specialist employee C
(2) Specialist employee B
(3) Specialist employee A

9.2 Specialist Employee C.

9.2.1 General.

9.2.1.1 Introduction.

9.2.1.1.1 The specialist employee C shall be that person who responds to incidents involving hazardous materials/WMD and/or containers in the organization's area of specialization, and the following:

(1) Consistent with the emergency response plan and/or standard operating procedures, the specialist employee C can be called on to gather and record information, provide technical advice, and arrange for technical assistance.
(2) The specialist employee C does not enter the hot or warm zone at an emergency.

9.2.1.1.2 The specialist employee C shall be trained to meet all competencies at the awareness level *(see Chapter 4)* relative to the organization's area of specialization and all additional competencies in Section 9.2.

9.2.1.2 Goal.

9.2.1.2.1 The goal of the competencies in this section shall be to provide the specialist employee C with the knowledge and skills to perform the duties and responsibilities assigned in the emergency response plan and/or standard operating procedures and to perform the tasks in 9.2.1.2.2 in a safe and effective manner.

9.2.1.2.2 When responding to hazardous materials/WMD incidents, the specialist employee C shall have the knowledge and skills to perform the following tasks in a safe manner:

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

9.2.2 Competencies — Analyzing the Incident.

9.2.2.1 Providing Information on the Hazards and Harmful Effects of Specific Hazardous Materials/WMD. Given a specific chemical(s) used in the organization's area of specialization and the corresponding SDS or other applicable resource, the specialist employee C shall advise the incident commander of the chemical's hazards and harmful effects and shall complete the following tasks:

Specialist employees C are required by 9.2.2.1 to provide information about the chemical involved in an incident. The items listed in 9.2.2.1(1) represent the minimum requirements needed to determine proficiency in this area. Additional resources include the *Emergency Response Guidebook* (ERG) and *Emergency Handling of Hazardous Materials in Surface Transportation*, among others [1, 2].

(1) Identify the following hazard information from the SDS or other resource:
   (a) Physical and chemical properties
   (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

The name of the material safety data sheet (MSDS) is changing to the global harmonization name, which is safety data sheet (SDS).

(2) Identify how to contact CHEMTREC/CANUTEC/SETIQ and governmental authorities

The requirement in 9.2.2.1(2) can be met by determining whether a responder can find the correct telephone number listed in the ERG. The company to which the product belongs most likely includes the telephone number on an SDS, on labels, on containers, and in shipping papers. The number must be included in the emergency response plan or standard operating procedures of the specialist employee's organization.

(3) Identify the resources available from CHEMTREC/CANUTEC/SETIQ and governmental authorities

CHEMTREC, the Canadian Transport Emergency Center (CANUTEC), and SETIQ, which is the Emergency Transportation System for the Chemical Industry in Mexico, can provide information on products, fax SDSs, and contact manufacturers, mutual aid responders, and contractors for hire. CHEMTREC is a public service of the American Chemical Council in Arlington, Virginia. CHEMTREC gives the on-scene

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commander immediate advice by telephone and contacts the involved shipper for detailed assistance and response follow-up. The organization can also notify the National Response Center (NRC) about significant incidents or transfer a caller to the NRC to report a spill. CHEMTREC operates 24 hours a day and can be contacted throughout the United States and Canada.

CHEMTREC can usually provide hazard information warnings and guidance when given a material's four-digit identification number, the name of the product, and the nature of the problem. If the product is unknown or more detailed information and assistance is needed, the caller should attempt to provide as much of the following information as possible:

- Caller's name and callback number
- Guide number being used
- Name of the shipper or manufacturer
- Railcar or truck number
- Consignee
- Local conditions

At an incident, a phone line should be kept open to CHEMTREC so that the center can provide guidance and assistance. CHEMTREC can also establish a conference call that connects technical experts to a caller's line as necessary.

CANUTEC is located in Ottawa, Canada, and operated by the Transport Dangerous Goods Directorate of Transport Canada. The organization provides technical assistance to emergency responders, much the same as CHEMTREC. Personnel provide technical information about the physical, chemical, toxicological, and other properties of the products involved in an incident; recommend remedial actions for fires, spills, or leaks; give advice on protective clothing and emergency first aid; and contact the shipper, manufacturer, or others who are deemed necessary.

SETIQ provides the same services as CHEMTREC and CANUTEC.

(4) Given the emergency response plan and/or standard operating procedures, identify additional resources of hazard information, including a method of contact

Specialist employees C are required by 9.2.2.1(4) to be able to contact knowledgeable personnel, as prescribed in the organization's emergency response plan or standard operating procedures. They should also know where to find the organization's plan to locate the appropriate information.

9.2.2.2 Providing Information on the Characteristics of Specific Containers. Given examples of containers for hazardous materials/WMD in the organization's area of specialization, the specialist employee C shall advise the incident commander of the characteristics of the containers and shall complete the following tasks:

Specialist employees C are required to identify the containers, such as tank cars, cargo tanks, drums, and cylinders, routinely used in the manufacture, storage, and transport of hazardous materials, in accordance with 9.2.2.2. (See Exhibit I.9.2.) Specialist employees might already know about these containers, or they may learn about them from resources such as other company specialists and their own companies' packaging guides.

(1) Identify each container by name
(2) Identify the markings that differentiate one container from another

Specialist employees C are required by 9.2.2.2(2) to be able to identify various container markings used in their work area including tank car marks and numbers, cargo tank numbers, portable tank numbers, and fixed facility tank markings. Exhibit I.9.3 and Exhibit I.9.4 show some of the various warning placards and labels required by the U.S. Department of Transportation (DOT).

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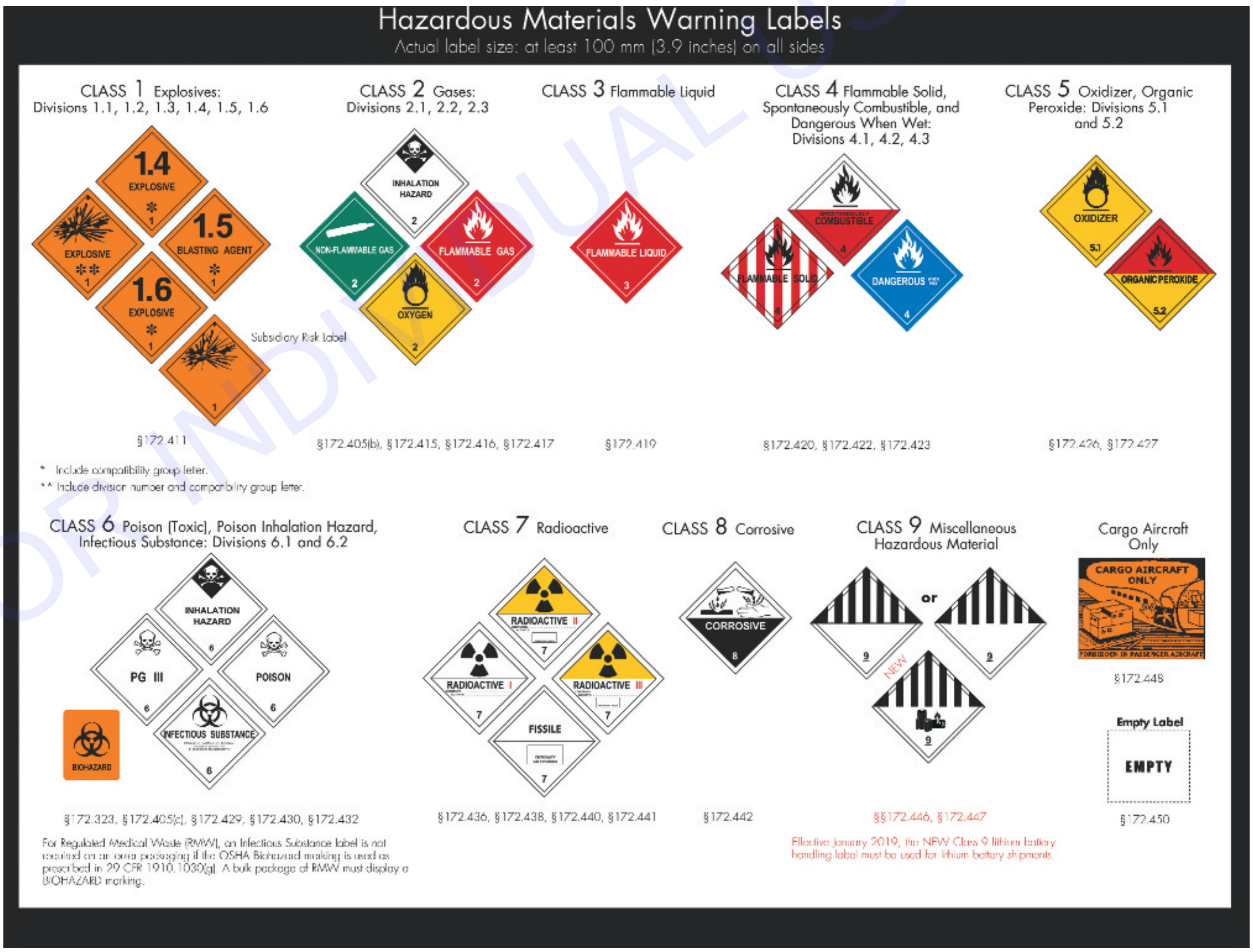
EXHIBIT I.9.2

Private sector specialist employees must be familiar with the containers used in routine storage and transport of hazardous materials as well as the facility's emergency plans, piping cutoffs, and access points that public sector responders need to find during an emergency. (Courtesy of curraheeshutter/iStock/Thinkstock)

EXHIBIT I.9.3



The U.S. Department of Transportation's Chart 16 shows the warning placards required for the transport of hazardous materials. Like their public sector counterparts, specialist employees need to be familiar with these placards. (Source: U.S. Department of Transportation, DOT Chart 16, Hazardous Materials Marking, Labeling and Placarding Guide.)

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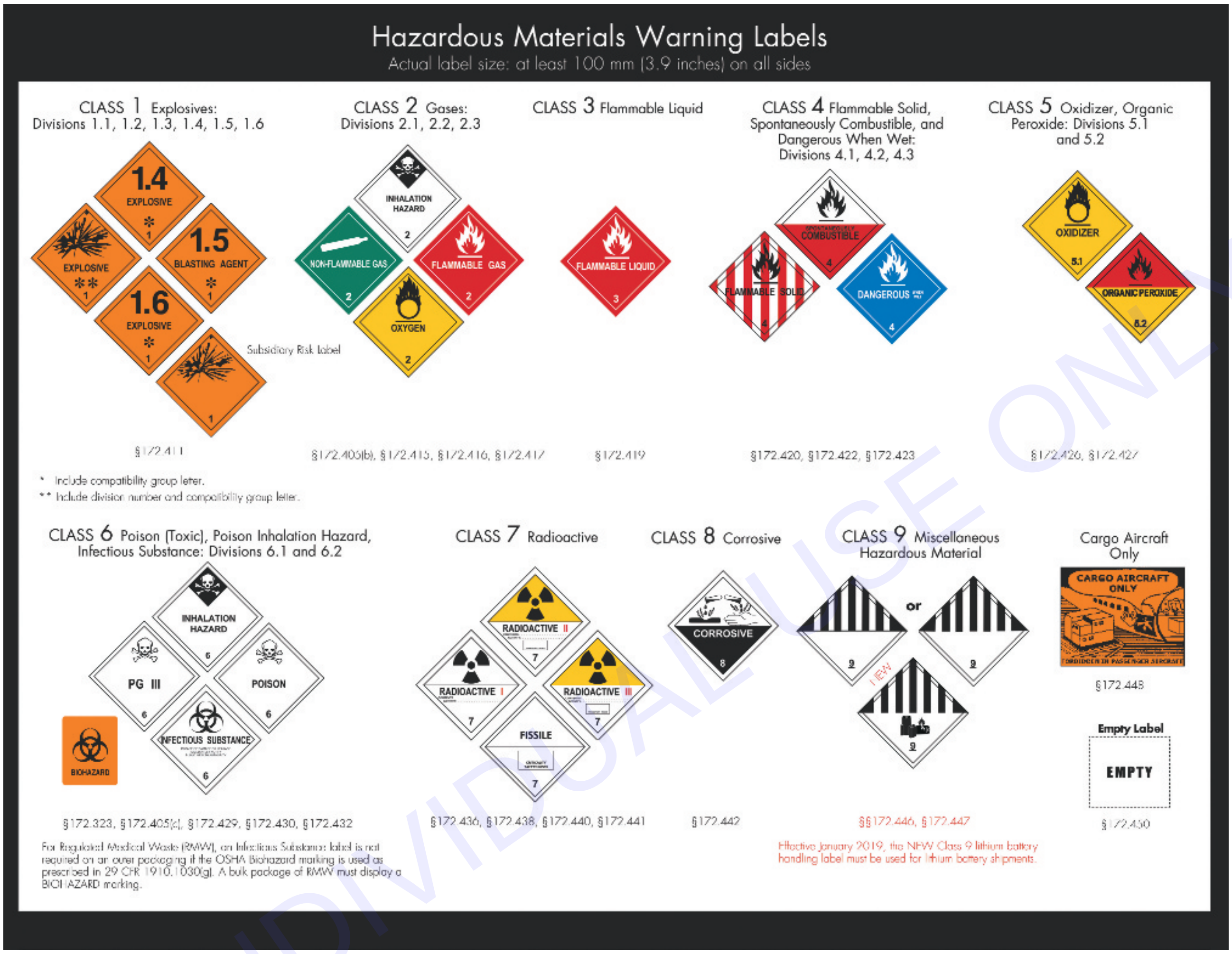
EXHIBIT I.9.4



The U.S. Department of Transportation's Chart 16 shows the warning labels required for the transport of hazardous materials. (Source: U.S. Department of Transportation, DOT Chart 16, Hazardous Materials Marking, Labeling and Placarding Guide.)

(3) Given the emergency response plan and/or standard operating procedures, identify the resources available that can provide information about the characteristics of the container

Among the resources that can give the responder information about the container's characteristics are knowledgeable persons in the responder's organization, container manufacturers, the Association of American Railroads (AAR), CHEMTREC, and various carriers.

(4) Identify indicators of possible criminal or terrorist activity, including the following:
   (a) Intentional release of hazardous materials
   (b) Unexplained bomb- and munitions-like material

9.2.3 Competencies — Planning the Response.

9.2.3.1 Providing Information on Potential Response Options for Specific Hazardous Materials/WMD. Given a specific chemical used in the organization's area of specialization and a corresponding SDS or other resource, the specialist employee C shall advise the incident commander of the response information for that chemical by being able to complete the following tasks:

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By virtue of their job duties, knowledge of specific chemicals, or access to appropriate resources within their organizations, specialist employees C are required by 9.2.3.1 to be able to supply the incident commander with response information. This information should include the physical and chemical properties of the hazardous material involved in an incident, health and environmental data, and containment and reactivity data.

(1) Obtain the following response information:
    (a) Precautions for safe handling, including industrial hygiene practices, protective measures, and procedures for cleanup of spills and leaks
    (b) Applicable emergency response control measures, including PPE
    (c) Emergency and first-aid procedures
(2) Relay any suspicions of criminal or terrorist activity to the incident commander
(3) Identify additional resources for obtaining response information

Additional resources the specialist employee might use include the ERG, the AAR's *Emergency Action Guides* (EAG), experts in his or her organization, and CHEMTREC/CANUTEC/SETIQ [3].

9.2.3.2 Providing Information on Potential Response Options for Specific Containers. Given a specific facility or transportation container used in the organization's area of specialization, the specialist employee C shall advise the incident commander of the response information for that chemical by being able to complete the following tasks:

(1) Identify safe operating procedures for that container, including acceptable pressures, temperatures, and materials of construction, and potential adverse outcomes resulting from those conditions
(2) Describe safety devices on the container, including emergency shutoff valves, pressure relief devices, and vacuum breakers
(3) Identify early signs of container and safety device failure
(4) Suggest emergency response procedures

9.3 Specialist Employee B.

9.3.1 General.

9.3.1.1 Introduction.

9.3.1.1.1* The specialist employee B shall be that person who, in the course of regular job duties, works with or is trained in the hazards of specific chemicals or containers in the individual's area of specialization and the following:

(1) Because of the employee's education, training, or work experience, the specialist employee B can be called on to respond to incidents involving these chemicals or containers.
(2) The specialist employee B can be used to gather and record information, provide technical advice, and provide technical assistance (including work in the hot zone) at the incident, consistent with the emergency response plan and/or standard operating procedures.

A.9.3.1.1.1 An example of a specialist employee B is a person who regularly loads and unloads tank trucks of the specific chemical involved in the incident as part of his or her regular job. At a hazardous materials/WMD incident, this person would be assigned the task of transferring the contents of the damaged tank truck into another container. The specialist employee B would not be involved with chemicals for which he or she has not been trained and would leave the hot or warm zone when this work is completed.

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9.3.1.1.2 The specialist employee B shall be trained to meet all competencies at the awareness level *(see Chapter 4)* relative to the organization's area of specialization, all competencies at the specialist employee C level *(see Section 9.2)*, and all additional competencies in Section 9.3.

9.3.1.2 Goal.

Δ **9.3.1.2.1** The goal of these competencies shall be to ensure that the specialist employee B has the knowledge and skills to perform the duties and responsibilities assigned in the emergency response plan and/or standard operating procedures and the tasks in 9.3.1.2.2.

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

(1) Assist the incident commander in analyzing the magnitude of an incident involving hazardous materials/WMD or containers for hazardous materials/WMD by completing the following tasks:
  (a) Provide and interpret information on the hazards and harmful effects of specific hazardous materials/WMD
  (b) Provide and interpret information on the characteristics of specific containers
  (c) Provide information on concentrations of hazardous materials/WMD from exposure monitoring, dispersion modeling, or any other predictive method
(2) Assist the incident commander in planning a response to an incident involving hazardous materials/WMD or containers for hazardous materials/WMD by completing the following tasks:
  (a) Provide information on the potential response options and their consequences for specific hazardous materials/WMD or containers for hazardous materials/WMD
  (b) Provide information on the PPE requirements for a specific chemical
  (c) Provide information on the technical decontamination methods for a specific chemical
  (d) Provide information on the federal or provincial regulations that relate to the handling and disposal of a specific chemical
  (e)* Support the incident commander with the development of an incident action plan (IAP) consistent with the emergency response plan and/or standard operating procedures and within the capabilities of the available resources, for handling hazardous materials/WMD or containers in that incident
(3) Implement the planned response, as developed with the incident commander, for hazardous materials/WMD or containers for hazardous materials/WMD, consistent with the emergency response plan and/or standard operating procedures and within the capabilities of the available resources, by completing the following tasks:
  (a) Perform response options specified in the IAP, as agreed upon with the incident commander and consistent with the emergency response plan and/or standard operating procedures
  (b) Don, work in, and doff PPE 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 hazardous materials/WMD as required

A.9.3.1.2.2(2)(e) The following site safety plan considerations are from the EPA *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

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(7) On-site work plans
(8) Communication procedures
(9) Decontamination procedures
(10) Site safety and health plan

9.3.2 Competencies — Analyzing the Incident.

9.3.2.1 Providing and Interpreting Information on Hazards of Specific Hazardous Materials/WMD. Given a specific chemical within the individual's area of specialization and a corresponding SDS or other resource, the specialist employee B shall advise the incident commander of the chemical's hazards and harmful effects of specific hazardous materials/WMD and the potential consequences based on the incident by completing the following requirements:

(1) Given a specific chemical, identify and interpret the following hazard information:
  (a) Physical and chemical properties
  (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

All specialist employees B must be able to locate the hazard information in 9.3.2.1(1) in their organization's SDS and understand it. The product specialist described in Section 9.3 must be able to interpret this information and give advice to the incident commander. If specialist employee B responders cannot interpret the information, they must be able to contact the individuals in their organization who can interpret it. For an example of a typical SDS, see Chapter 4 of NFPA 472 in this handbook.

(2) Given examples of specific hazardous materials/WMD and the necessary resources, predict the potential behavior of the hazardous materials/WMD based on the damage found, including the consequences of that behavior

Specialist employees B are required by 9.3.2.1(2) to be able to predict what will happen when a liquid, solid, or gas is released from its container. What will occur, for example, if the chemical is exposed to air? Will the chemical react, vaporize, or ignite?

(3) Identify the general types of hazard information available from the other resources identified in the emergency response plan and/or standard operating procedures

Among the types of hazard information available to the specialist employee from sources identified in the organization's emergency response plan and standard operating procedures are containment techniques, medical treatment protocols, container design, reactivity data, and decontamination and mitigation procedures.

9.3.2.2 Providing Information on Characteristics of Specific Containers. Given a container for specific hazardous materials/WMD, the specialist employee B shall advise the incident commander of the characteristics and potential behavior of that container by completing the following requirements:

Specialist employees B are required by 9.3.2.2 to be able to identify the person or persons in their organizations they can contact for information on such activities as damage assessment, fitting arrangement, and probability of container failure.

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(1) Given examples of containers for specific hazardous materials/WMD, identify the purpose and operation of the closures found on those containers

Specialist employees must be able to identify the types of nonbulk and bulk containers used in their organization. Commentary Table I.9.1 displays sample types of containers and should also include other types of containers, such as sample containers and supersacks that the responder's organization may use. The specialist employee B should know how to contact the organization's container specialist who can provide this information.

COMMENTARY TABLE I.9.1 *Types of Nonbulk and Bulk Containers*

Type of Container	*Example*	*Characteristics to Be Identified*
Nonbulk containers	Drums	Type of bungs and seal caps
		Closed and open
		Head drums
		Closure rings
		Safety relief devices
	Cylinders	Valves
		Valve caps
		Relief devices
		Purge devices
Bulk containers	Tote bins	Valves
		Bungs, and safety and relief devices
		Spouts
		Secondary closures
		Purge devices
		Couplings
	Cargo tanks	Venting devices
		Valves
		Relief purge devices
		Connections
		Manways
		Emergency shutoff valves
		Excess flow valves
		Gauging devices
		Sampling devices
		Secondary closures
		Safety relief devices
	Tank cars	Valves
		Safety and relief devices
		Connections
		Sampling valves
		Vapor and liquid valves
		Heater coils
		Caps
		Bottom outlet
		Dome cover
		Dome gasket
	Hopper cars and hopper trucks	Gates
		Manways

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COMMENTARY TABLE I.9.1 Continued

Type of Container	*Example*	*Characteristics to Be Identified*
	ISO containers	Venting devices Valves Relief purge devices Connections Manways Emergency shutoff valves Excess flow valves Gauging devices Sampling devices Secondary closures Safety and relief devices

(2) Given a chemical container, list the types of damage that could occur

The types of damage specified in 9.3.2.2(2) might include punctures, scores, gouges, blown rupture disks, damaged gaskets, corrosion, damaged o-rings, liner failure, weld seam failure, cracked bungs, and frictional damage on drums, among other things. The specialist employee B should know how to contact the organization's container specialist who can provide this type of information.

(3) Given examples of containers for specific hazardous materials/WMD and the necessary resources, predict the potential behavior of the containers and the consequences, based on the damage found

Based on the types of damage listed in 9.3.2.2(3), all specialist employees B should be able to assess potential container failures. They should know, for example, that a scored pressurized container could lead to a boiling liquid expanding vapor explosion (BLEVE), that a sheared valve on a cylinder could cause the container to rocket, that a bulging drum could rupture, and that damaged or stripped threads could cause a product release. Exhibit I.9.5 shows an example of the warning signs that lead to detection of a leak.

EXHIBIT I.9.5

This plugged drum (top right drum) has the warning signs of leakage, such as corrosion visible on the far left, dents and scratches visible along the seam side by the second plug, and seepage below the plugged hole, that the private sector specialist employee should be able to spot. (Courtesy of MG_54/iStock/Thinkstock)

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(4) Given the emergency response plan and/or standard operating procedures, identify resources (including a method of contact) for knowledge of the design, construction, and damage assessment of containers for hazardous materials/WMD

The resources in 9.3.2.2(4) could include, but are not limited to, chemical and mechanical engineers, packaging specialists, and container manufacturers. The carrier, especially the cargo tank carrier, could be another resource.

9.3.2.3 Providing Information on Concentrations of Hazardous Materials/WMD.

9.3.2.3.1 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 specialist employee B shall advise the incident commander of the concentrations of the released chemical and the implications of that information to the incident.

9.3.2.3.2 The specialist employee B shall meet the following additional requirements:

(1) Identify the applicable monitoring equipment

Specialist employees B, who are trained to select and use monitoring equipment as part of their regular duties, are required by 9.3.2.3.2(1) to be able to identify the equipment appropriate for monitoring a chemical used in their areas of specialization. The equipment should be operated in accordance with the manufacturer's instructions.

(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

Specialist employees B should be able to interpret the results of monitoring in terms of known hazards. When unable to do so, the specialist employee should be able to contact the person in the organization who can.

(4) Demonstrate field calibration and testing procedures, as necessary, for the monitoring equipment provided by the organization
(5) Given the emergency response plan and/or standard operating procedures, identify the resources (including a method of contact) capable of providing monitoring equipment, dispersion modeling, or monitoring services

Specialist employees B are required by 9.3.2.3.2(5) to be familiar with their organization's emergency response plan, standard operating procedures, and other resources so that they can identify the industrial hygienist, the site safety officer, the equipment supplier, and any other source that can provide this information.

9.3.3 Competencies — Planning the Response.

9.3.3.1 Providing Information on Potential Response Options and Consequences for Specific Hazardous Materials/WMD. Given specific hazardous materials/WMD or containers within the employee's individual area of specialization and the associated resources, the specialist employee B shall advise the incident commander of the potential response options and their consequences and shall complete the following tasks:

(1) Given a specific chemical and a corresponding SDS, identify and interpret the following response information:
   (a) Precautions for safe handling, including industrial hygiene practices, protective measures, and procedures for cleanup of spills or leaks

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Using their organizations' SDSs, specialist employees B should be able to determine what PPE is needed to deal with spills and decontamination procedures, taking into consideration the class and state of the material, the external hazards, and the possible secondary hazards.

When dealing with flammables, for example, specialist employees B should eliminate ignition sources, use sparkproof tools, and consider using foam to suppress vapors. When dealing with corrosives, the specialist employee B should ensure that the equipment and tools specific to the materials involved in the incident are compatible with the material and type of neutralizing materials being used. For example, certain chemicals can react with some metal shovels, pumps, and hoses. When dealing with poison, the specialist employee B should consider evacuation or protection in-place; should not allow eating, smoking, or gum chewing in hazardous areas; and should ensure that any PPE and tools that have been used are properly decontaminated.

(b) Applicable control measures, including PPE

Specialist employees B should be able to locate and identify the information on applicable control measures from an SDS. Interpreting specific control and remediation procedures might require the expertise of a product specialist, an industrial hygienist, or another appropriate person in the organization.

(c) Emergency and first-aid procedures

The first-aid section of an SDS is generally comprehensive and self-explanatory. The specialist employee B should pay particular attention to the use and availability of antidotes.

(2) Given the emergency response plan and/or standard operating procedures, identify additional resources for interpreting the hazards and applicable response information for a hazardous material/WMD

Specialist employees B are required by 9.3.3.1(2) to be able to demonstrate how to access additional sources of assistance from other resources, such as CHEMTREC/CANUTEC/SETIQ.

(3) Describe the advantages and limitations of the potential response options for a specific chemical

In accordance with 9.3.3.1(3), the specialist employee B should be able to select the appropriate response option to the particular chemical involved. For example, Commentary Table I.9.2 lists three event scenarios and possible responses to each event.

COMMENTARY TABLE I.9.2 *Examples of Response Options*

Event	*Response*	*Advantages*	*Disadvantages*
Pesticide fire	Allow to burn	Minimal runoff Minimal containment	Products of combustion Demand on fire departments Vapor release
Acid spill	Neutralize runoff	Reduces hazard	Exposure from process Lessens corrosivity
Poisonous liquid releasing vapor	Apply foam blanket	Suppresses vapor	Contributes to contamination, increases cleanup

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(4) Given the emergency response plan and/or standard operating procedures, identify resources (including a method of contact) capable of the following:
  (a) Repairing containers for hazardous materials
  (b) Removing the contents of containers for hazardous materials
  (c) Cleaning and disposing of hazardous materials/WMD or containers for hazardous materials/WMD

The specialist employee B should be able to locate individuals or organizations identified by organizational resources (e.g., the emergency response plan) and standard operating procedures that can accomplish the tasks in Commentary Table I.9.3, which are tasks they normally perform in their day-to-day activities.

COMMENTARY TABLE I.9.3 *Individuals Who Can Assist the Private Sector Specialist Employee at Level B*

Normal Job Function	*Task(s)*
Material handler	Repairs containers
Container specialist	
Material handler	Removes container contents
Loader/unloader	
Container specialist	
Environmental specialist	Cleans up site
	Disposes of chemicals

9.3.3.2 Providing Information on PPE Requirements. Given specific hazardous materials/WMD or containers for hazardous materials/WMD within the employee's individual area of specialization and the associated resources, the specialist employee B shall advise the incident commander of the PPE necessary for various response options by completing the following requirements:

(1) Given a specific chemical and a corresponding SDS or other chemical-specific resource, identify PPE, including the construction materials that are compatible with that chemical
(2) Given the emergency response plan and/or standard operating procedures, identify other resources (including a method of contact) capable of identifying the PPE that is compatible with a specific chemical

Some resources a specialist employee B can use to identify PPE compatible with a specific chemical are compatibility charts, databases, and PPE manufacturers' literature.

(3) Given an incident involving a specific chemical and the response options for that incident, determine whether the PPE is appropriate for the options presented

All specialist employees B who are trained to select and/or use PPE are required by 9.3.3.2(3) to be able to identify, interpret, and apply compatibility data from compatibility charts and to consider the limitations associated with the use of such equipment, especially if the potential for fire is present.

9.3.3.3 Providing Information on Decontamination Methods. Given a specific chemical within the employee's individual area of specialization and the available resources, the specialist employee B shall identify the technical decontamination process for various response options and shall complete the following tasks:

(1) Given a specific chemical and a corresponding SDS or other chemical-specific resource, identify the potential methods for removing or neutralizing that chemical

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In accordance with 9.3.3.3(1), the specialist employee B should be able to point out the sections on an SDS that include decontamination and neutralization information or be able to contact an individual in the organization who can provide this information.

(2) Given a specific chemical and a corresponding SDS or other chemical-specific resource, identify the circumstances under which disposal of contaminated equipment would be necessary

Materials that cannot be decontaminated such as porous materials like leather or wood, limited-use equipment such as one-time-use protective clothing, or equipment for which decontamination procedures are unknown might have to be disposed of through bagging. The specialist employee B should be able to clearly identify, in accordance with 9.3.3.3(2), when disposal is necessary and the appropriate method to use.

(3) Given the emergency response plan and/or standard operating procedures, identify resources (including a method of contact) capable of identifying potential decontamination methods

9.3.3.4 Providing Information on Handling and Disposal Regulations. Given a specific chemical within the employee's individual area of specialization and the available resources, the 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 complete the following tasks:

(1) Given a specific chemical and a corresponding SDS or other resource, identify federal or provincial regulations that apply to the handling, transportation, and disposal of that chemical

Among the regulations that apply to the handling, transportation, and disposal of chemicals are DOT's Title 49 CFR; EPA's Title 40 CFR; and, in Canada, Transportation of Dangerous Goods Act (TDG) and/or the Ministry of the Environment (MOE) [4, 5, 6]. In the event of an incident, the agencies that handle these regulations should be contacted by someone identified in the organization's emergency response plan or standard operating procedures as the person responsible for making the necessary notifications according to regulations.

(2) Given a specific chemical and a corresponding SDS 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

In accordance with 9.3.3.4(2), the agencies responsible for compliance with regulations applying to the handling, transportation, and disposal of a specific chemical include the Occupational Safety and Health Administration (OSHA), which covers emergency response activities; DOT, which deals with transportation; and Environmental Protection Agency (EPA), which handles hazardous materials disposal in the United States. Transport Canada, Environment Canada, and Labor Canada cover the same issues for the provinces. In the event of an incident, the agencies should be contacted by someone identified in the organization's emergency response plan or standard operating procedures as the person responsible for making the necessary notifications according to regulations.

(3) Given the emergency response plan and/or standard operating procedures, identify resources for information pertaining to federal or provincial regulations relative to the handling and disposal of a specific chemical

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The specialist employee B is required by 9.3.3.4(3) to be able to contact a knowledgeable person within the organization, such as an environmental engineer, chemist, or specialist, who knows where in the organization's emergency response plan or standard operating procedures the needed information can be located.

9.3.3.5 Developing an Incident Action Plan (IAP). Given a scenario involving hazardous materials/WMD or containers used in the employee's individual area of specialization, the specialist employee B shall (in conjunction with the incident commander) develop an IAP, consistent with the emergency response plan and/or standard operating procedures and within the capabilities of the available resources, for handling hazardous materials/WMD or containers in that incident and shall complete the following tasks:

(1) Given the emergency response plan and/or standard operating procedures, identify the process for development of an IAP, including roles and responsibilities under the incident management system/incident command system (IMS/ICS) site safety and control plan

Each potential hazardous materials incident is required to have an overall plan of action. However, specialist employees B are expected to develop an action plan only for the tasks and procedures associated with their areas of expertise and regular job duties. They are also expected to define the processes needed to execute that plan. For example, loaders and unloaders who transload material as part of their normal duties may be called on to develop an action plan for performing the same procedure at the scene of a hazardous materials incident and to define the steps and safety considerations required to execute that plan.

(2) Include a site safety and control plan in the IAP

9.3.4 Competencies — Implementing the Planned Response.

9.3.4.1 Performing Response Options Specified in the Incident Action Plan. Given an assignment by the incident commander in the employee's individual area of specialization, the specialist employee B shall perform the assigned actions consistent with the emergency response plan and/or standard operating procedures and shall complete the following tasks:

(1) Perform assigned tasks consistent with the emergency response plan and/or standard operating procedures and the available personnel, tools, and equipment (including PPE), 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

A.9.3.4.1(2) Such factors include heat, cold, working in a confined space, working in personal protective equipment, working in a flammable or toxic atmosphere, and pre-existing health conditions.

9.3.4.2 Using PPE. Given an assignment within the employee's individual area of specialization that is consistent with the emergency response plan and/or standard operating procedures, the specialist employee B shall be able to complete the following tasks:

(1) Don, work in, and doff the correct respiratory protection and protective clothing for the assigned tasks

(2) Identify the safety considerations for personnel working in PPE, including the following:
    (a) Buddy system

All responders at a hazardous materials incident must work in a minimum of two-person teams, as required by 9.3.4.2(2)(a). Each person must be within sight or sound of the other person at all times during the incident.

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(b) Backup personnel

Safety procedures in 9.3.4.2(2)(b) require that backup responders dress at the same level of protection as those on the entry team. Backup personnel may have to enter the same hazardous area as the primary entry team to perform a rescue and should be prepared to do so at any time.

(c) Symptoms of heat and cold stress

Safety procedures in 9.3.4.2(2)(c) require that personnel be monitored for symptoms such as abnormal pulse, change in body temperature, respiratory difficulty, changes in skin color, and decreased mental alertness during or shortly after exposure to a hazardous material.

(d) Limitations of personnel working in PPE

Safety procedures establish time limits for wearing personal protective clothing during an incident. Other limiting factors include the responder's level of physical fitness, endurance ability, and the psychological condition of the individual responder.

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

Safety procedures in 9.3.4.2(2)(e) require that responders evaluate signs of material degradation, including discoloration, the loss of integrity and flexibility, the formation of blisters, and melting or stretching of material.

(f) Physical and psychological stresses on the wearer

Safety procedures required to maintain the well-being of the responder include monitoring responders for signs of stress related to work in the hazardous materials incident environment. Such stress could cause a rise in body temperature, loss of body fluids, elevated pulse and respiration rates, vertigo, nausea, changes in skin color, disorientation, anxiety, and incoherence.

(g) Emergency procedures and hand signals

Safety procedures in 9.3.4.2(2)(g) require that responders maintain visual contact and that they demonstrate appropriate hand signals for loss of air and emergency escape assistance.

(3) Identify the procedures for cleaning, sanitizing, and inspecting PPE provided by the organization

Cleaning, sanitizing, and inspecting PPE should be performed in accordance with the manufacturer's recommendations and the organization's standard operating procedures for the use and maintenance of PPE.

9.3.5 Competencies — Evaluating Progress.

9.3.5.1 Providing an Evaluation of the Effectiveness of Selected Response Options. Given an incident involving specific hazardous materials/WMD or containers for hazardous materials/WMD within the employee's individual area of specialization, the specialist employee B shall advise the incident commander of the effectiveness of the selected response options and shall complete the following tasks:

(1) Identify the criteria for evaluating whether the selected response options are effective in accomplishing the objectives

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The criteria in 9.3.5.1(1) must be based on the desired outcome. The responder must determine how hazards to personnel, the environment, and property affect the outcome sought. Effective options result in diminished hazards, stabilization, or complete mitigation.

(2) Identify the circumstances under which it would be prudent to withdraw from a chemical incident

In accordance with 9.3.5.1(2), the responder should withdraw from a chemical incident when the following conditions exist:

- Intervention will not or cannot produce a favorable outcome.
- The immediate hazard level is unacceptable.
- The incident is worsening as a result of the option selected.

9.3.5.2 Reporting and Documenting the Incident. Given a scenario involving hazardous materials/WMD or containers for hazardous materials/WMD used in the employee's individual area of specialization, the specialist employee B shall complete the reporting and subsequent documentation requirements consistent with the emergency response plan and/or standard operating procedures and shall complete the following tasks:

(1) Identify the importance of documentation (including training records, exposure records, incident reports, and critique reports) for an incident involving hazardous materials/WMD

Organizations require documentation to help establish preventive and corrective actions. Documentation of hazardous materials incidents is mandated by governmental regulation and is required for emergency response training, medical monitoring, and PPE certification. Regulatory organizations require documentation for similar reasons. Finally, documentation is frequently used for trend analysis in hazardous materials incident prevention assessments.

(2) Identify the steps used in keeping an activity log and exposure records

Most emergency response plans require that an employee's name and identifying code (usually a Social Security number) be recorded with each of the functions performed at a hazardous materials incident. In addition, the time and duration of each activity must be documented. Exposure records are compiled in a similar manner, listing the materials to which the employee may be exposed, the duration of exposure, the manner in which the contaminant was identified, and the name of the person who made that determination.

(3) Identify the requirements for compiling incident reports

The requirements in 9.3.5.2(3) for compiling an incident report are to provide a factual, objective format for defining the who, what, where, when, and how of an incident.

(4) Identify the requirements for compiling hot zone entry and exit logs

Hot zone entry and exit logs are needed so that those in charge of an incident can monitor an employee's health and keep track of the work performed and the time spent in the hot zone. See 9.3.5.2(2) for more information.

(5) Identify the requirements for compiling PPE logs

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In accordance with 9.3.5.2(5), PPE logs should include information about use time, inspections, testing, and the results of inspection and decontamination procedures for each garment or suit used. This documentation should also include a list of the contaminants to which the equipment has been exposed during its lifetime of use and the duration of each exposure.

(6) Identify the requirements for filing documents and maintaining records

Most organizations keep records to protect themselves and their employees and provide a written account of each incident. Appropriate sources within the organization, such as regulatory specialists, should be consulted for both internal and external reporting requirements.

(7) Identify resources (including a method of contact) knowledgeable of the federal or provincial reporting requirements for hazardous materials/WMD incidents

9.4 Specialist Employee A.

9.4.1 General.

9.4.1.1 Introduction.

Specialist employees A can provide the incident commander with considerable assistance because their training deals with a range of products and containers specific to their employing organization and is usually equivalent to that of the hazardous materials technician for these specific products and containers. However, specialist employees A need demonstrate only the technician level competencies that apply to the materials and containers for which they are expected to respond at their company's property.

9.4.1.1.1 The specialist employee A shall be that person who is specifically trained to handle incidents involving chemicals or containers for chemicals used in the organization's area of specialization, and the following:

(1) Consistent with the emergency response plan and/or standard operating procedures, the specialist employee A is able to analyze an incident involving chemicals within his or her organization's area of specialization.
(2) The specialist employee A can then 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.

9.4.1.1.2 The specialist employee A shall be trained to meet all competencies at the awareness level *(see Chapter 4)* relative to the organization's area of specialization, all competencies at the specialist employee C level *(see Section 9.2)*, and all competencies at the hazardous materials technician level *(see Chapter 7)* relative to the hazardous materials/WMD and containers used in the organization's area of specialization.

9.4.1.2 Goal.

Δ **9.4.1.2.1** The goal of this level of competence shall be to ensure that the specialist employee A has the knowledge and skills to perform the duties and responsibilities assigned in the emergency response plan and/or standard operating procedures.

9.4.1.2.2 In addition to being competent at the specialist employee C and the hazardous materials technician levels, the specialist employee A shall be able to, in conjunction with the incident commander, perform the following tasks:

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(1) Analyze an incident involving hazardous materials/WMD and containers for hazardous materials/WMD 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 hazardous materials/WMD and containers for hazardous materials/WMD, including the following:

i. Identify the containers involved

The specialist employee A is required by 9.4.1.2.2(1)(a)(i) to be able to identify the characteristics of on-site containers that might indicate the presence of hazardous materials. These special containers include high-pressure containers (identified by their rounded ends), cryogenic cargo tanks or cylinders, and casks used for radioactive materials.

ii. Identify or classify unknown materials

The specialist employee A is required by 9.4.1.2.2(1)(a)(ii) to be able to identify unknown materials likely to be on hand in the employer's manufacturing or storage facilities in the event that a container's shipping papers, placards, SDSs, or other identifying items have been destroyed or are unavailable.

iii. Verify the identity of the hazardous materials/WMD

(b) Collect and interpret hazard and response information from printed resources, technical resources, computer databases, and monitoring equipment for hazardous materials/WMD

Specialist employees A must understand the importance of using multiple resources for gathering hazard and response information. In 9.4.1.2.2(1)(b), these responders are required to collect information from a variety of resources, be able to appropriately compare that information, and then make decisions based on this comparison and evaluation. Most responders generally give more weight to the more conservative information and base their actions on that information.

(c) Determine the extent of damage to containers of hazardous materials/WMD

The following terms allow the responder to use standard terminology when assessing containers to determine how badly they have been damaged. The condition of the container should be described using one of the following terms:

- Undamaged, no product release
- Damaged, no product release
- Damaged, product release
- Undamaged, product release

(d) Predict the likely behavior of the hazardous materials/WMD and containers for hazardous materials/WMD

After the chemical is identified, information about the chemical's hazards and behavior should be collected from appropriate reference sources. This information, which can be obtained simultaneously with determining the extent of container/packaging damage, is used to predict the behavior of the chemical and its container.

(e) Estimate the potential outcomes of an incident involving hazardous materials/WMD and containers for hazardous materials/WMD

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An estimate is a series of predictions that attempts to provide an overall picture of potential outcomes. Responders must assess the information gathered during analysis and predict the outcome based on that assessment.

(2) Plan a response (within the capabilities of available resources) to an incident involving hazardous materials/WMD and containers for hazardous materials/WMD used in the organization's area of specialization by completing the following tasks:

(a) Identify the response objectives for an incident involving hazardous materials/WMD and containers for hazardous materials/WMD

The specialist employee A should note that many options available in 9.4.1.2.2(2)(a) can be used either offensively or defensively. For example, the size of the potential endangered area can be changed defensively, by diking to contain a spill, or offensively, by entering the hot zone and plugging the leak. Defensive operations might be the most prudent method of dealing with many hazardous materials.

(b) Identify the potential response options for each response objective for an incident involving hazardous materials/WMD and containers for hazardous materials/WMD

Chapter 7 of this handbook supplies information about options available to the specialist employee A for accomplishing response objectives.

(c) Select the PPE required for a given response option for an incident involving hazardous materials/WMD and containers for hazardous materials/WMD

As directed in 9.4.1.2.2(2)(c), the responder should always use the highest level of protection until the chemicals likely to be involved in an incident can be positively identified and the level of concentration can be determined. Determining the most appropriate type of respiratory protection required at each incident depends on many factors. A key factor is the level of protective clothing necessary to protect the specialist employee A. Level A protection limits the user to positive pressure self-contained breathing apparatus or positive pressure supplied-air respirators.

(d) Select the technical decontamination process for an incident involving hazardous materials/WMD and containers for hazardous materials/WMD

The two methods of decontamination are physical and chemical. Physical methods manually separate the chemical from the material being decontaminated by scrubbing or washing the material, or both. Physical decontamination is often easier than chemical decontamination, but it may not completely remove all the contaminants. Chemical methods involve changing one chemical into another or into a form that facilitates its removal. Unfortunately, the chemical process involved could introduce other hazards. Care must be taken to collect all the contamination that has been removed by either method and to dispose of it properly.

(e) Develop an IAP (within the capabilities of the available resources), including a site safety and control plan, for handling an incident involving hazardous materials/WMD and containers for hazardous materials/WMD consistent with the emergency response plan and/or standard operating procedures

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After selecting the response option for a hazardous materials incident, an incident action plan including safety and health considerations should be developed in accordance with 9.4.1.2.2(2)(e). The incident action plan describes the response objectives and options and the personnel and equipment required to accomplish the objectives. The plan provides a permanent record of the decisions made at the incident. An organization's standard operating procedures provide the basis of the incident action plan. Components for a typical plan of action include the following:

- Site description
- Entry objectives
- On-scene organization and coordination
- On-scene control
- Hazard evaluation
- PPE
- On-scene work assignments
- Communications procedures
- Decontamination procedures
- On-scene safety and health considerations including designation of the safety officer, emergency medical care procedures, environmental monitoring, emergency procedures, and personnel monitoring

The complexity of an incident determines the level of detail identified in the incident action plan. Each of the items in the preceding list must be considered, however, to ensure that nothing is overlooked.

(3) Operating under the incident management system/incident command system (IMS/ICS), implement the planned response (as developed with the incident commander) to an incident involving hazardous materials/WMD and containers for hazardous materials/WMD used in the organization's area of specialization consistent with the emergency response plan and/or standard operating procedures by completing the following tasks:
  (a) Don, work in, and doff correct PPE for use with hazardous materials/WMD

Specialist employees A should practice donning and doffing chemical-protective clothing to become proficient in the competency required in 9.4.1.2.2(3)(a). One of the most effective ways to evaluate the ability to don and doff protective clothing is to conduct training exercises that require putting on PPE and to conduct simulated control activities, followed by simulated decontamination.

Because some types of chemical-protective clothing are very costly, using garments that are no longer adequate for emergency response might be advisable. Hazardous materials training suits that are less expensive are also available; these suits allow for cost-effective training in the use of totally encapsulating suits.

  (b) Perform containment, control, and product transfer functions, as agreed upon with the incident commander, for hazardous materials/WMD and containers for hazardous materials/WMD

The purpose of the competency required by 9.4.1.2.2(3)(b) is to allow the specialist employee A to demonstrate the ability to choose appropriate equipment and methods to control a simulated incident. The equipment necessary to conduct the operations varies, depending on the type of material that is leaking and the physical properties of the damaged area, valve, or breach. For example, nonsparking tools should be used when working with flammable liquids or gases. In some cases, special tools might be needed for certain valves. Such situations should be identified during pre-incident planning.

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

9.4.2 Competencies — Analyzing, Planning, Implementing, and Evaluating. The specialist employee A shall demonstrate competencies at the specialist employee C level *(see Section 9.2)* and the hazardous materials technician level *(see Chapter 7)* relative to hazardous materials/WMD and containers used in the organization's area of specialization.

References Cited in Commentary

1. *Emergency Response Guidebook* (ERG). Office of Hazardous Materials Initiatives and Training, PHH-50, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, 1200 New Jersey Avenue, SE East Building, 2nd Floor, Washington, DC 20590, www.phmsa.dot.gov/hazmat/library/erg, 2012.
2. *Emergency Handling of Hazardous Materials in Surface Transportation,* Association of American Railroads, Washington, DC.
3. *Emergency Action Guides,* Association of American Railroads, Washington, 2003.
4. Title 49, Code of Federal Regulations, U.S. Government Publishing Office, Washington, DC.
5. Title 40, Code of Federal Regulations, U.S. Government Publishing Office, Washington, DC.
6. Transportation of Dangerous Goods Act 1992, Transport Canada, Ontario, Ottawa, Canada.

Additional Reference

Cote, A., ed., *Fire Protection Handbook®*, 20th ed., National Fire Protection Association, Quincy, MA, 2008.

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10 Competencies for Hazardous Materials Officers

The term *hazardous materials branch officer* was added to the 1997 edition of NFPA 472 and was changed to *hazardous materials officer* in the 2008 edition. The technical committee created the designation to meet the need for an individual who could function as the hazardous materials response team leader, the hazardous materials group supervisor, or as a hazardous materials technician. Exhibit I.10.1 illustrates a typical incident command chart and shows where the hazardous materials officer fits into the team command.

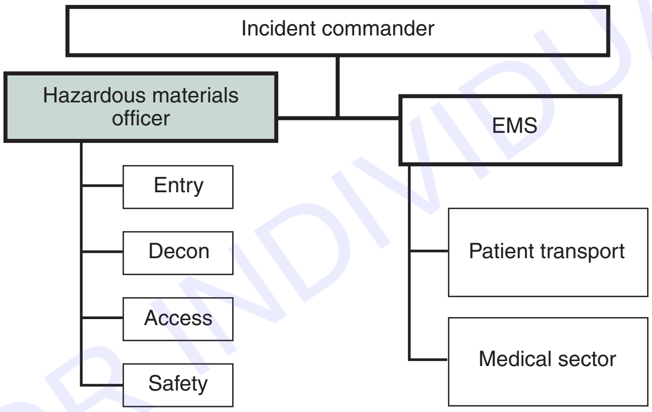

EXHIBIT I.10.1

This incident command chart shows the role of the hazardous materials officer.

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10.1 General.

10.1.1 Introduction.

Δ **10.1.1.1** The hazardous materials officer (National Incident Management System: Hazardous Materials Group Supervisor) at hazardous materials/WMD incidents shall be that person who is responsible for directing and coordinating all operations involving hazardous materials/WMD as assigned by the incident commander.

Δ **10.1.1.2** The hazardous materials officer shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all competencies at the technician level *(see Chapter 7)*, and all competencies of this chapter.

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10.1.1.3 Hazardous materials officers shall also receive training to meet governmental response and occupational health and safety regulations.

The hazardous materials officer has the same technical competencies as a technician and completes the chain of command needed at an incident, which, in turn, can increase the safety and efficiency at the hazardous materials/WMD incident site. In incidents involving chemicals or hazardous materials, the incident commander (IC) would use the hazardous materials officer's expertise in formulating response objectives, action options, and the plan of action. In addition, the IC would rely on the hazardous materials officer to provide direct supervision of the team to accomplish the objectives. More than one team can then work at an incident, and each has its own leader.

10.1.2 Goal.

10.1.2.1 The goal of the competencies in this chapter shall be to provide the hazardous materials officer with the knowledge and skills to perform the tasks in 10.1.2.2 in a safe manner.

Δ **10.1.2.2** When responding to hazardous materials/WMD incidents, the hazardous materials officer shall be able to perform the following tasks:

(1) Analyze a hazardous materials/WMD incident to determine the complexity of the problem by estimating the potential outcomes within the endangered area
(2) Plan a response within the capabilities and competencies of available personnel, PPE, and response equipment by completing the following tasks:

   (a) Identify the response objectives (defensive, offensive, and nonintervention) for hazardous materials/WMD incidents
   (b) Identify the potential response options (defensive, offensive, and nonintervention) available by response objective
   (c) Determine the level of PPE required for a given action option
   (d) Provide recommendations to the incident commander for the development of an incident action plan (IAP) for the hazardous materials group consistent with the emergency response plan and/or standard operating procedures and within the capability of available personnel, personal protective, and response equipment

The hazardous materials officer can perform many of the same planning functions as an IC, as outlined in 10.1.2.2(1) and 10.1.2.2(2). However, the officer can only recommend that various actions be taken. The IC must consider each incident in its entirety and make the final decision.

(3) Implement a response to favorably change the outcomes consistent with the emergency response plan and/or standard operating procedures by completing the following tasks:

   (a) Implement the functions within the incident command system as they directly relate to the specified procedures for hazardous materials group operations
   (b) Direct hazardous materials group resources (private, governmental, and others) with task assignments and on-scene activities and provide management overviews, technical review, and logistical support to hazardous materials group resources

(4) Evaluate the progress of the planned response to ensure that the response objectives are effective, and adjust the IAP accordingly
(5) Terminate the incident by completing the following:

   (a) Conduct a debriefing for hazardous materials group personnel
   (b) Conduct a critique for hazardous materials group personnel
   (c) Report and document the hazardous materials group operations
   (d) Coordinate hazardous materials operations with the AHJ for post-incident operations (PIRO)

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10.2 Competencies — Analyzing the Incident. Given scenarios involving hazardous materials/WMD incidents, including the surrounding conditions and the predicted behavior of the container and its contents, the hazardous materials officer shall estimate the potential outcomes within the endangered area.

Outcomes are the result of implementing the response objectives. These objectives can include the following:

- Modify the stress applied to the container
- Change the size of the breach
- Change the quantity being released
- Change the size of the endangered area
- Reduce exposures
- Reduce the level of harm

Keep in mind that an acceptable alternative response that should always be considered is to do nothing and keep everyone away.

The outcomes can be the result of defensive, offensive, or nonintervention actions. Several potential outcomes can be recommended to the IC. Each outcome has its own risks, potential for success, and technical expertise required for successful completion. Each option must be thought through to its end or predicted outcome. Only if the outcome can improve the situation should the option be considered.

10.3 Competencies — Planning the Response.

10.3.1 Given a scenario involving a hazardous materials/WMD incident, the hazardous materials officer shall identify the response objectives (defensive, offensive, and nonintervention) for each incident.

10.3.2 Given a scenario involving hazardous materials/WMD incidents, the hazardous materials officer shall identify the potential response options (defensive, offensive, and nonintervention) for each incident.

10.3.3 Selecting the Level of PPE and Resources. Given scenarios involving hazardous materials/WMD incidents with known and unknown hazardous materials/WMD, the hazardous materials officer shall select the PPE for the response options specified in the IAP in each situation.

In accordance with 10.3.3, the hazardous materials officer can select the level of personal protective equipment (PPE), but the IC must approve the selection. The type of respiratory protection required depends on many factors. A key factor is the level of protective clothing necessary for protection in the hot zone. A responder should always use the highest level of protection until the specific hazardous material and the levels of concentration have been determined.

10.3.4 Developing a Plan of Action. Given scenarios involving hazardous materials/WMD incidents, the hazardous materials officer shall develop a plan of action consistent with the emergency response plan and/or standard operating procedures that are within the capability of the available personnel, PPE, and response equipment, and shall complete the following tasks:

A plan of action, as required by 10.3.4, describes the response objectives and any options available in achieving the objectives. Again, with each objective should be an estimate of the likely outcome. The basis for the plan is the estimate of the potential outcomes, the organization's standard operating

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procedures, and the local emergency response plan. In the plan, safety and health considerations, necessary personnel, and control equipment should be listed for each objective. This plan provides a permanent record of the incident and can be the outline for the incident critique.

(1) Identify the order of the steps for developing the plan of action

In accordance with 10.3.4(1), the following steps need to be considered when developing a plan of action:

- Site restrictions
- Entry objectives
- On-scene organization and control
- PPE selection
- Hazard evaluation
- Communications procedures
- Emergency procedures and personnel accountability
- Emergency medical care arrangements
- Rehabilitation plan
- Decontamination procedures
- On-scene work assignments (branches)
- Debriefing and critiquing

(2) Identify the factors to be evaluated in selecting public protective actions, including evacuation and shelter-in-place

The goal of the evaluation in 10.3.4(2) should be to reduce or prevent contamination of the members of the public who are or could be exposed to the hazardous materials. If these individuals are safe in their locations and the structure in which they are housed can be protected from contamination by methods such as closing windows and doors and turning off ventilation systems that might draw air in from the outside, leaving these individuals in place until the incident can be controlled might be the best option. Even after the public has been notified that they must remain in their present location, responders should provide them with constant updates on the progress of the incident and reassurances of their safety. The factors should be assessed throughout the incident to ensure that the protective actions will continue to provide the best possible outcome.

(3) Given the emergency response plan and/or standard operating procedures, identify procedures to accomplish the following tasks:

(a) Make ongoing assessments of the situation
(b) Coordinate on-scene personnel assigned to the hazardous materials branch/group
(c) Coordinate hazardous materials/WMD support and mutual aid
(d) Coordinate public protective actions (evacuation or shelter-in-place)
(e) Coordinate with fire suppression services as they relate to hazardous materials/WMD incidents
(f) Coordinate control, containment, and confinement operations
(g) Coordinate with the medical group to ensure medical assistance, support, and treatment
(h) Coordinate on-scene decontamination
(i) Coordinate activities with those of the environmental remediation (cleanup) services
(j) Coordinate evidence preservation and sampling in a contaminated environment
(k) Coordinate with law enforcement and/or special operations agencies as they relate to hazardous materials/WMD incidents

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(4) Identify the process for determining the effectiveness of an action option on the potential outcomes

Direct observations from technicians and the hazardous materials officer should be compared against the expected outcomes as listed in the plan of action. If time is a factor, specific time frames should be determined before any actions are started. At the agreed-on times, reports should be forwarded to the IC.

(5) Identify the procedures for presenting a safety briefing prior to allowing personnel to work on a hazardous materials/WMD incident

Some of the topics that should be evaluated in the safety briefing, as required by 10.3.4(5), include the following:

- Incident commander, hazardous materials officers, and hazardous materials responders have met all the competencies for their appropriate levels in accordance with NFPA 472.
- Activities that present a significant risk to the safety of members are limited to situations that offer the potential to save endangered lives.
- No risk to the safety of members is acceptable when saving lives or property is not possible.
- All personnel working in the warm zone or hot zone are under the supervision of a hazardous materials officer.
- Personnel accountability procedures are being utilized.
- Appropriate decontamination and personnel for the incident have been established.
- A rest and rehabilitation area that is ready and available for responders once their assignments have been completed is described and its location identified.
- A hazardous materials safety officer has been designated and is operational.
- Communications have been established on one radio channel that is not used by anyone close enough to interfere. Hand signals are available as a backup if the radios fail.
- Appropriate protective clothing and protective equipment are used whenever the responder is exposed, or potentially exposed, to the hazardous materials.
- A rapid intervention crew consisting of at least two responders is available for rescue of a member or team if the need arises. Responders operating in the hot zone are operating in teams of two or more.
- Medical monitoring of all responders is completed before they can proceed to work in PPE.
- Responders are warned to be aware of any clues indicating that the incident could be a chemical, biological, nuclear, or explosives incident. If terrorism is suspected, responders are alert to the possibility of secondary devices or attempts to disguise the true nature of the incident.

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10.4 Competencies — Implementing the Planned Response.

Δ **10.4.1 Implementing the Functions in the Incident Management System.** Given a copy of the emergency response plan, the hazardous materials officer shall identify the requirements of the plan, including the required procedures for notification and utilization of nonlocal resources (governmental personnel), and shall complete the following tasks:

Several models for incident management systems are available. Each system generally has the same components, although different titles for the various responders are sometimes used. For example, hazardous materials officers, hazardous materials branch directors, and hazardous materials group

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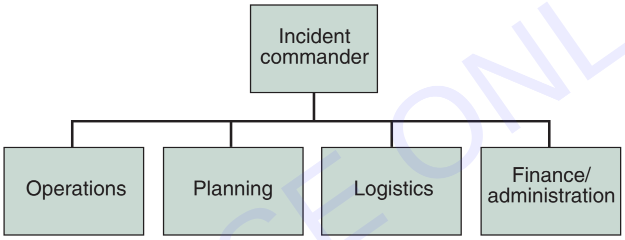
supervisors generally perform the same functions. Basically, these workers are responsible for implementing the incident action plan that deals with operations intended to control the hazardous materials portion of an incident. Direction and approval of the action plan is the duty of the IC. Exhibit I.10.2 shows that there are five primary functional areas within the incident management system.

A public information officer, liaison officer, and an incident safety officer are usually included as part of the team. For hazardous materials incidents, additional functions are identified, including the hazardous materials officer, hazardous materials safety officer, decontamination unit leader, rehabilitation unit leader, information research and resources unit leader, and the entry/reconnaissance unit leader, who typically operates within the hazardous materials branch or group.

EXHIBIT I.10.2

These are the five areas of an incident management system.



(1) Identify the process and procedures for obtaining cleanup and remediation services in the emergency response plan and/or standard operating procedures
(2) Identify the steps for implementing the emergency response plans as required under SARA, Title III, Section 303, of the federal regulations or other 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 local incident management system necessary to coordinate response activities at hazardous materials/WMD incidents
(5) Identify the primary governmental agencies and the scope of their regulatory authority (including the regulations) pertaining to the production, transportation, storage, and use of hazardous materials/WMD and the disposal of hazardous wastes

The hazardous materials officer is required by 10.4.1(5) to know which agencies could become involved and the agencies' regulatory authority in a hazardous materials incident. The local emergency response plan should identify these agencies and delineate their roles, authority, and functions.

(6) Identify the governmental agencies and resources offering assistance to the hazardous materials group during a hazardous materials/WMD incident, and identify their role and the type of assistance or resources available

Some government agencies provide response or technical assistance to local hazardous materials response teams. For example, the U.S. Coast Guard staffs three strategically located National Strike Teams (Atlantic, Gulf, and Pacific) that are trained and equipped to respond to major oil spills and chemical releases. Strike teams are part of the National Strike Force, which consists of active duty, civilian, and support personnel. Strike teams have provided support and expertise to many events, including vessel groundings, hurricanes, air crashes, and oil spills. More information about the Coast Guard's Strike Force can be found at www.uscg.mil. The U.S. Environmental Protection Agency also has a response component called the Environmental Response Team (ERT). The ERT comprises scientists

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and engineers who are trained in sampling and analysis, hazard assessment, cleanup techniques, and other avenues of technical support. More information on the ERT can be found at www.ert.org. In addition, many state and local governments and private industries provide technical assistance. Hazardous materials response teams from municipalities or private industry, for example, are a great resource for large incidents and might have specialized monitoring equipment and knowledge to help identify complex or obscure hazardous materials.

The local emergency response plan should identify the law enforcement and related agencies and delineate their roles, authority, and functions. A key element will be the ability of local, state, and federal law enforcement personnel to collect evidence in a contaminated environment.

The Federal Bureau of Investigation (FBI) has a WMD coordinator in each of its 56 field divisions. The WMD coordinator is the liaison for the hazmat officer to the FBI and can also contact FBI Evidence Response Teams, FBI Hazardous Materials Response Teams, and other FBI assets that may be of assistance.

The private sector also has many resources, from providing technical advice and assisting with on-scene monitoring to providing specialized equipment, available to emergency responders. In most areas, private sector companies that provide cleanup and disposal services are available. Some of these companies can stage equipment in an area and fly personnel to the scene when a hazardous materials incident occurs. CHEMTREC/CANUTEC/SETIQ offers referrals to private sector resources.

The hazardous materials officer must know how to get specialized assistance when it is needed and must be familiar with available public and private sector assistance. These resources and their contacts should be identified in the local emergency response plan.

(7) Identify the governmental agencies and resources offering assistance during a hazardous materials incident involving criminal or terrorist activities, and identify their role and the type of assistance or resources available

Δ **10.4.2* Directing Resources (Private and Governmental).** Given a scenario involving a hazardous materials/WMD incident and the necessary resources to implement the planned response, the hazardous materials officer shall demonstrate the ability to direct the hazardous materials group resources in a safe and efficient manner consistent with the capabilities of those resources.

A.10.4.2 These abilities should include the following:

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

10.4.3 Providing a Focal Point for Information Transfer to Media and Elected Officials. Given a scenario involving a hazardous materials/WMD incident, the hazardous materials officer shall demonstrate the ability to act as a resource to provide information to the command element, the public information officer, or the liaison officer for distribution to the media and governmental officials and shall complete the following tasks:

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

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Δ **10.5 Competencies — Evaluating Progress.** Given scenarios involving hazardous materials/WMD incidents, the hazardous materials officer shall evaluate the progress of the IAP to determine whether the efforts are accomplishing the response objectives and shall complete the following tasks:

(1) Identify the procedures for evaluating whether the response options are effective in accomplishing the objectives

To determine whether the actions being taken at an incident are effective and the objectives are being met, responders must frequently re-evaluate whether the incident is stabilizing or increasing in intensity, in accordance with 10.5(1). By comparing the predicted outcomes in the action plan to what is unfolding in the incident, the hazardous materials officer has another indication of progress. Feedback from the entry teams and safety officer and other observations allow the hazardous materials officer to recommend modifying the action options to the IC. This feedback should include information on the effectiveness of personnel, on personal protective clothing and equipment, on control zones, on decontamination procedures, and on the action options being implemented.

(2) Identify the steps for comparing actual behavior of the material and the container to that predicted in the analysis process

When comparing behavior to predicted behavior as required by 10.5(2), the hazardous materials officer should determine whether events at an incident are happening as predicted, are occurring out of sequence, or are different from expected. The hazardous materials officer should also determine whether events that were predicted to occur have occurred at the incident. This ongoing evaluation and re-evaluation process should continue until the incident has been terminated in order to minimize "surprises" during the cleanup or overhaul phase of the incident response.

(3) Determine the effectiveness of the following:

   (a) Personnel
   (b) Control zones
   (c) PPE
   (d) Control, containment, and confinement operations
   (e) Decontamination
   (f) EMS resources

(4) Make recommendations for appropriate modifications to the IAP

10.6 Competencies — Terminating the Incident.

10.6.1 Terminating the Emergency Phase of the Incident. Given a scenario involving a hazardous materials/WMD incident in which the IAP objectives have been achieved, the hazardous materials officer shall describe the steps necessary to terminate the emergency phase of the incident consistent with the emergency response plan and/or standard operating procedures and shall complete the following tasks:

(1) Describe the steps required for terminating the emergency phase of a hazardous materials/WMD incident

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As required by 10.6.1(1), the steps involved in terminating the emergency phase of an incident include the following:

- Transferring command
- Debriefing
- Critiquing the incident
- Conducting after-action activities, such as restocking disposables or damaged equipment

(2) Describe the procedures for transferring command to the AHJ having responsibility for PIRO

Δ **10.6.2 Conducting a Debriefing.** Given a scenario involving a hazardous materials/WMD incident, the hazardous materials officer shall demonstrate the ability to conduct a debriefing of the incident for all units assigned to the hazardous materials group and shall complete the following tasks:

(1) Describe the 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/WMD incident

The incident debriefing by 10.6.2(5) involves gathering information from response personnel as soon as possible after terminating the incident. This information should then be used to develop a chronological report of all incident management activities.

Δ **10.6.3 Conducting a Critique.** Given the details of a scenario involving a hazardous materials/WMD incident, the hazardous materials officer shall demonstrate the ability to conduct a critique of the incident for all units assigned to the hazardous materials group and shall complete the following tasks:

(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/WMD 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 emergency response plan, standard operating procedures, or local, state, and federal regulations

The critique, as required in 10.6.3, is a review of the incident intended to identify and document the lessons learned from the incident response. This process should allow the participants to review response activities and determine what worked well and what did not. The critique should be conducted in a positive manner that allows responders to modify response procedures if problems are identified, without assigning blame. After analyzing the information gathered during the debriefing and the critique and documenting that analysis, the termination process should also include a plan to follow up as necessary to ensure that any recommendations made to improve emergency operations are implemented.

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10.6.4 Reporting and Documenting the Incident. Given an example of a hazardous materials/WMD incident, the hazardous materials officer shall demonstrate the ability to report and document the incident consistent with the governmental requirements and shall complete the following tasks:

In accordance with 10.6.4, the hazardous materials officer must be aware of the reporting requirements associated with a hazardous materials incident. In many cases, the responsibility for reporting to specific agencies is outlined in the responding agency or organization's standard operating procedures. However, the hazardous materials officer must ensure that the proper agencies have been notified and that the proper reports have been made.

(1) Identify the requirements for compiling incident reports, filing documents, and maintaining records as defined in the emergency response plan and/or standard operating procedures
(2) Identify the importance of documentation for a hazardous materials/WMD incident, including training records, exposure records, incident reports, and critique reports

Throughout the incident, the hazardous materials officer should assign someone to maintain a record of incident events as they occur. This documentation will be helpful in completing the post-incident analysis and conducting the critique because the "live" report conveys information as the incident unfolds. Reconstructing an incident afterward can result in a flawed timeline and misinterpretation of events. Personnel exposure records must also be maintained at the scene in accordance with federal and state laws. The necessary information about the type of exposure to which personnel were subjected, the exposure level, the length of the exposure, the type of personal protective clothing and equipment personnel were using, and the type of decontamination that personnel had undergone should be included as part of each responder's record. Any on-scene medical assistance that personnel received should also be documented.

(3) Identify the steps in keeping an activity log and exposure records for hazardous materials/WMD incidents
(4) Identify the procedures required for legal documentation and chain of custody/continuity described in the emergency response plan and/or standard operating procedures

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11 Competencies for Hazardous Materials Safety Officers

The hazardous materials safety officer must be knowledgeable in the tactical actions being undertaken to ensure responder safety. To perform this function, the hazardous materials safety officer must know and understand the risk associated with all the actions and interventions occurring and be able to identify situations that can pose immediate harm. The hazardous materials safety officer has the authority and responsibility to intervene and stop an unsafe activity. The activity is then reconciled and remedied with the hazardous materials group supervisor/branch director, the incident commander, and/or the incident safety officer. Under Occupational Safety and Health Administration (OSHA) Title 29 CFR Part 1910.120(q), the term *safety official* is used to describe the tasks for the safety officer or hazardous materials safety officer [1].

11.1 General.

11.1.1* Introduction.

A.11.1.1 If the functions and responsibilities of the hazardous materials safety officer are performed by the overall incident safety officer or on-scene incident commander, that individual should meet the competencies of this chapter.

Δ **11.1.1.1** The hazardous materials safety officer (NIMS: Assistant Safety Officer — Hazardous Material in the United States) shall be that person who works within an incident management system/incident command system (IMS/ICS) (specifically, the hazardous material group) to ensure that recognized hazardous materials/WMD safe practices are followed at hazardous materials/WMD incidents.

Δ **11.1.1.2** The hazardous materials safety officer shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all competencies for mission-specific operations (*see Chapter 6*), all competencies at the technician level *(see Chapter 7)*, and all competencies of this chapter.

In addition to being competent as a hazardous materials technician, the hazardous materials safety officer needs to be knowledgeable in risk management techniques and have a thorough understanding of the safety of responders during hot and warm zone operations. While safety is everyone's responsibility, the hazardous materials safety officer is responsible for ensuring safe practices and identifying immediately dangerous to life or health (IDLH) conditions that have not been identified and/or protected against that may place the responder at risk. The hazardous materials safety officer must ensure that his or her activities are coordinated with the incident safety officer.

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11.1.1.3 Hazardous materials safety officers shall also receive training to meet governmental response and occupational health and safety regulations.

11.1.2 Goal.

Δ **11.1.2.1*** The goal of the competencies in this chapter shall be to provide the hazardous materials safety officer with the knowledge and skills to evaluate a hazardous materials/WMD incident for safety, ensure that recognized safe operational practices are followed, and perform the tasks in 11.1.2.2 in a safe manner.

A.11.1.2.1 Under this section, the hazardous materials safety officer is given specific responsibilities. It should be understood that even though these duties are to be carried out by the hazardous materials safety officer, the incident commander has overall responsibility for the implementation of these tasks.

The hazardous materials safety officer should meet all the competencies for the responder at the level of operations being performed. A hazardous materials safety officer directs the safety of operations in the hot and the warm zones. A hazardous materials safety officer should be designated specifically at all hazardous material incidents (29 CFR 1910.120) and is responsible for the following tasks:

(1) Obtain a briefing from the incident commander or incident safety officer
(2) Participate in the preparation of and monitor the implementation of the incident site safety and control plan (including medical monitoring of entry team personnel before and after entry)
(3) Advise the incident commander/sector officer of deviations from the incident site safety and control plan and of any dangerous situations
(4) Alter, suspend, or terminate any activity that is judged to be unsafe

Δ **11.1.2.2** When responding to hazardous materials/WMD incidents, the hazardous materials safety officer shall be able to perform the following tasks in a safe and effective manner:

(1) Use a risk-based response to analyze a hazardous materials/WMD incident to determine the complexity of the problem in terms of safety by observing a scene, review and evaluate hazard and response information, and apply risk-based response principles as it pertains to the safety of all persons in the hazardous materials group
(2) Assist in planning a safe response within the capabilities of available response personnel, and personal protective and response equipment by completing the following tasks:
    (a) Identify the safety precautions for potential response options
    (b) Provide recommendations regarding the site safety and control plan
    (c) Assist in the development of an incident action plan (IAP)
    (d) Review the IAP and provide recommendations regarding safety
    (e) Review the IAP for the action objectives as they pertain to:
        (i) Personnel and resources
        (ii) Control zones
        (iii) PPE
        (iv) Control, containment, and confinement operations
        (v) Decontamination
        (vi) Medical branch
(3) Ensure the implementation of a safe response consistent with the IAP, the emergency response plan, and/or standard operating procedures by completing the following tasks:
    (a) Perform the duties of the hazardous materials safety officer within the incident command system
    (b) Identify safety considerations for personnel performing the control functions identified in the site safety and control plan

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(c) Conduct safety briefings for personnel performing the control functions identified in the site safety and control plan
(d) Assist in the implementation and enforcement of the site safety and control plan
(e) Maintain communications within the incident command structure during the incident
(f) Monitor status reports of activities in the hot and the warm zones
(g) Ensure the implementation of exposure monitoring, (and decontamination of personnel and the environment)

(4) Evaluate the progress of the planned response to ensure that the response objectives are being met in a safe manner by completing the following tasks:

(a) Identify deviations from the site safety and control plan or other high-risk situations, and identify re-evaluated tasks
(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 safety officer
(b) Assist in the debriefing of hazardous materials group personnel
(c) Assist in the incident critique

11.2 Competencies — Analyzing the Incident.

Δ **11.2.1 Determining the Magnitude of the Problem in Terms of Safety.** Given scenarios involving hazardous materials/WMD incidents, the hazardous materials safety officer shall observe a scene, review and evaluate hazard and response information, apply a risk-based response principle as it pertains to the safety of all persons within the hazardous materials group, and meet the requirements of 11.2.1.1 through 11.2.1.4.

The hazardous materials safety officer must have a thorough understanding of risk-based response processes associated with the initial response to hazardous materials incidents. This response process is used when conditions can be rapidly assessed and interventions quickly initiated to lessen the overall impact and duration of the incident. The hazardous materials safety officer is responsible for implementing a measured and procedural-driven risk management model for large-scale, unique, or long-duration incidents.

11.2.1.1 The hazardous materials safety officer when given a chemical shall explain the basic toxicological principles relative to the safety of personnel exposed to hazardous materials/WMD, including the following:

(1) Acute and chronic toxicity
(2) Dose response
(3) Local and systemic effects
(4) Routes of exposure to toxic materials
(5) Non-measured effects (synergistic, potentiation, additive, and agonistic)

11.2.1.2* The hazardous materials safety officer shall identify at least three conditions using the following factors where the hazards from flammability would require PPE:

(1) Unknown materials involved
(2) Oxygen-enriched atmosphere
(3) Detectable percentage of LEL on monitoring instruments
(4) Presence of materials with a widely flammable range
(5) Presence of reactive materials

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A.11.2.1.2 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 percentage of LEL on monitoring instruments
(4) Materials with a wide flammable range present
(5) Reactive materials present

11.2.1.3* The hazardous materials safety officer shall identify at least three conditions using the following factors where personnel would not be allowed to enter the hot zone:

(1) Decontamination plan not established or not in place
(2) Advanced first-aid and EMS transportation not available
(3) Back-up personnel not available or not in place
(4) Flammable or explosive atmosphere present
(5) Oxygen-enriched atmosphere of 23.5 percent or greater present
(6) Required PPE not available
(7) Risk outweighing benefit
(8) Personnel not properly trained
(9) Insufficient personnel to perform tasks
(10) No identified tactical options that can positively influence the outcome of the incident
(11) Runaway reaction occurring

A.11.2.1.3 Conditions under which personnel would not be allowed in the hot zone include the following:

(1) Decontamination procedures not established or not in place
(2) Advanced first-aid and transportation not available
(3) Flammable or explosive atmosphere present
(4) Oxygen-enriched atmosphere of 23.5 percent or greater present
(5) Runaway reaction occurring
(6) Required personal protective equipment not available
(7) No identified tactical options that can positively influence the outcome of the incident
(8) Risk outweighing benefit
(9) Personnel not properly trained
(10) Insufficient personnel to perform tasks

11.2.1.4 Given the names of at least three hazardous materials/WMD agents, a description of the containers, and at least three reference sources, the hazardous materials safety officer shall identify the hazards, physical and chemical properties, health concerns, and the potential impacts on the safety of personnel at an incident involving each of the materials or agents.

11.2.1.5 Given the names of five hazardous materials/WMD and at least three reference sources, the hazardous materials 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 or agents.

11.2.1.6* Given the names of five hazardous materials and a description of their containers, the hazardous materials safety officer shall identify five hazards or physical conditions that would affect the safety of personnel at an incident involving each of the materials or agents.

A.11.2.1.6 Examples of scenarios that emergency responders might 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 150 lb (68 kg) cylinder
(3) Lacquer thinner leaking from a hole in a 55 gal (208 L) drum

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(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

11.3 Competencies — Planning the Response.

The continued development of operations level, mission-specific personnel has blurred the traditional lines between offensive and defensive operations. The specific mission of all responders and support personnel needs to be understood and assessed based on risk, training, and equipment. All actions undertaken at an emergency scene have some inherent risk associated with them. It is the responsibility of the hazardous materials safety officer to be able to identify these risks, advise personnel, and provide recommendations to minimize or control identified risks. The hazardous materials safety officer must coordinate safety tasks and activities with the incident safety officer.

11.3.1* Identifying the Safety Precautions for Potential Response Options. Given scenarios involving hazardous materials/WMD incidents, the hazardous materials safety officer shall assist the incident safety officer and hazardous materials officer in developing a site safety and control plan to respond within the capabilities of available response personnel, PPE, and response equipment and shall complete the following tasks:

(1)* Identify specific safety precautions to be observed during mitigation of each of the hazards or conditions identified in 11.2.1.1 through 11.2.1.3
(2)* Identify safety precautions associated with search and rescue missions at hazardous materials/WMD incidents

A.11.3.1 Potential response options are either defensive or offensive in nature. The site safety and control plan is integrated into the formal incident action plan.

A.11.3.1(1) Safety precautions to be observed during mitigation of hazards or conditions can include the following:

(1) Elimination of ignition sources
(2) Use of 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) Working in proper protective equipment

A.11.3.1(2) Safety precautions to be observed during search and rescue missions at hazardous materials/WMD incidents can include the following:

(1) Ensuring availability of appropriate personal protective equipment for all personnel
(2) Use of 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

11.3.2 Providing Recommendations Regarding Safety Considerations.

Δ **11.3.2.1** Given scenarios involving hazardous materials/WMD incidents, the hazardous materials safety officer shall develop risk-based recommendations for the protection of responders for each of the hazardous materials/WMD identified in 11.2.1.4.

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The hazardous materials safety officer evaluates the situation, personnel, equipment, and available information to make specific recommendations to the hazardous materials officer, incident safety officer, or incident commander as required to ensure proper risk management for personnel operating on-site in the hot and warm zones of a hazardous materials incident. It must be understood that at incidents involving multiple discipline operations (i.e., law enforcement, fire, EMS), there could be multiple assistant safety officers overseeing different activities. It is crucial that these activities and the safety of responders performing them are coordinated through the incident command system.

Δ **11.3.3 Assisting in the Development of a Site Safety and Control Plan for Inclusion in the Incident Action Plan.** Given scenarios involving hazardous materials/WMD incidents, the hazardous materials safety officer shall assist the incident safety officer and hazardous materials officer in the development of the site safety and control plan for inclusion in the IAP and shall complete the following tasks:

(1)* Identify the importance and benefits of pre-emergency planning relating to specific sites

(a) Identification and mitigation of hazards during the planning process
(b) Familiarization of personnel with facility
(c) Identification of 24-hour responsible parties
(d) Identification of a built-in containment system
(e) Identification of the location of utility and other shutoff/shut on valves and switches
(f) Identification of location of facility map
(g) Identification of location and quantities of hazardous materials/WMD
(h) Identification of vulnerable populations
(i) Identification of facility response capabilities

(2)* List at least five hazards and precautions to be observed in the following factors when personnel approach a hazardous materials/WMD incident:

(a) Inhalation hazards
(b) Dermal hazards
(c) Flammable hazards
(d) Reactive hazards
(e) Electrical hazards
(f) Mechanical hazards

(3)* List the elements of a site safety and control plan:

(a) Site description
(b) Entry objectives
(c) On-site organization
(d) Hazard evaluation
(e) PPE
(f) On-site work plans
(g) Communication procedures
(h) Decontamination procedures

(4) Given an IAP and a scenario involving one of the hazardous materials/WMD described in 11.2.1.4, develop a list of safety considerations for the incident

A.11.3.3(1) Benefits of pre-emergency planning include the following:

(1) Identification and mitigation of hazards during the planning process
(2) Familiarization of personnel with facility
(3) Identification of 24-hour responsible parties
(4) Identification of built-in containment systems
(5) Identification of the location of utility and other shutoff/shutdown valves and switches

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(6) Identification of location of facility map
(7) Identification of location and quantities of hazardous materials/WMD
(8) Identification of vulnerable populations
(9) Identification of facility response capabilities

A.11.3.3(2) Hazards that should be observed when personnel approach a hazardous materials/WMD incident include the following:

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

> The list in A.11.3.3(2) is not all inclusive. Additional hazards could exist that would not be observable. An example of a nonobservable hazard is radiation, which must be monitored with instrumentation.

A.11.3.3(3) The following elements of a site safety plan are from the EPA *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

11.3.4 Providing Recommendations Regarding Safety and Reviewing the Incident Action Plan. Given a proposed IAP for an incident involving one of the hazardous materials/WMD and containers described in 11.2.1.4, the hazardous materials safety officer shall identify to the incident safety officer, the hazardous materials officer, and the incident commander, the safety precautions for the IAP and shall complete the following tasks:

(1) Ensure that the site safety and control plan in the proposed IAP is consistent with the emergency response plan and/or standard operating procedures
(2) Make recommendations to the incident safety officer and the hazardous materials officer on the safety considerations in the proposed IAP

11.3.5 Reviewing Selection of Personal Protective Equipment (PPE). Given scenarios involving hazardous materials/WMD incidents, the hazardous materials safety officer shall demonstrate the ability to review the selection of PPE required for a given action option and shall complete the following tasks:

(1) Identify six safety considerations using the following factors for personnel working in PPE

   (a) Cold or heat stress
   (b) Diminished visibility
   (c) Product incompatibility issues
   (d) Mission work duration or orientation
   (e) Physiological stressors
   (f) Emergency conditions while working in PPE

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(2) Given the names of three hazardous materials/WMD agents and a chemical compatibility chart for chemical-protective clothing provided by the AHJ, identify the chemical-protective clothing that would provide protection from the identified hazards to the wearer for each of the three substances
(3)* Given the names of three hazardous materials/WMD agents, identify the PPE options for specified response options
(4) Identify the recommended methods for donning, doffing, and using all PPE provided by the AHJ for use in hazardous materials/WMD response activities

A.11.3.5(3) Response options can include surveying the scene, sampling, monitoring, plugging, and patching.

11.3.6 Reviewing the Proposed Decontamination Procedures. Given site-specific decontamination procedures by the hazardous materials officer or incident commander for a scenario involving a hazardous materials/WMD incident, the hazardous materials safety officer shall review the procedures to ensure that applicable safety considerations are included prior to implementation of the IAP.

11.3.7 Ensuring Provision of Emergency Medical Services. Given a scenario involving a hazardous materials/WMD incident, the hazardous materials safety officer shall review the emergency medical services procedures to ensure that response personnel are provided medical care and shall complete the following tasks:

(1)* Identify the elements required in an emergency medical services plan

Emergency medical services (EMS) activities occurring outside the warm zone and not involving hazardous materials responders may not be the responsibility of the hazardous materials safety officer. During incidents involving mass causalities, it is often best to assign an assistant safety officer to oversee other activities taking place outside the hot and warm zones. The hazardous materials safety officer is specifically responsible for ensuring that EMS are available for responders involved in the control and intervention of the hazardous materials release, and for other hazardous materials response activities conducted in the hot and warm zone.

(2) Identify the importance of an on-site medical monitoring program
(3) Identify the resources for the transportation and care of the injured personnel exposed to hazardous materials/WMD agents

Δ **A.11.3.7(1)** The elements of an emergency medical services plan according to NFPA 473 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/WMD victims
(5) Medical treatment for chemically contaminated individuals
(6) Product and exposure information gathering and documentation

N **11.3.8 Reviewing the Control Procedures.** Given site-specific control procedures by the hazardous materials officer or incident commander for a scenario involving a hazardous materials/WMD incident, the hazardous materials safety officer shall review the procedures to ensure that applicable safety considerations are included prior to implementation of the IAP.

N **11.3.9 Reviewing the Proposed Control Zones.** Given site-specific control zones by the hazardous materials officer or incident commander for a scenario involving a hazardous materials/WMD incident, the hazardous materials safety officer shall review the procedures to

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ensure that applicable safety considerations are included prior to implementation of the IAP and that these zones are evaluated continuously.

N **11.3.10 Reviewing the Credentials of Personnel Within Assigned Positions.** Given site-specific personnel (internal and external resources) at the hazardous materials/WMD incident, the hazardous materials officer or incident commander authorizes the personnel working at the event. The hazardous materials safety officer shall review the credentials to ensure that applicable safety considerations are included prior to implementation of the IAP.

11.4 Competencies — Implementing the Planned Response.

11.4.1 Performing the Duties of the Hazardous Materials Safety Officer. Given a scenario involving hazardous materials/WMD incidents, the hazardous materials safety officer shall perform the duties of the position in a manner consistent with the emergency response plan and/or standard operating procedures and shall complete the following tasks:

(1) Identify the duties of the hazardous materials safety officer as defined in the emergency response plan and/or standard operating procedures. Determine the safety issues of the following:

  (a) Personnel
  (b) Control zones
  (c) PPE
  (d) Control, containment, and confinement operations
  (e) Decontamination
  (f) Medical branch

(2) Demonstrate performance of the duties of the hazardous materials safety officer as defined in the emergency response plan and/or standard operating procedures

11.4.2 Monitoring Safety of Response Personnel. Given scenarios involving a hazardous materials/WMD incident, the hazardous materials 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 site safety and control plan and shall complete the following tasks:

(1) Identify the safe operating practices that are required to be followed at a hazardous materials/WMD incident as stated in the emergency response plan and/or 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 PPE
  (f) Physical fitness

(3) Identify the methods that minimize the potential harm from heat and cold stresses
(4) Identify the safety considerations that minimize the psychological and physical stresses on personnel working in PPE
(5) Describe five conditions in which it would be prudent to withdraw from a hazardous materials/WMD incident

  (a) Fire or explosion
  (b) Container failure
  (c) PPE incompatibility with chemical
  (d) Thermal insult

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(e) Changing chemical conditions
(f) Conditions inconsistent with mission
(g) Physical issue with responder
(h) Damaged, malfunctioning, or failed PPE or equipment
(i) Loss of communications
(j) Inadequate lighting

(6) Describe the procedures for the emergency removal and extraction of entry personnel who are down within the hot zone:

(a) Partner extraction
(b) Backup/rapid intervention crew (RIC), also known as a rapid intervention team (RIT), extraction

11.4.3 Conducting Safety Briefings.

11.4.3.1 Given a scenario involving a hazardous materials/WMD incident and site safety and control plan, the hazardous materials safety officer shall conduct safety briefings for personnel performing the functions identified in the IAP.

11.4.3.2 The hazardous materials 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/WMD and its container identified in 11.2.1.4, as specified by the emergency response plan and/or standard operating procedures.

Δ **11.4.4 Implementing and Enforcing the Site Safety and Control Plan.** Given a scenario involving a hazardous materials/WMD incident and site safety and control plan, the hazardous materials safety officer shall assist the incident commander, the incident safety officer, and the hazardous materials officer in implementing and enforcing the safety considerations and shall complete the following tasks:

(1) Identify whether the boundaries of the established control zones are clearly marked, consistent with the site safety and control plan, and are being maintained
(2) Identify whether the on-site medical monitoring required by the emergency response plan and/or standard operating procedures is being performed
(3) Given an entry team, a backup team, and a decontamination team working in PPE, verify that each team is protected and prepared to perform its assigned tasks by completing the following:

(a) Verify whether the selection of PPE and equipment is consistent with the site safety and control plan
(b) Verify whether each team has examined the PPE for barrier integrity and the equipment to ensure correct working order
(c) Verify whether PPE have been donned in accordance with the standard operating procedures and the manufacturer's recommendations

(4) Verify 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) Verify whether a backup team is prepared at all times for immediate entry into the hot zone during entry team operations
(6) Verify whether the decontamination procedures specified in the site safety and control plan are in place before any entry into the hot zone
(7) Verify the location(s) of the area of safe refuge
(8) Verify that each person exiting the hot zone and each tool or piece of equipment is decontaminated in accordance with the site safety and control plan and the degree of hazardous materials/WMD contamination

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(9) Demonstrate the procedure for recording the names of the individuals exiting the hot zone, as specified in the emergency response plan and/or standard operating procedures

Once responders are operating in the warm and hot zones, it is the responsibility of the hazardous materials safety officer to use observation-based information and communications monitoring to ensure proper implementation of the safety and control plan. Deviations from the plan can be made after conferring with the hazardous materials officer and with the concurrence of the incident commander. Actions that pose an immediate threat to responders will be stopped by the hazardous materials safety officer.

(10)* Identify three safety considerations that can minimize secondary contamination

Δ **A.11.4.4(10)** 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.

11.4.5 Maintaining Communications. Given a scenario involving a hazardous materials/WMD incident and the site safety and control plan, the hazardous materials safety officer shall maintain routine and emergency communications within the incident command structure at all times during the incident and shall complete the following tasks:

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

(a) Communications systems including in-suit radios
(b) Hand-held portable radios
(c) Emergency signaling devices
(d) Hand signals

(2) Verify that 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

The hazardous materials safety officer is responsible for performing the safety briefing for hazardous materials responders and support personnel working in the hot and warm zones (see Exhibit I.11.1). This briefing should ensure that responders understand the incident-specific emergency alerting procedures and any other procedures for other operations that might be taking place in the area. Backup communication processes, systems, and/or pathways are essential. Combinations of electronic and nonelectronic means might be necessary, especially in high-noise environments that could preclude verbal communications.

A.11.4.5(1) Communications systems include in-suit radio communications, hand-held portable radios, emergency signaling devices, and hand signals.

11.4.6 Monitoring Status Reports.

11.4.6.1 Given a scenario involving a hazardous materials/WMD incident and the site safety and control plan, the hazardous materials safety officer shall monitor routine and emergency communications within the incident command structure at all times during the incident.

Δ **11.4.6.2** The hazardous materials safety officer shall ensure that entry team members communicate the status of their work assignment to the hazardous materials officer.

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EXHIBIT I.11.1

An incident command briefing at this FEMA Emergency Operations Center keeps everyone updated on progress and safety issues. Briefings are held twice daily with representatives of relief organizations and town, county, state, and federal governments. (Courtesy of FEMA/Greg Henshall)

11.4.7 Implementing Exposure Monitoring. Given a scenario involving a hazardous materials/WMD incident and the site safety and control plan, the hazardous materials safety officer shall assist the incident commander, the incident safety officer, and the hazardous materials officer in implementing exposure monitoring.

Δ **11.4.8 Verifying Exposure Monitoring.** The hazardous materials safety officer shall identify that exposure monitoring (personnel and environment), is performed, as specified in the emergency response plan and/or standard operating procedures, and site safety and control plan considerations.

11.5 Competencies — Evaluating Progress.

11.5.1 Identifying Deviations from Safety Considerations or Other Dangerous Situations. Given scenarios involving hazardous materials/WMD incidents and given deviations from the site safety and control plan for activities in both the hot and warm zones and high-risk conditions, the hazardous materials safety officer shall evaluate the progress of the planned response to ensure that the response objectives are met in a safe manner and shall complete the following tasks:

(1) Identify those actions that deviate from the site safety and control plan or that otherwise violate accepted safe operating practices, organizational policies, or applicable occupational safety and health laws, regulations, codes, standards, or guidelines
(2) Identify high-risk 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 PPE

Δ **11.5.2 Taking Corrective Actions.** Given scenarios involving hazardous materials/WMD incidents and given deviations from the site safety and control plan for activities in both the hot and warm zones and high-risk conditions, the hazardous materials 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 complete the following tasks:

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(1) Send emergency communications to and receive emergency communications from the incident safety officer, entry team personnel, the hazardous materials officer, and others regarding safe working practices and conditions:

(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 site safety and control plan to communicate the hazard and emergency response information to the affected personnel

Once the hazardous materials safety officer observes or becomes aware of a deviation from the site safety and control plan, or a sudden change in the incident causes an IDLH situation, the hazardous materials safety officer will determine the appropriate course of action to ensure the safety of responders. This will include conferring with the incident safety officer, hazardous materials officer, and incident commander. If the situation poses an immediate threat to responders, the hazardous materials safety officer has the authority to alter or terminate activities until another course of action that mitigates the risk is decided on. Termination of intervention activities should be a last resort.

(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 site safety and control plan

(2) Identify the procedures to alter, suspend, or terminate any activity that can be judged to be unsafe, as specified in the emergency response plan and/or 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 site safety and control plan and 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 emergency response plan and standard operating procedures

A.11.5.2(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's personal protective clothing and/or equipment
(5) Updated information on identification of hazardous material(s) involved that warrants reassessment of level of protective clothing and equipment being used

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11.6 Competencies — Terminating the Incident.

11.6.1 Reporting and Documenting the Incident. Given scenarios involving hazardous materials/WMD incidents, the hazardous materials safety officer shall complete and submit the reports, documentation, and follow-up required of the hazardous materials safety officer and shall complete the following tasks:

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

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Reporting requirements for the incident are the responsibility of the incident commander and can be delegated to another individual, such as the documentation unit leader. It is incumbent upon the incident safety officer to assist the incident commander with any information or documentation that will assist in the incident documentation. The employer's emergency response plan and/or standard operating procedures should designate reporting requirements.

Δ **11.6.2 Debriefing of Hazardous Materials Group Personnel.** Given scenarios involving hazardous materials/WMD incidents, the hazardous materials safety officer shall debrief hazardous materials group personnel regarding site-specific occupational safety and health issues.

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

A.11.6.2.1 Topics can include, but are not limited to, the following:

(1) Identity of the hazardous materials/WMD agent to which personnel have been or might 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 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

Δ **11.6.2.2** The hazardous materials safety officer shall demonstrate the procedure for debriefing hazardous materials group personnel regarding site-specific occupational safety and health areas of concern, as specified in the site safety and control plan, emergency response plan, and standard operating procedures.

The debriefing process occurs when the incident commander and others in the chain of command learn of the incident objectives achieved, specific task-level activities performed, and they then pass along health and safety information to the responders. While the incident commander is responsible for ensuring that a debriefing takes place, this may be delegated in accordance with the emergency response plan and standard operating procedures.

11.6.3 Assisting in the Incident Critique. Given scenarios involving hazardous materials/WMD incidents and the site safety and control plan, the hazardous materials 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.

Δ **11.6.3.1 Information to Be Presented.** Given the site safety and control plan and the hazardous materials safety officer's report for a scenario involving a hazardous materials/WMD incident, the hazardous materials safety officer shall demonstrate the procedure for verbally presenting the following information in accordance with the emergency response plan and/or 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 site safety and control plan or 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

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(4) Injuries or deaths that occurred as a result of violations of the site safety and control plan, 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 likely would have prevented the injuries or deaths that occurred as a result of the safety violations identified in 11.6.3.1(4)
(6) Deficiencies or weaknesses in the site safety and control plan, emergency response plan, and standard operating procedures that were noted during or following the incident

It is important that the hazardous materials safety officer be a good communicator as well as an observer. The value of a critique, after-action review, or post-incident analysis should not be lost due to poor communications skills. The critique should be as positive and upbeat as possible to allow involved personnel to be open and objective.

Reference Cited in Commentary

1. Title 29, Code of Federal Regulations, Part 1910.120(q), U.S. Government Publishing Office, Washington, DC.

Additional References

NFPA 1521, *Standard for Fire Department Safety Officer Professional Qualifications,* National Fire Protection Association, Quincy, MA, 2015.
NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety,* National Fire Protection Association, Quincy, MA, 2014.
Title 49, Code of Federal Regulations, U.S. Government Publishing Office, Washington, DC.

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Competencies for Hazardous Materials Technicians with a Tank Car Specialty

12

The use of railroad tank cars began in the mid-1860s when wooden tubs were mounted on wooden flat cars and used to transport petroleum products in Pennsylvania. Since then, the tank car fleet has grown to more than 270,000 cars (2015 data), most of which are owned by non-railroad companies.

Tank cars transport a variety of nonhazardous and hazardous materials, including approximately 73 percent of the 2.9 million shipments of hazardous materials transported in North America by rail (2015 data).

While problems with tank cars occur infrequently, response personnel are called on to handle those few problems. When faced with a tank car problem, the responder's ability to communicate an accurate and detailed description of the contents, condition of the tank, and other circumstances is extremely important, as explained in the Association of American Railroads' *Field Guide to Tank Cars* [1].

Tank cars are not only found on railroad property (terminals, yards, mechanical shops) and rights-of-way; they can be found at industrial facilities and on rail barges by water. The hazardous materials technician with a tank car specialty must learn to conduct operations safely in each of these locations.

This chapter specifies the competencies required of hazardous materials technicians with a tank car specialty when responding to incidents involving intermodal tanks.

12.1 General.

12.1.1 Introduction.

12.1.1.1 The hazardous materials technician with a tank car specialty shall be that person who provides technical support pertaining to tank cars, provides oversight for product removal and movement of damaged tank cars, and acts as a liaison between technicians and outside resources on tank car issues.

There are allied professional and specialized employees who can assist in various aspects of tank car response including shippers, carriers, tank car manufacturers and their repair personnel, and environmental contractors.

Δ **12.1.1.2** The hazardous materials technician with a tank car specialty shall be trained to meet all competencies at the awareness level (see Chapter 4), all competencies at the operations

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level (see Chapter 5), all competencies at the technician level (see Chapter 7), and all competencies of this chapter.

Hazardous materials technician with a tank car specialty, hazardous materials technician with a cargo tank specialty, and hazardous materials technician with an intermodal tank specialty are levels that are above the Occupational Health and Safety Administration's (OSHA) technician and specialist levels and are not defined by the present OSHA regulations Title 29 CFR Part 1910.120 [2].

Commentary Table I.1.1 in Part I of this handbook offers a comparison of the levels described by NFPA and OSHA. Responders with the tank car specialty are required by 12.1.1.2 to demonstrate competency in performing these tasks. See the competency requirements in 12.4.1(7) for an example.

12.1.1.3 Hazardous materials technicians with a tank car specialty shall also receive training to meet governmental response and occupational health and other regulations.

12.1.2 Goal.

12.1.2.1 The goal of the competencies in this chapter shall be to provide the hazardous materials technician with a tank car specialty with the knowledge and skills to perform the tasks in 12.1.2.2 in a safe manner.

12.1.2.2 When responding to hazardous materials/WMD incidents, the hazardous materials technician with a tank car specialty shall be able to perform the following tasks:

(1) Analyze a hazardous materials/WMD incident involving tank cars to determine the complexity of the problem and potential outcomes by completing the following tasks:
    (a) Determine the type and extent of damage to tank cars

The type and extent of damage to tank cars includes damage to the valves and fittings (most commonly found in incidents) as well as damage to the tank.

    (b) Predict the likely behavior of tank cars and their contents during an incident
(2) Plan a response to an incident involving tank cars within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by determining the response options (offensive, defensive, or nonintervention) for a hazardous materials/WMD incident involving tank cars
(3) Implement or oversee the implementation of the planned response to a hazardous materials/WMD incident involving tank cars

12.1.3 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.

12.1.3.1 Hazardous materials technicians operating within the bounds of their training as listed in Chapter 7 shall be able to intervene in railroad incidents.

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

The committee wanted to make clear that existing and new responders at the hazardous materials technician level can still perform the operations on tank cars for which they have been qualified. This specialty level covers highly technical skills and knowledge rarely needed except at major incidents. For example, skills required by the competency in Section 12.4 are skills that the technician normally

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does not possess. A hazardous materials response team might have a few members trained to this level in accordance with 12.1.3.2, or a request can be made to the railroad, shipper, or manufacturer to provide a qualified individual with this specialty at the incident scene.

Programs covering these competencies are in place at many hazardous materials training centers, including the Association of American Railroads' Security and Emergency Response Training Center, the California Specialized Training Institute, Texas A&M, and others.

The committee also states that this specialty level is not mandated for any hazardous materials response team or its members, as stated in 12.1.3. Arrangements to request assistance to perform these operations are appropriate and are encouraged in these situations.

12.2 Competencies — Analyzing the Incident.

Safety Considerations. Determining the type and extent of damage to tank car fittings and the tank is inherently dangerous, so:

- Limit access to the danger area until it is safe to do so.
- Certain conditions may preclude completing damage assessment tasks, such as:
  - Direct flame impingement on vapor space
  - Tank sitting in a pool fire
  - Operation of tank's pressure relief device
  - Bulging of tank
  - Tank being inaccessible (tank car covered by other cars or debris)
- Identify the tank car's contents and hazards.
- Identify the tank car's type.
- Review the tank's construction, safety systems, service equipment, and behavior.
- Consider the orientation of the car.
- Wear appropriate protective equipment during the inspection.

Request assistance from those experienced in damage assessment, such as railroad hazardous material specialists, shipper personnel, and tank car builders or repair personnel.

Δ **12.2.1 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 complete the following tasks:

In NFPA 472, tank cars are grouped into the following four types:

1. Nonpressure tank cars
2. Pressure tank cars
3. Cryogenic liquid tank cars
4. Pneumatically unloaded covered hopper cars

Nonpressure tank cars, also called general service and low-pressure tank cars in the *Emergency Response Guidebook*, transport liquids and solids, both hazardous (including Class 3 flammable liquids, Class 4 flammable solids/reactive liquids and solids, Class 5 oxidizers and organic peroxides, Class 6 toxic/poisonous materials, Class 8 corrosives, and Class 9 miscellaneous hazardous materials) and nonhazardous materials (such as corn oil, soy bean oil, corn syrup, tomato paste) at vapor

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pressure typically below 25 psi (172 kPa) at 105°F (40.5°C) to 115°F (46°C). Tank test pressures for nonpressure tank cars are 60 psi to 100 psi (414 kPa to 689 kPa). Capacities range from 4,000 gal to 33,000 gal (15,140 L to 124,919 L). Nonpressure tank cars are cylindrical with rounded heads with at least one manway for access to the tank's interior. Service equipment (fittings) for loading/unloading, pressure and/or vacuum relief, gauging, and other purposes may not be visible at the top and/or bottom of the car. Older nonpressure tank car tanks had at least one expansion dome with a manway, but these cars are no longer found in commerce. Nonpressure tank cars can be compartmented, up to six compartments, with each compartment constructed as a separate and distinct tank with its own set of fittings. Each compartment can have a different capacity and transport a different commodity. See Exhibit I.12.1.

EXHIBIT I.12.1

These are two examples of nonpressure tank cars. (Source: Provided by members of the Association of American Railroads)

Pressure tank cars typically transport nonrefrigerated liquefied compressed gases (Class 2 gases – flammable, nonflammable, and toxic/poison), toxic/poison inhalation hazard (TIH/PIH) materials, reactive materials, and/or corrosive materials requiring the additional protection afforded by a stronger car [at pressures greater than 40 psi (276 kPa) at (68°F)]. They may also transport flammable liquids. Tank test pressures for these tank cars are 100, 200, 300, 340, 400, 500, and 600 psi (689.5, 1379, 2068, 2344, 2758, 3447, and 4137 kPa) and range in capacity from 4,000 gal to 33,000 gal (15,140 L to 124,919 L) with burst strengths of from 500 to 1500 psig. Pressure tank cars are cylindrical with rounded heads and without compartments. They typically are top-loading, with their fittings inside a protective housing mounted on the manway cover plate in the top center of the tank. Pressure tank cars, such as the one shown in Exhibit I.12.2, can be insulated and/or thermally protected.

EXHIBIT I.12.2

This is an example of a pressure tank car. (Source: Provided by members of the Association of American Railroads)

Cryogenic liquid tank cars carry low-pressure, usually 25 psi (172 kPa) or lower, refrigerated liquefied gases, which are –130°F (–90°C) and below at atmospheric pressures. Tank test pressures range from 60 psig to 120 psig. Materials typically found in these types of tank cars include

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liquid argon, ethylene, hydrogen, nitrogen, and oxygen. Cryogenic liquid tank cars, such as the one shown in Exhibit I.12.3, feature a "tank-within-a-tank" configuration, with a high-alloy (stainless) steel inner tank supported within a strong carbon steel outer tank. The tank is vacuum-insulated; the annular space between the inner tank and the outer tank is filled with insulation and kept under vacuum.

EXHIBIT I.12.3

This is an example of a cryogenic liquid tank car. (Source: Provided by members of the Association of American Railroads)

Pneumatically unloaded covered hopper cars are built to tank car specifications, but as of 2013 they are no longer considered tank cars. Covered hopper cars are unloaded by pressure differential (pneumatic) through the application of air pressure. Although the pressure is used only during unloading, tank test pressures for the car range from 20 psi to 80 psi (138 kPa to 552 kPa). Dry caustic soda is one material frequently transported in this type of car.

(1) Given the specification mark for a tank car and the reference materials, describe the car's basic construction and features, including authorizing agency, class designation, significance of letter after the class designation (A, J, S, and T for nonpressure and pressure tank cars; P and R for DOT-117 tank cars; and A, C, and, D for DOT 113 tank cars), tank test pressure, material of construction, and fittings, linings, and materials as shown in Table 12.2.1.

Tank cars are built to precisely defined standards established by the U.S. Department of Transportation (DOT), Transport Canada (TC), and the Association of American Railroads (AAR). A tank car's specification is stenciled on both sides of the tank and indicates the standards to which the tank car was constructed. (See Exhibit I.12.4.) As the responder faces the side of the car, the specification mark is to the right (at the opposite end from the reporting mark, or initials, and number).

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N TABLE 12.2.1 *Current Tank Car Specifications*

Tank Car Types	*DOT Specifications*	*AAR Specifications*
Nonpressure	DOT-111, DOT-115, DOT-117 *(DOT-103 and DOT-104 are authorized for use, but new construction is not authorized)*	AAR-206, AAR-211 *(AAR-211 is authorized for use, but new construction is not authorized)*
Pressure	DOT-105, DOT-109, DOT-112, DOT-114, DOT-120	
Cryogenic liquid	DOT-113	AAR-204

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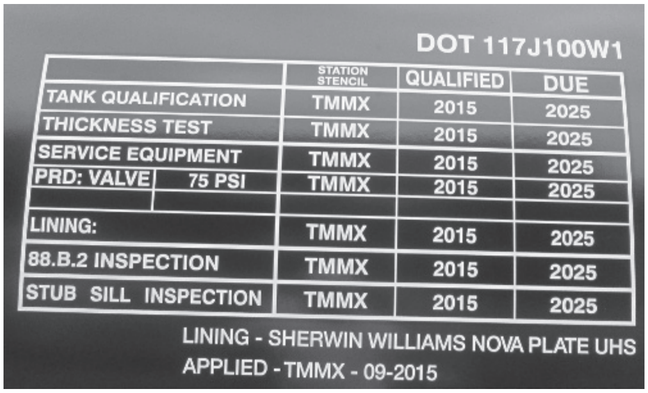
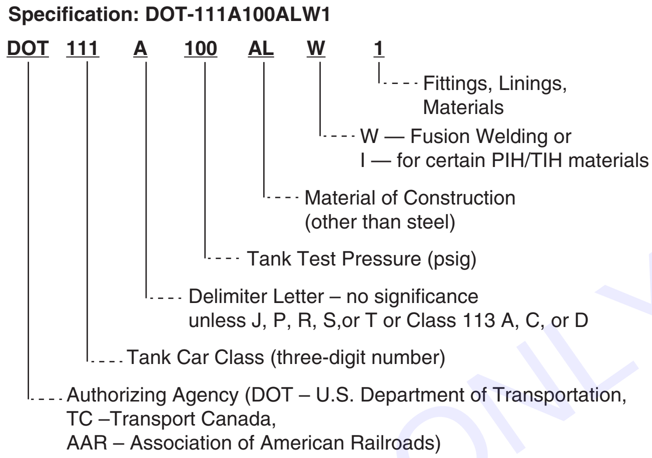
EXHIBIT I.12.4



(a)



(b)

This is an example of specification markings on tank cars: (a) shows the markings on the tank, and (b) shows the components of a tank car specification. [Source: a) Provided by members of the Association of American Railroads]

The specification is also found on the information plate mounted diagonally on the inboard surfaces of the right side (AR) and the left side (BL) body bolster web. The specification is also stamped into the head of the tank where it is not readily visible. The specification mark provides information on the authorizing agency, class number, delimiter letter, tank test pressure, material of construction other than carbon steel, welding method, and fittings, linings, and material of construction. The term *class designation*, made up of authorizing agency and three-digit class number, is used to reference a grouping of specifications.

The specification for a tank car can also be obtained from the railroad, shipper, car owner, or the AAR (from the car's certificate of construction) using the car's reporting mark and number.

The letters "TC" refer to Canadian tank cars, and may be substituted for the letters "DOT," which designate U.S. tank cars, when referring to a tank car's class or specification.

(2) Given an example of a tank car, identify the "B" end of the car

The "B" end of the car is the end where the hand brake is mounted. The reference to components of a tank car is based on facing the "B" end of the car (see Exhibit I.12.5). Additional information about tank cars and their markings, with a diagram of marking locations, is in Chapter 7 of NFPA 472.

(3) Given examples of various tank cars, identify each of the following tank car components present, and describe the design and purpose of each component:

Technicians with a tank car specialty are required to be able to identify and explain the components of a tank car so they can communicate the condition of a tank car at an incident using accepted terminology.

(a) Body bolster

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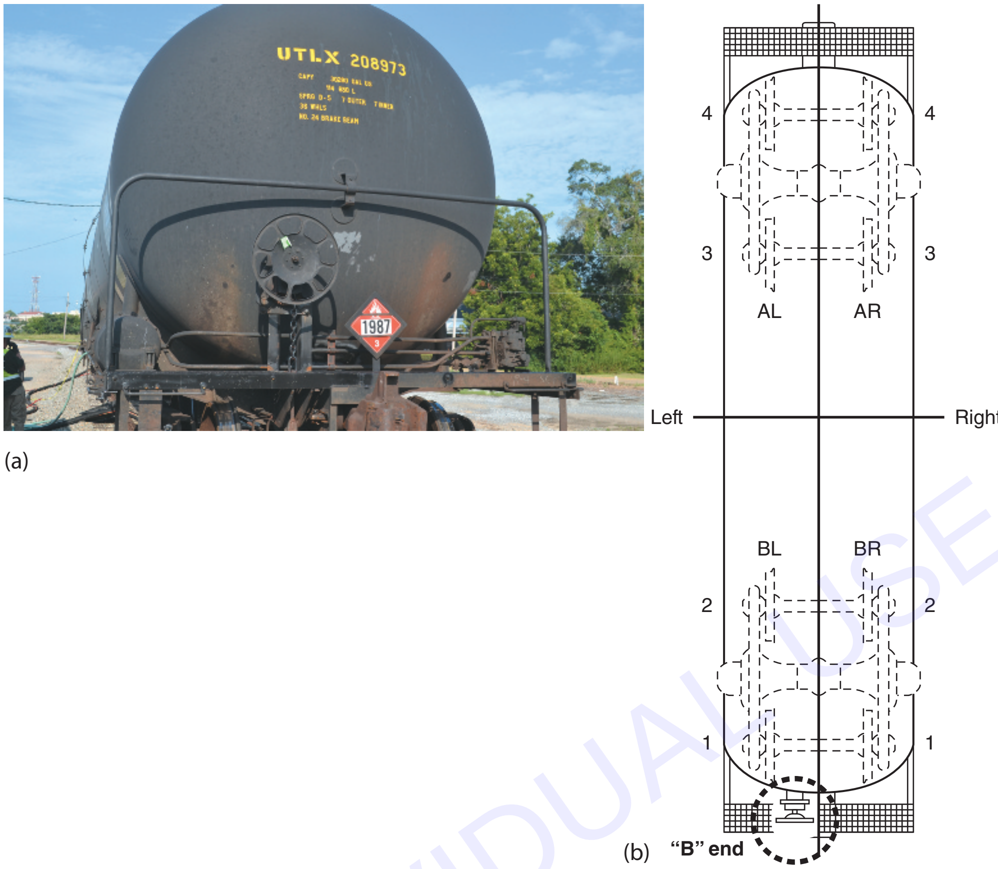
EXHIBIT I.12.5



(a)

(b)

This is an example of (a) the "B" end of a tank car and (b) an example of the orientation of a tank car as seen from above. [Sources: a) Provided by members of the Association of American Railroads; b) Adapted from Field Guide to Tank Cars, p. 12, 3rd Edition, Association of American Railroads]

The body bolster is a structural cross member, mounted at right angles to the underframe, at each end of the car body used to cradle the tank. Exhibit I.12.6 illustrates a typical body bolster.

(b) Head shield

Tank head puncture-resistance systems, commonly called head shields, are used to protect the heads of tank cars from punctures. For jacketed tank cars, either full or bottom half head shields can be incorporated in the head jacket. For nonjacketed tank cars, a full or bottom half head or trapezoidal-shaped head shield can be applied. Exhibit I.12.7 shows examples of a head shield.

(c) Heater coils — interior or exterior

Some tank cars are equipped with a series of continuous parallel pipes or coils mounted internally (inside the tank) or externally (outside the tank). Steam, water, or hot oil from an external source is run through these coils to heat thick or solidified materials (i.e., asphalts, fused solids, heavy fuel oils,

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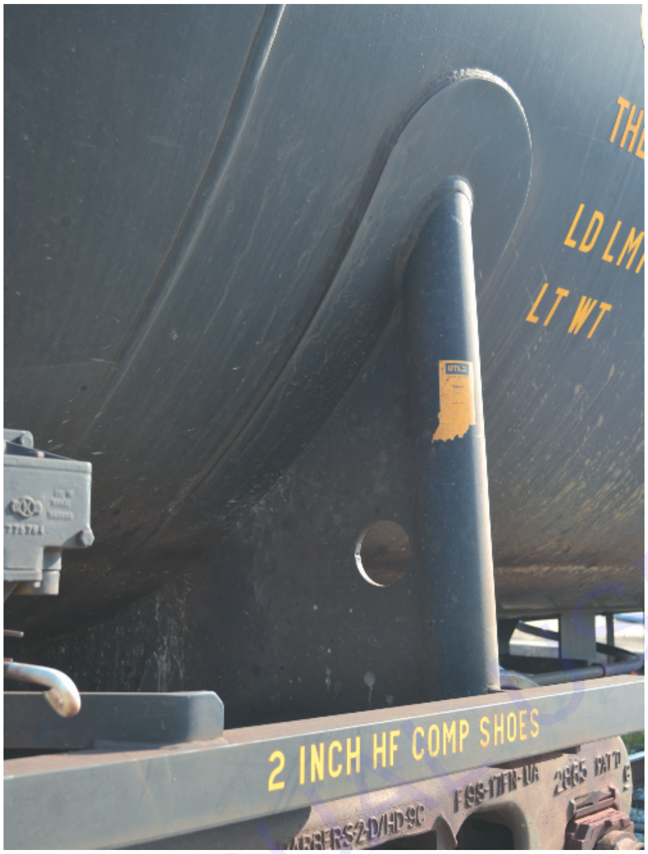
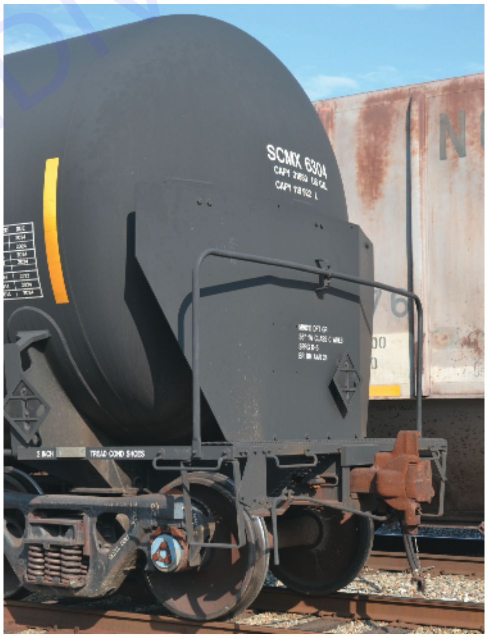


EXHIBIT I.12.6

This is an example of one of two styles of body bolster usually found on a tank car. (Source: Provided by members of the Association of American Railroads)

EXHIBIT I.12.7



(a)

(b)

These are examples of a head shield: (a) half-head shield and (b) a full-head shield. (Source: Provided by members of the Association of American Railroads)

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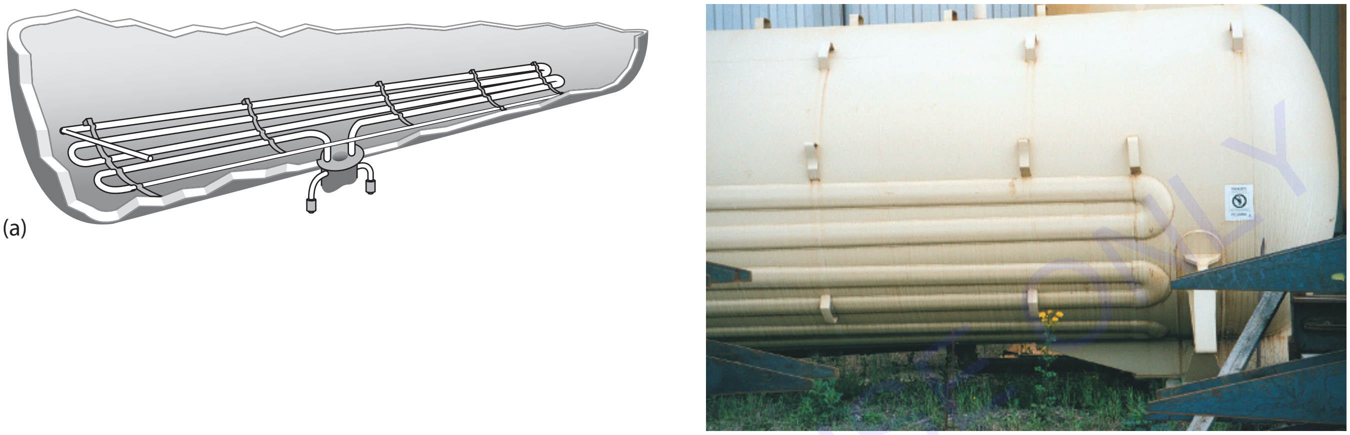
phenol, sulfur, metallic sodium, or petroleum waxes) to make them flow more easily when loading and unloading. Interior and exterior heater coils are shown in Exhibit I.12.8.

EXHIBIT I.12.8



(a) (b)

These are examples of heater coils: (a) internal heater coils and (b) exterior heater coils. (Source: Provided by members of the Association of American Railroads)

(d) Jacket

The jacket is an outer covering, typically 11 gauge (1/8 in.) steel, surrounding the tank car tank that holds both insulation and/or jacketed thermal protection in place as well as to protect the insulation or thermal protection from the weather. Wooden blocks or metal brackets hold the jacket away from the tank.

(e) Lining and cladding

The interiors of some tank cars are lined or clad with materials to protect the tank from the corrosive or reactive effects of the contents or to maintain the purity of the contents. A lining is a covering applied in strips or sections and fastened to the inside of the tank after the tank is constructed. Rubber is the most commonly used lining in tank cars transporting hazardous materials. Glass, lead, nickel, polyurethane, and polyvinyl chloride are also used as linings. Claddings are coverings applied to the base metal before the plate is formed. Nickel and stainless steel are used as cladding materials.

(f) Shelf couplers

Coupler vertical restraint systems, commonly known as top and bottom shelf couplers, is a type of coupler with a vertical restraint mechanism on the top and bottom. The coupler reduces the potential for coupler separation in a derailment or over-speed impact and possible head puncture. They are required on all DOT, TC, and AAR tank cars. Two versions of a typical coupler are shown in Exhibit I.12.9.

(g) Tank

Each tank car tank, as listed in 12.2.1(3)(a), is made up of a shell enclosed at the ends by heads. The shell is constructed of two to seven metal plates formed into rings. Heads are made from plates

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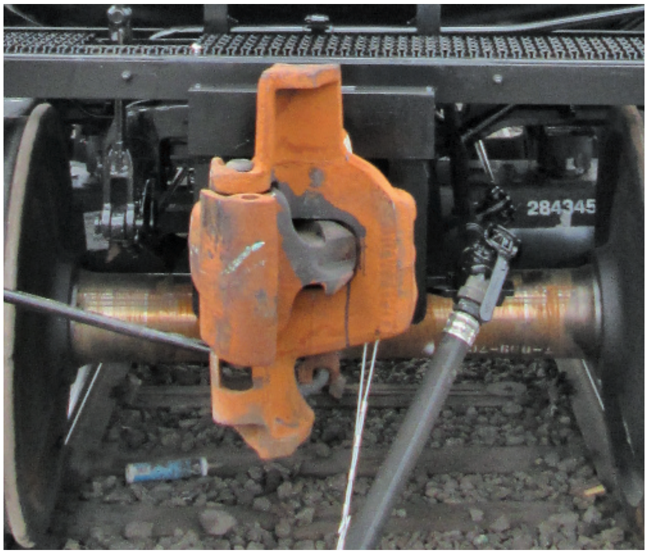
EXHIBIT I.12.9



(a)

(b)

These are examples of typical couplers: (a) one with a shelf coupler and (b) one with a regular coupler. (Source: Provided by members of the Association of American Railroads)

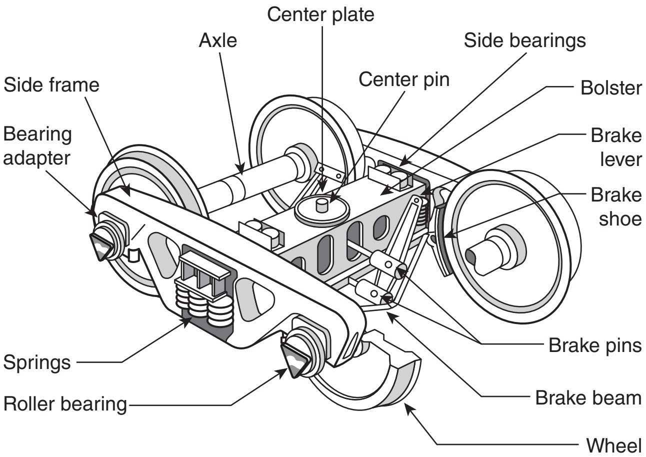
pressed into an ellipsoidal shape. The components (rings and heads) are fusion-welded together. As they are built, representative samples of the tanks are x-rayed to identify possible flaws in metal or welds. Steel tank car tanks are heated to 1600°F–1700°F (871.1 – 926.6 °C) for 1 hour to relieve metal stresses caused by welding. Finally, the tanks are hydrostatically tested. Tank car tanks can have as many as six compartments, with each compartment constructed as a separate tank. Compartments within the same tank car may have different capacities and can transport different commodities. Tank car tanks with multiple compartments are identified by the multiple sets of fittings on top of the car, one set for each compartment.

(h) Trucks (pin and bowl assembly)

See Exhibit 12.10 for an example of the trucks assembly.

EXHIBIT 12.10

This is an example of the trucks assembly found on tank cars. (Source: Provided by members of the Association of American Railroads)



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(i) Underframe — continuous or stub sill

Tank cars have either a continuous underframe or a stub sill underframe. The continuous underframe is a one-piece assembly, attached to the tank by the center anchor and tank bands at the body bolster, which bridges the trucks of a tank. This continuous underframe absorbs the draft and buff forces associated with train movement.

The stub sill type of frame is a short, longitudinal structural member welded to both ends of the tank to accommodate the coupler and draft gear. This part also attaches the tank to the truck. With this type of underframe, the tank transmits the draft and buff forces associated with train movement.

(j) Safety appliances

Examples include handholds, steps, walkways and railings, chains on openings, etc.

(4) Given examples of tank cars (jacketed and not jacketed), identify the jacketed tank cars.

Jacketed cars can be recognized by one or more of the following visual indicators:

- Flashing (shroud or cover) over the body bolster or tank bands
- Flat appearance of ends or flat sections on sides of tank car
- Rough appearance of visible welds, including lap welds, with welds generally thinner than the tank welds

(5) Describe the difference between insulation and thermal protection on tank cars

There is a clear difference between insulation and thermal protection. Insulation safeguards the contents of the tank car from outside temperatures. Insulation can be used on both pressure and nonpressure tank cars and is always used on cryogenic liquid tank cars. Fiberglass and polyurethane foams are the most common types of insulating materials. Currently, alternate wraps of paper and aluminum foil are used to insulate cryogenic liquid cars; older cryogenic liquid tank cars were insulated with perlite. The insulation is concealed by a jacket or the outer tank.

Thermal protection is used on certain tank cars, primarily DOT-117 nonpressure tank cars transporting high-hazard Class 3 flammable liquids (ethanol and crude oil) and pressure tank cars carrying Class 2 materials such as liquefied petroleum gases, to protect them from flame impingement from either a pool or torch fire. Thermal protection is designed to keep tank metal temperatures below 800°F (427°C) for 100 minutes (pool fire exposure) or 30 minutes (torch fire exposure).

(6) Describe the difference between interior and exterior heater coils on tank cars.

Interior heater coils are inside the tank. If these coils should become damaged, product can be released from the inlet or outlet pipes on the tank car. Exterior heater coils are welded to the outside of the tank shell and are not in contact with the product at all.

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(7) Given examples of various fittings arrangements for pressure, nonpressure, cryogenic, and carbon dioxide tank cars (including examples of each of the following fittings), identify each fitting present by name, and describe the design, construction, and operation of each of the following fittings:

(a) Fittings for loading and unloading tank cars, including the following:

(i) Air valve

On nonpressure tank cars, the valve that controls the flow of vapor is called an air valve. Unloading is accomplished from pressure or gravity generated from the contents or by pressurizing the tank with air, nitrogen, or other gas. The air valve is usually smaller than the liquid valve. On occasion, the air valve might be removed and replaced with a blind flange bolted to the cover plate. The blind flange reduces the possibility of tampering and subsequent release of the contents.

(ii) Bottom outlet nozzle

The bottom outlet nozzle is the pipe or flange from the bottom of the tank to the bottom outlet.

(iii) Bottom outlet valves (top operated with stuffing box, bottom operated — internal or external ball, wafer-sphere, plug)

The bottom outlet valve is used to load or unload the tank from the bottom. This valve can be any of the following types:

- Plug-type valve that is operated from the top of the tank, called a top-operated bottom outlet valve
- Ball-type valve mounted inside or outside the tank, operated from ground level with some type of operating handle
- Wafersphere (butterfly valve) mounted outside the tank, operated from ground level with an operating handle

(iv) Quick-fill hole cover

The fill hole on nonpressure acid cars is used for loading and unloading the tank.

(v) Carbon dioxide tank car fittings

Fittings for carbon dioxide tank cars typically include one angle valve for liquid, one angle valve for vapor, two pressure regulator valves (with different start-to-discharge settings), two or more fixed-length liquid level outage tubes (for gauging the amount of product), one pressure relief valve, and a rupture disc device. See Exhibit I.12.11.

(vi) Cryogenic liquid tank car fittings

(vii) Excess flow valve (product activated)

Excess flow valves, such as the one shown in Exhibit I.12.12, are attached inside the tank between the pressure plate and the eduction line. These valves almost completely cut off the flow of product when the valve is sheared off in an accident. They operate either by product flow or, when the car is over-

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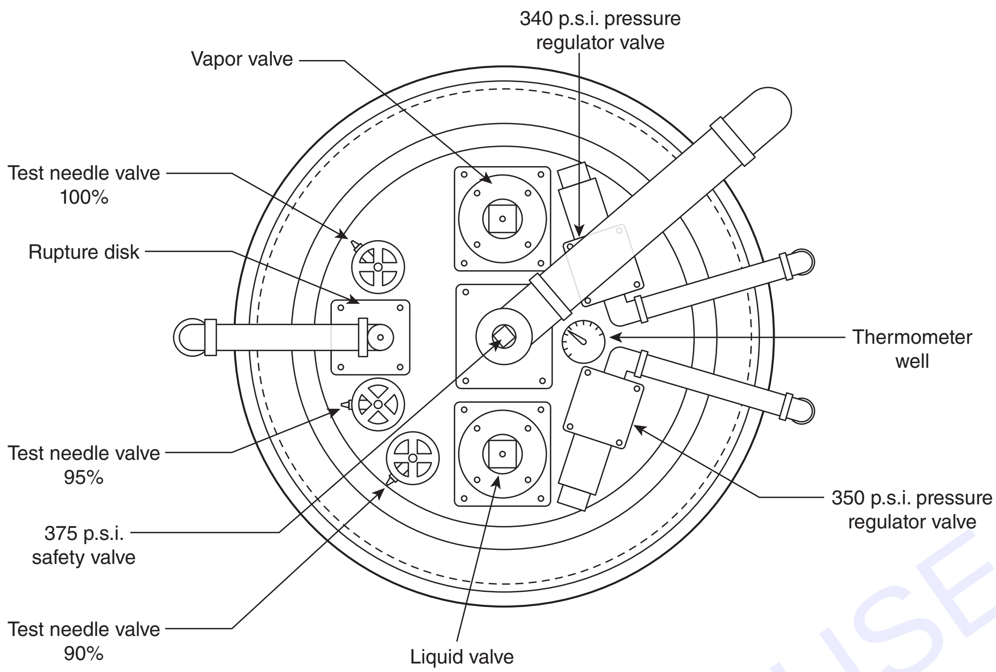

EXHIBIT I.12.11

This is an example of carbon dioxide protective housing and fittings. (Source: Provided by members of the Association of American Railroads)

turned, by gravity. Under normal conditions, gravity keeps the excess flow valves open, but higher flow rates associated with a valve being sheared off or a hose break closes them. When the tank car is turned over, gravity closes the valves. An excess flow valve can be found on gauging devices and sample lines.

(viii) Excess flow check valve (spring activated)

For TIH/PIH tank cars (chlorine), liquid and vapor angle valves will be equipped with spring-loaded check valves that are closed when the angle valve is closed; opening the valve opens the check valve and allows liquid or vapor to flow. See Exhibit I.12.13.

(ix) Flange for manway and valves

Flanges can be used as a form of closure and are subject to leakage due to insufficient bolt tension or gasket deterioration.

(x) Liquid valve and vapor valve (ball versus plug type)

Liquid valves are typically angle valves, with the primary closure being either plug type or ball type, and are mounted on the manway cover plate. The orifice of the liquid valve is closed by a secondary closure — a plug attached by a chain – or a blind flange. Liquid valves are found in 1 in., 2 in., and 3 in. (25.4 mm, 50.8 mm, and 76.2 mm) sizes. A gasket is used to complete the seal between the liquid valve and the manway cover plate (although older cars may have threaded connections). An eduction line is a pipe that extends to within 1 in. to 2 in. (25.4 mm to 50.8 mm) of the bottom of the tank or into a sump. In many cases, an excess flow valve is attached between the liquid valve and the eduction line, just below the manway cover plate.

EXHIBIT I.12.12

These are examples of product activated excess flow valves. (Source: Provided by members of the Association of American Railroads)

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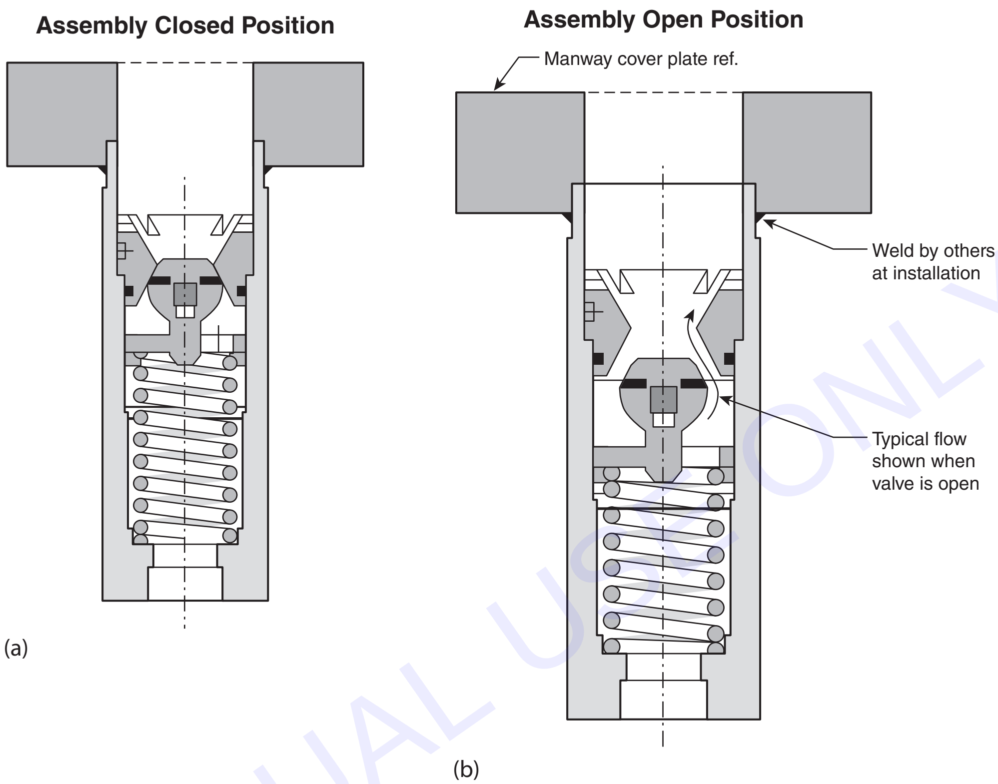
EXHIBIT I.12.13



This is an example of a spring-activated excess flow valve: (a) in the closed position and (b) in the open position. (Source: Provided by members of the Association of American Railroads)

Vapor valves are typically angle valves, either plug type or ball type, and are mounted on the manway cover plate. The orifice of the vapor valve is closed by a secondary closure — a plug attached by a chain – or a blind flange. Vapor valves are found in 1 in., 2 in., and 3 in. (25.4 mm, 50.8 mm, and 76.2 mm) sizes. Vapor valves are interchangeable with liquid valves. A gasket is used to complete the seal between the vapor valve and the manway cover plate. Exhibit I.12.14 shows an example of a typical angle-type liquid and vapor valve.

(xi) Indicator device (needle valve, tricock, and telltale indicator)

(xii) Eduction piping

See commentary for 12.1(7)(a)10.

(b) Fittings for pressure relief, including the following:

(i) Pressure regulators on carbon dioxide cars and liquefied atmospheric gases in cryogenic liquid tank cars

The devices in 12.2.1(7)(b)(i) release vapors from the tank when the pressure of the contents reaches the start-to-discharge pressure setting on the device.

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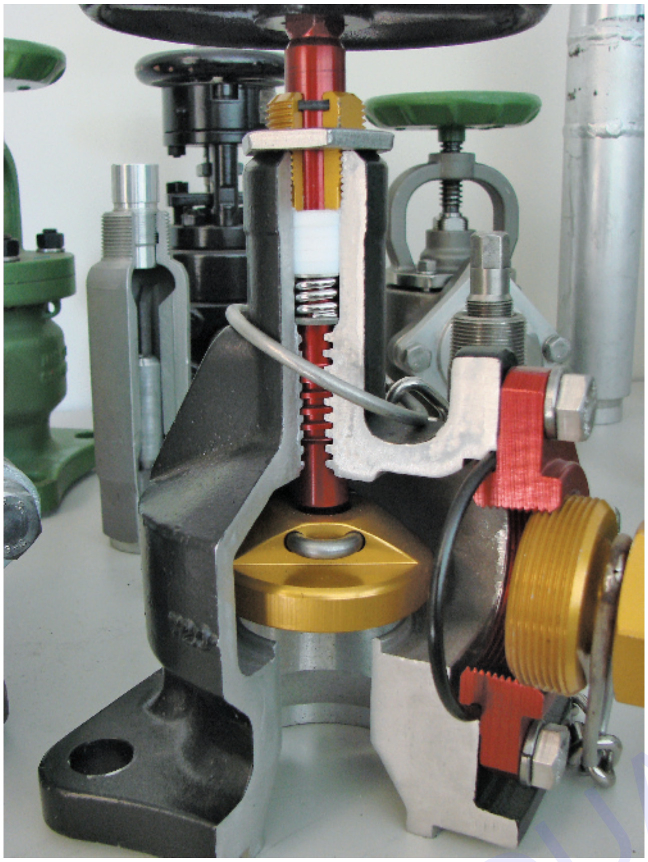

EXHIBIT I.12.14

This is an example of typical angle valves. (Source: Provided by members of the Association of American Railroads)

(ii) Pressure relief devices [reclosing pressure relief device (pressure relief valve), nonclosing pressure relief device (safety vent), or a nonclosing pressure relief device used in combination with a reclosing pressure relief device combination pressure relief valve]

Pressure relief devices are designed to reduce the buildup of excess internal pressure caused by commodity vaporization and expansion. These devices can be mounted on the manway cover plate or tank shell. Pressure relief devices include reclosing devices (pressure relief valves and combination pressure relief valves) and nonreclosing devices (rupture disc device or safety vent).

Pressure relief valves are reclosing pressure relief devices with the valve held closed by one or more springs. When pressure in the tank exceeds the start-to-discharge setting of the pressure relief valve setting, the valve opens. The valve recloses when the tank pressure is reduced below the pressure relief valve setting. The pressure relief valve on a pressure tank car is usually set at 75 percent of the tank test pressure but can be set as high as 82.5 percent of the tank test pressure.

Safety vents are nonreclosing pressure relief devices that use a frangible disc, also called a rupture disc, to seal the vent opening. This disc is designed to rupture at a predetermined pressure to relieve internal pressure. Once ruptured, the safety vent does not reclose and may allow product to be released. Rupture discs are made of metal (lead is no longer authorized by the AAR), plastic, rubber, or a combination of metal, plastic, and rubber. Safety vents are used primarily on nonpressure tank cars but cannot be used with flammable liquids and poisons.

Combination pressure relief valves incorporate rupture discs or breaking pins in series with spring-operated valves. This type of pressure relief valve is typically mounted on the manway cover

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plate and is usually found on tank cars transporting chlorine. The spring is external to the tank and is protected from the effects of the lading by the rupture disc and breaking pin protected by a corrosion-resistant diaphragm. The internal working parts of the valve are also protected from ambient atmospheric conditions by the upper diaphragm, which is clamped in place by the valve cap. When the pin fractures, the valve instantly pops fully open and the upper diaphragm is broken automatically to permit free discharge. (See Exhibit I.12.15.)

(iii) Staged pressure relief system for a carbon dioxide car

The staged pressure relief system accounts for sufficient release of vapors to keep the liquid autorefrigerated during transportation. Carbon dioxide tank cars are equipped with three types of pressure relief devices:

- A reclosing pressure relief valve having an STD pressure not exceeding 75 percent of the tank test pressure
- A nonreclosing safety vent designed to burst at a pressure less than the tank test pressure
- Two regulating valves set to open at a pressure not to exceed 350 psig on a 500 psig test pressure tank or 400 psig on a 600 psig test pressure tank

EXHIBIT I.12.15

This is an example of a combination pressure relief valve. (Source: Provided by members of the Association of American Railroads)

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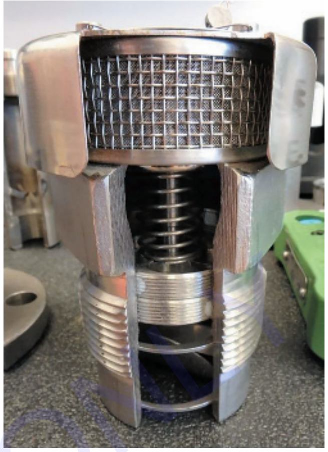
In addition, the final discharge of each pressure relief device must be piped outside of the protective housing.

(iv) Vacuum relief valve (negative pressure or vacuum).

Vacuum relief valves, such as the ones shown in Exhibit I.12.16, are designed to prevent a buildup of excessive internal negative pressure (a vacuum greater than –0.75 psi (–5.2 kPa). The vacuum relief is not intended to flow enough CFM to account for unloading, but just enough to deal with vacuum caused by temperature changes.

EXHIBIT I.12.16



This is an example of a vacuum relief device. (Source: Provided by members of the Association of American Railroads)

(v) Breather vent (continuous vent) for hydrogen peroxide tank cars.

(c) Fittings for gauging, including the following:

Gauging devices are mounted on the manway cover plate and are used to measure the amount of commodity in a tank. These devices measure either "innage," which is the amount of liquid in the tank, including liquefied or cryogenic gases, or "outage," which is the amount of vapor space left in the tank.

(i) Closed gauging devices (e.g., magnetic)

Closed-type gauging devices use a float coupled with a magnet on a measuring rod or a dial indicator to show the liquid level of the commodity (see Exhibit I.12.17).

EXHIBIT I.12.17

This is an example of a closed gauging device. (Source: Provided by members of the Association of American Railroads)

(ii) Other gauging devices (T-bar, long pole, short pole)

The "T", or notch, of the gauge bar is mounted inside the manway of a nonpressure tank car. Liquid to the top of the notch or the bottom of the T indicates appropriate outage, normally 2 percent. The long pole/short pole type of gauging device resembles the sample line on pressure tank cars. This device consists of a valve and fixed-length tube that extends into the tank to a specified level for measuring outage.

(d) Miscellaneous fittings, including the following:

(i) Manway, hinged and bolted manway cover, manway cover bolts, pressure plates, and protective housing

All pressure and nonpressure tank cars have manways. A manway is an opening on top of the tank car large enough to allow access to the tank's interior for cleaning, inspecting the interior, and making repairs. Manways for most nonpressure tank cars are closed with a hinged and bolted manway cover (with six or eight bolts) and have a gasket between the manway nozzle and cover (this manway is the number-one source of nonaccident releases). Manways on pressure tank cars and some nonpressure tank cars (DOT-117 and others) are closed with a permanent 20-bolt manway cover plate that is used for attaching fittings. A protective housing is mounted on the manway. This housing protects the valves and fittings within from mechanical damage in a derailment. The protective housing has a hinged cover that must be opened to reach the valves and fittings. The protective housing is always found on pressure tank cars and can be found on some nonpressure tank cars.

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(ii) Sample line

A sample line can be mounted on the manway cover plate and is used to obtain a sample of the commodity without otherwise opening the tank. For flammable gases, the sample line has an excess flow valve on the end inside the tank.

(iii) Sump

A sump is a closed depression in the bottom of the tank. This fitting allows the eduction line to extend slightly below the bottom of the tank to unload the tank more completely.

(iv) Thermometer well

A thermometer well, mounted on the manway cover plate, consists of a closed tube that extends into the tank. This device is filled with a small amount of permanent antifreeze. By inserting a thermometer into the tube, the temperature of the commodity inside the tank can be measured.

(v) Washout

A washout is a closed-off opening in the bottom of the tank car tank that is used to facilitate cleaning or purging the tank. Once the closure is removed, the commodity flow cannot be controlled.

(vi) GPS transponders

Remote monitoring equipment (GPS transponders) monitor, record, and transmit information such as location, temperature and/or pressure of the lading, leak detection, impact detection, indication of tampering or opening of the protective housing, and loaded or empty status. Yellow label or stencil describing the device and providing a phone number to call for information on the device. See Exhibit I.12.18.

Additional information on tank car construction, components, and fittings can be found in the AAR *Field Guide to Tank Cars* [1].

EXHIBIT I.12.18

This is an example of a GPS transponder with a yellow label and emergency contact phone number. (Source: Provided by members of the Association of American Railroads)

(8) Given examples of various fitting arrangements on tank cars (including carbon dioxide and cryogenic liquid tank cars) with the following fittings included, identify the location(s) where each fitting is likely to leak and a reason for the leak:

(a) Air valve
(b) Bottom outlet nozzle
(c) Bottom outlet valve and top-operated bottom outlet valve (with stuffing box)
(d) Closed gauging devices (e.g., magnetic)
(e) Flange
(f) Liquid valve and vapor valve (ball versus plug type)
(g) Manway, manway cover plate, hinged and bolted manway cover, protective housing
(h) Non-reclosing pressure relief devices (safety vent with rupture disc)
(i) Pressure regulators on carbon dioxide cars and liquefied atmospheric gases in cryogenic liquid tank cars
(j) Quick-fill hole cover
(k) Reclosing pressure relief device (pressure relief valves and combination pressure relief valves)

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(l) Sample line
(m) Thermometer well
(n) Vacuum relief valve (negative pressure or vacuum)
(o) Washout

Incident release data is available at the AAR web site or through your local railroad representative.

(9) Given examples of each of the following types of tank car damage, identify the type of damage in each example:

Two closely related conditions can trigger tank car tank failure or rupture:

- Cracks in the tank associated with dents and rail burns
- Gross thinning of the tank beyond acceptable limits associated with gouges, scores, wheel burns, and flame impingement

Both conditions cause stress concentrations, or notches, which can lead to tank failure or rupture. Increased stress on this notch will make cracks grow, initiating failure or rupture.

(a) Corrosion

Corrosion is pitting of the tank metal, thus reducing the thickness and, possibly, the strength of the tank metal.

(b) Crack

A crack is a narrow split or break that can penetrate the metal of the container. Cracks are typically associated with dents and rail burns. Characteristics of cracks include the following:

- Typically occur in tension areas, not compression areas
- Cause failure because they can grow under stress
- Can grow at speeds approaching the speed of sound
- Grow very rapidly in brittle steels and relatively slowly in ductile steels

(c) Dent

A dent is a deformation of the container metal. This damage is caused by impact with a relatively blunt object. When a sharp radius of curvature is associated with the dent, the possibility of cracking exists. Long dents with cold work (gouges) at the bottom of the dent are called rail burns.

(d) Flame impingement

Flame impingement is fire in direct contact with the surface of the tank, either in the liquid space or in the vapor space.

(e) Puncture

A puncture is a hole in the tank.

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(f) Score, gouge, wheel burn, rail burn

Scores and gouges, wheel burns, and rail burns equate to metal loss from the tank and potential weakening of the tank structure. A score is a reduction in the thickness of the tank caused by relatively blunt object. The scoring action relocates the tank and/or weld metal along the track of contact. A gouge is a reduction in the thickness of the container caused by a sharp, chisel-like object cutting and completely removing the tank and/or weld metal along the track of contact.

Wheel burns, sometimes called spot burns, are similar to a score in that the prolonged contact of the wheel with the tank reduces the thickness of the tank, pushing the metal aside at the point of contact. Long dents with cold work at the bottom of the dent are called rail burns. See 12.2.1(9)(e).

(10) Given examples (actual or simulated) of scores, gouges, wheel burns, and rail burns, perform each of the following tasks:

(a) Measure the depth of each score, gouge, wheel burn, and rail burn
(b) Identify 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 at 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

A.12.2.1(10)(d) The heat-affected zone is an area in the metal next to the actual weld. This zone is less ductile that either the weld or the metal due to the welding process. The heat-affected zone is vulnerable to cracks.

The head-affected zone of a weld is that portion of the base metal, next to the weld, that has not been melted, but whose mechanical properties or microstructure has been altered by the heat of welding. This zone is less ductile that either the weld or the metal due to the welding process. The heat-affected zone is vulnerable to cracks.

(11) Given examples (actual or simulated) of dents and rail burns, perform each of the following tasks:

The technician with a tank car specialty performs the tasks in 12.2.1(11) in a manner appropriate to the rail equipment used. These tasks should be performed using personal protective equipment (PPE) appropriate for the material involved and the working conditions.

(a) Determine the radius of the curvature of each dent or rail burn

The tank car dent gauge is a damage assessment tool used to compare the actual radius of curvature of a dent in a tank car tank to accepted standards to determine the severity of damage. Dents exceeding (sharper than) accepted threshold radii (minimum radius of curvature of 2 in. (51 mm) or less) are deemed critical and require additional evaluation for tank cars currently in service.

(b) Recognize those examples that include cracks at the point of minimum curvature

The technician with the tank car specialty is required to identify cracks at the point of minimum curvature and explain the significance of this condition, in accordance with 12.2.1(11)(b).

(12) Given examples of damaged tank car fittings, describe the extent of damage to those fittings

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The technician with a tank car specialty is required to describe the extent of damage to tank car fittings such as damaged and not leaking, damaged and leaking, repairable or not, and so forth, in accordance with 12.2.1(12).

(13) Given examples of tank car tank damage, describe the extent of damage to the tank car tank

The technician with a tank car specialty is required to describe the extent of damage to a tank car tank with terms such as damaged and not leaking, damaged and leaking, repairable or not, potential for release and so forth, in accordance with 12.2.1(13). The technician must also determine the depth (amount of metal removed) of score, gouge, wheel burn or rail burn, radius of curvature of dents and rail burns, amount and location of corrosion, presence of cracks, and so forth, as appropriate for the example.

(14) Given a tank car, its contents, and the applicable equipment and reference material, determine the pressure in the tank, using either of the following methods:

(a) Pressure gauge

The technician with a tank car specialty is required to determine the pressure in the tank car using a pressure gauge attached to the tank car through one of the fittings, typically the sample line, in accordance with 12.2.1(14)(a).

(b) Temperature of the contents

Alternatively, the temperature of the material can be obtained and checked against temperature-pressure charts to determine the pressure of the contents. This method is unlikely to be used in an emergency

(15)* Given a tank car, use the tank car's gauging device to determine the outage in the tank

The technician with a tank car specialty is required to use various types of gauging devices to determine the innage (amount of liquid) or outage (amount of vapor space) in a tank car assuming the tank car is upright.

A.12.2.1(15) 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.

12.2.2 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 complete the following tasks:

(1) Given the following types of tank cars, describe the likely breach and release mechanisms associated with each type:

The technician with a tank car specialty is required to describe the types of breach/release mechanisms associated with the following types of tank cars.

(a) Cryogenic liquid tank cars

This includes DOT-113 and AAR-204 tank cars.

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(b) Nonpressure tank cars

This includes DOT-111, DOT-115, DOT-117, AAR-206, and AAR-211 tank cars.

(c) Pressure tank cars

This includes DOT-105, DOT-109, DOT-112, DOT-114, and DOT-120 tank cars.

(2) Describe the difference in the following types of construction materials used in tank cars and their significance in assessing tank damage as shown in Table 12.2.2:

The minimum plate thickness of materials used to construct tank cars is specified by regulation.

N ***TABLE 12.2.2*** *Tank Car Type and Materials Used in Construction of Tank*

Tank Car Types	***Materials of Construction of Tank***
Nonpressure	Steel plate, aluminum alloy plate, high-alloy steel plate, nickel plate, manganese-molybdenum steel plate
Pressure	Carbon steel plate, aluminum alloy plate, and high-alloy steel plate
Cryogenic liquid	Stainless steel — ASTM A240/A240M, Type 304 or 304L for the inner tank

(a) High-alloy steel plate

High-alloy steel plate is referred to as stainless steel.

(b) Aluminum alloy plate

(c) Carbon steel plate

Carbon steel is used in over 90 percent of the tank car tanks in use today, with aluminum making up most of the remainder. Stainless steel, referred to as alloy steel, is used in a smaller number of cars. Nickel or nickel alloy is used for some tanks that are used to transport acid or food.

(d) Nickel plate

Nickel and nickel alloy are used for some tanks. Nickel is found in nonpressure tank cars that are used to transport acid or food.

(3) Describe the significance of selection of lading for compatibility with tank car construction material

Consequences include chemical reaction that corrodes the metal, reducing the thickness and strength of the metal, causing failure of the tank; chemical reaction with the product that increases the pressure in the tank causing failure of fittings and possibly the tank; loss of purity of the contents; etc.

(4) Describe the significance of lining and cladding on tank cars in assessing tank damage

The interiors of some tank cars are lined or clad with materials to protect the tank from the corrosive or reactive effects of the contents or to maintain the purity of the contents. During an

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emergency, responders must consider the potential effects of lining or cladding damage, as required in 12.2.2(4).

(5) Describe the significance of the jacket on tank cars in assessing tank damage

An undamaged jacket can serve as a heat shield from radiated heat. The jacket is not designed to hold the product. Mechanical damage to the jacket might not reveal the extent of damage to the tank itself.

(6) Describe the significance of insulation and thermal protection on tank cars in assessing tank damage

Insulation is used to safeguard the contents of the tank car from outside temperatures. Thermal protection is used on certain tank cars to protect them from flame impingement from either a pool or torch fire. This protection is designed to keep tank metal temperatures below 800°F (427°C) for 100 minutes (pool fire exposure) or 30 minutes (torch fire exposure).

(7) Describe the significance of jacketed and sprayed-on thermal protection on tank cars in assessing tank damage

Both types of thermal protection in 12.2.2(7) provide the same function; sprayed-on thermal protection is no longer found on tank cars in commerce. Like other forms of thermal protection, mechanical damage to the sprayed-on coating or jacket will compromise the function of the thermal protection. Jacket damage might not indicate the extent of damage to the tank itself.

(8) Describe the significance of interior and exterior heater coils on tank cars in assessing tank damage

Exterior heater coils pose less of a problem than interior coils when damaged because they are outside of the tank and have no contact with the contents. However, heater coils inside the tank can allow the contents to get outside the tank because the coil is connected to a heater coil inlet on the outside of the tank. Without a cap, the flow cannot be controlled.

(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) Corrosion

Corrosion is pitting of the tank metal, thus reducing the thickness and, possibly, the strength of the tank metal.

(b) Crack

It is difficult to determine when a crack in a tank is critical, so accurate and timely decisions about a tank's condition must be made. The following guidelines can be helpful:

- Any crack found in a tank, no matter how small, is deemed critical and may require immediate action.
- Cracks in fillet welds (i.e., those used to attach brackets or reinforcement plates) are not critical unless a crack extends into tank metal.
- The pressure of the commodity should be considered, and the potential for a pressure rise should be evaluated.

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(c) Dent

Sharp dents in the shell of the tank are the most serious because these dents can reduce the strength of the tank significantly or result in internal cracking. Another critical factor is the temperature of the steel when the stress occurred. This is due to steels having transition temperatures, i.e., the temperature at which a steel transitions from ductile to brittle. Extremely cold temperatures warrant consideration in this matter.

In accordance with 12.2.2(9)(c), dents should be evaluated using the following guidelines:

1. Minimum radius of curvature of 2 in. (51 mm) or less
2. Presence of a crack within the dent
3. Dent crossing a weld
4. Presence of a score or gouge
5. Evidence of cold work

Massive dents in heads of the tank are generally not serious unless gouges or cracks are present with the dents.

Note: Massive denting could reduce tank capacity significantly. If massive denting causes the volume of the tank to equal the volume of the loading, the tank might undergo hydrostatic failure.

(d) Flame impingement

Flame impingement on the vapor space can adversely affect the strength and thickness of the steel. Flame impingement on the liquid space can increase the pressure within the tank due to vaporization and expansion of the liquid.

(e) Puncture

(f) Tank thinning caused by a score, gouge, wheel burn, or rail burn

Tank thinning (score, gouge, wheel burn, or rail burn) is evaluated in terms of metal removal in the following manner:

- It is important to measure the depth of metal removed in relation to tank thickness.
- Longitudinal scores are of greatest concern; however, circumferential (hoop) scores must be evaluated as well.
- Scores or gouges crossing a weld with removal of the crown metal only are of little concern.
- Longitudinal scores or gouges that cross a weld and damage the heat-affected zone are potentially critical and require additional evaluation.
- All rail burns require additional evaluation.
- All wheel burns require additional evaluation.

(10) Describe the significance of the depth of scores, gouges, wheel burns, and rail burns on tank cars in assessing tank damage

Scores, gouges, wheel burns, and rail burns reduce the thickness of the metal in the tank, thus reducing the strength of the tank metal.

(11) Describe the significance of damage to the heat-affected zone of a weld on a tank car in assessing tank damage

Scores, gouges, wheel burns, and rail burns reduce the thickness of the metal in the tank, thus reducing the strength of the tank metal. This damage is also complicated by the reduction of strength associated with damage to the heat-affected zone of a welded seam.

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(12) Describe the significance of a dent that includes the thinning of tank metal

(13) Given various types of tank cars, describe the significance of pressure increases in assessing tank damage

Pressure increases in a damaged tank may cause tank failure and release of contents.

(14) Given various types of tank cars, describe the significance of the amount of lading in the tank in assessing tank damage

In a damaged tank car, the amount of lading can affect the stability of the tank car or overstress the tank and cause tank failure.

(15) Describe the significance of flame impingement on the vapor space and liquid space as it relates to a tank car

Flame impingement on the vapor space can adversely affect the strength and thickness of the steel. Flame impingement on the liquid space can increase the pressure within the tank due to vaporization and expansion.

Commentary Table I.12.1 summarizes risk-based tactical factors to consider when analyzing tank cars in an emergency regarding types, appearance, causes, and considerations.

COMMENTARY TABLE I.12.1 *Significant Tank Damage*

Type	*Appearance*	*Cause*	*Extent of Damage Considerations*
Cracks	Narrow split or break in the tank metal that could penetrate tank metal	Application of mechanical force; inward deformation	• Cracks extending into the base metal of the tank • Cracks in conjunction with dents, rail burns, scores, or gouges
Dents	Deformation of tank head or shell	Impact with a relatively blunt object	• Sharp radius of curvature — 2 in. or sharper • Dents with gouges or scores with damage to weld's heat-affected zone
Rail burns	Long inward dent with gouge; typically crosses welds	Contact with rail or other stationary object (i.e., wheel flange)	• Length of rail burn • Damage to the heat-affected zone of a weld • Amount of metal removed from gouge • Direction of gouge — longitudinal or circumferential
Scores	Reduction in thickness of the tank shell or head; displaced metal relocates along the path of contact	Impact with a relatively blunt object	• Amount of tank metal removed • Damage to the heat-affected zone of a weld • Direction of score • Length of score
Gouges	Reduction in thickness of the tank shell or head; displaced metal along the path of contact is removed	Impact with a relatively sharp object	• Amount of tank metal removed • Damage to the heat-affected zone of a weld • Direction of gouge • Length of gouge
Wheel burns	Reduction in thickness, spot burn; displaced metal is deposited along the path of contact	Turning wheel in prolonged contact with tank	• Amount of tank metal removed • Damage to the heat-affected zone of a weld (not likely) • Depth measurement complicated by displaced metal
Bulging	Raised area on tank	Flame impingement	• Presence of bulging

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12.3 Competencies — Planning the Response.

In Chapter 7, the hazardous material technician is required to identify appropriate response objectives (nonintervention, defensive, or offensive) for responders at that level. While the hazardous materials technician can stabilize an incident until industrial specialists arrive for final and complete mitigation, the technician with a tank car specialty can assist with or perform the highly technical, inherently dangerous, offensive operations that lead to final mitigation of the incident. See Commentary Table I.12.2.

COMMENTARY TABLE I.12.2 *Potential Response Options for Tank Car Problems*

Problem	*Objectives*	*Actions*	*Methods*
Leaking fitting • not secure • worn • damaged	Stop release, forward to destination	• Close • Tighten • Repair part • Repair/replace	
	Stop release, forward for further action	• Cap • Repair after empty • Replace after empty	• Capping kit
Overloaded tank	Reduce load, forward to destination	• Product removal – At fixed facility – In field	• Transfer
Tank or car structure damage	Off-load, forward for further action	• Product removal – At fixed facility – In field	• Transfer • Flare • Vent
	Reduce internal pressure	• Vapor removal	• Flare • Vent
	Gain access to contents		• Hot tap • Cold tap
	No other options		• Vent and burn

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12.3.1 Determining the Response Options. Given the analysis of an incident involving tank cars, technicians with a tank car specialty shall determine the response options for each tank car involved and shall complete the following tasks:

The competencies in 12.3.1(1) build on the competencies of the hazardous materials technician.

Because most of these operations are rarely done at an incident, the technician with a tank car specialty should give a detailed briefing to the hazardous materials branch safety officer, branch officer, and incident commander on the planned operations before staffing any operations, including:

- Plan the operation as follows:
  1. Develop a list of required equipment for the selected operation
  2. Prepare a plan for set-up, implementation, and shutdown of the operation
  3. Prepare a site safety plan
- Set up the operation as follows:
  1. Hold a safety briefing
  2. Position the equipment
  3. Set up and activate the emergency shutoff system, if used
  4. Purge the liquid and vapor hoses and test for leaks

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- Implement the operation
- Shut down the operation as follows:
  1. Purge the hoses and/or piping
  2. Disassemble and decontaminate the equipment
  3. Secure cars
- Determine disposition of tank cars and prepare them for transportation

(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:

Extreme care must be exercised in a product removal operation and only after consultation with the shipper, carrier, or other tank car specialist.

The product removal methods in 12.3.1(1) are outside the legitimate responsibility of the local emergency response personnel. However, oversight of planning and implementation is within the responsibilities of local emergency response agencies. Product removal procedures should be established in advance based on current industry standards and recommended practice. Only essential personnel — outlined, in most cases, in the overall incident management system of the hazardous materials branch — should be involved in the process.

(a) Flaring liquids and vapors

Flaring is the controlled release and disposal of flammable liquids or gases by burning from the outlet of a vertical or horizontal flare pipe. This product removal method is used to reduce the pressure within the tank, dispose of vapors remaining in the tank after transfer, or burn off liquid when transfer is impractical.

Vapor flaring is accomplished by burning the flammable vapors at the outlet of a vertical flare pipe.

Liquid flaring is accomplished by burning of flammable liquids or gases that vaporize at the end of a horizontal flare pipe. A pit is built at the end of the horizontal flare pipe to contain any liquid that is not vaporized immediately. It is used to dispose of the lading when another product removal method is not practical.

(b) Hot and cold tapping

Hot tapping is a technique for providing access to the contents of a tank when either damage to the valves and fittings precludes their use or the valves and fittings are inaccessible. To make a hot tap, one or more threaded nipple(s) are welded to the tank, typically one in the vapor space and one in the liquid space. A ball valve is connected to each threaded nipple. Then, a hole is drilled or cut into the tank through the center of both the threaded nipple and attached valve with a drilling machine designed for the application. The drill is removed and hose/pipe is attached. After completing and testing the hot tap, transfer, flaring, or venting product removal techniques can take place.

Cold tapping serves the same purpose as hot tapping except that the attachment of the threaded nozzle to the tank is accomplished without welding by strapping or bolting the nozzle plate onto the tank.

(c) Transferring liquids and vapors

Transfer is the controlled movement of the contents of a damaged or overloaded tank into a receiving (undamaged) tank (i.e., tank car, cargo tank, intermodal tank, fixed tank, or other container). It is

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also known as load reduction when transferring product from an overloaded tank, or transload when receiving tank is from another mode of transportation or fixed facility.

Transfers can be used when the following conditions exist:

- The tank has been damaged to the extent that it cannot be moved safely to an appropriate unloading point.
- The tank itself is sound but, due to other mechanical damage, the tank cannot be moved safely to an appropriate unloading point.
- The site conditions prevent moving the damaged tank (e.g., the terrain does not permit use of cranes or other equipment).
- The tank is overloaded.
- The damage to leaking valves and fittings cannot be repaired.

Typically, transfers in the field are distinguished by the basic equipment used to move the contents from a damaged or overloaded tank car. A gas or liquid transfer uses one of the following methods to facilitate the transfer.

- Vapor compressor: to create a pressure differential by pulling the vapors from the receiving tank, compressing them, and forcing them into the damaged tank. The pressure in the damaged tank pushes the liquefied gas into the receiving tank.
- Liquid pump: to move the contents of a damaged tank to a receiving tank.
- Liquid pump and vapor compressor: to create a pressure differential by withdrawing vapors from the receiving tank, compressing them, and forcing them into the damaged tank. The pressure in the damaged tank helps keep the pump primed.
- Compressed air or inert gas compatible with the product (e.g., nitrogen or carbon dioxide): to move the contents of a damaged car to a receiving tank. The compressed gas (inert gas) creates a pressure differential and pushes the liquid into the receiving tank. Vapor from the receiving tank may have to be scrubbed or vented.
- Vapor pressure (with or without flaring): to move the contents of a damaged tank to a receiving tank. The vapor pressure in the damaged tank pushes the material into the receiving tank. When flaring, the pressure differential between the damaged tank and the receiving tank is maintained by burning off vapors from the receiving tank at the outlet of a flare pipe.

(d) Vent and burn

Vent and burn is a process of removal and ignition of flammable liquids and gases using explosives to create openings in the tank. This product removal method is a last-resort method, and only experienced personnel should perform it. Explosive charges are placed on the tank, one at the highest point on the tank for venting vapor and reducing the pressure in the tank instantaneously, and the second charge at the lowest point on the tank for releasing the liquid. A pit collects the released liquid for burn-off. Vent and burn should only be performed by experienced personnel.

(e) Venting vapors to atmosphere

Venting is the process of reducing the pressure in a tank containing nonflammable gas by releasing vapors from the tank directly to the atmosphere.

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(f) Venting vapors through a treatment (scrubbing) process

In this case, venting is the process of reducing the pressure in a tank containing toxic gas by releasing vapor indirectly to the atmosphere through an appropriate treatment (scrubbing) system.

(2) Describe the inherent risks associated with, procedures for, equipment required to implement, and safety precautions for controlling leaks from various fittings on various tank cars.

(3) Describe the effect flaring or venting gas or liquid has on the pressure in the tank

Flaring and venting reduce the pressure or dispose of the residual vapors in a damaged or overloaded tank.

(4) Describe the inherent risks associated with, procedures for, equipment required to implement, and safety precautions for movement of damaged tank cars

The lifting of tanks should be performed only by experienced personnel. Allied professional and specialized employees including shippers, carriers, tank builders and their repair personnel, and environmental contractors can assist in all aspects of tank response.

(5) Describe the inherent risks associated with, procedures for, and safety precautions for the following operations:
   (a) Setting and releasing brakes on rail cars
   (b) Shutting off locomotives using the fuel shutoff and the battery disconnect
   (c) Uncoupling rail cars

The technician with a tank car specialty is required in 12.3.1(5) to perform these tasks in a manner appropriate to the rail equipment used. These tasks should be performed using appropriate PPE for the material involved and the working conditions.

(6) Describe the hazards associated with working on railroad property during emergencies

While working on railroad property take the following precautions:

- Wear a hard hat, safety glasses, and sturdy work boots, preferably steel-toed.
- Obtain positive confirmation from the railroad that the tracks are locked out and you have track protection.
- Wear hearing protection in situations that call for its use.
- Stay clear of the tracks whenever possible; trains can approach undetected due to atmospheric conditions and terrain.
- When confronted with a passing train, stand away from the track to prevent injury from flying debris or loose rigging. Observe the train as it passes so that you are prepared to take evasive action in the event of an emergency.
- In double track territory, never stand between tracks when a train is passing. This could place you in a precarious situation if another train suddenly appears on the other track. Never walk or stand on the track; rail surfaces can be extremely slippery and many rails in curves are lubricated. When you cross the rails, step over them.
- Maintain at least 20 ft distance from the rails when walking on the right-of-way. Never walk down the center of the track.

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- Be prepared for the movement of cars at any time — in either direction. Stay at least 50 ft away from the ends of cars when crossing the track. Never climb on, under, or between cars. Never rely solely on others to protect you from train movement — watch yourself.
- Stay away from remote-controlled switches. The switch points can move unexpectedly and with enough force to crush ballast rock! Stay away from any other devices you are unsure of.
- Avoid pole lines within the right-of-way. These lines may carry from 500 volts to 2700 volts. Depending on the terrain, sometimes these lines are located very close to the ground.
- Be careful when working around a derailment. Hazardous materials may be present, so check with the local railroad personnel before approaching.
- Equipment must never be moved across the tracks except at established road crossings and never moved across bridges or through tunnels.
- A 100-car train moving at 60 miles per hour can cover more than 1 mile to stop in the event of an emergency. Never judge the distance or speed of a train by its headlight.
- Never lay metal objects across the rails. This is a safety hazard.

Commentary Table I.12.3 describes risk-based tactical factors to consider as part of planning and implementation based on the type and extent of damage found and current incident conditions.

COMMENTARY TABLE I.12.3 *Tactical Considerations*

Damage	*Condition*	*Options*
Crack	Any cracks in tank's base metal	Reduce internal pressure Unload or transfer contents as soon as possible
	Note: Cracks in fillet welds are of little consequence	
Dent	Radius of curvature sharper 2 in. (post 1967); cold work, evidence of cracks, or crossing a weld	Reduce internal pressure Unload or transfer contents as soon as possible
	Radius of curvature not as sharp 2 in. (post 1967); cold work, evidence of cracks, or crossing a weld	Reduce internal pressure Upright and unload or transfer contents
	Other dents (undamaged)	Rerail and transport to nearest point to unload or transfer contents
Scores and gouges	Any scores and gouges crossing a weld with damage to the heat-affected zone	Reduce internal pressure Upright and unload or transfer contents
	Note: Longitudinal scores and gouges are of more concern than circumferential ones. Scores and gouges that cross a weld and remove only weld metal reinforcement or crown metal are not critical.	
Wheel burn	Less than 1/8 in. deep	Rerail and transport a short distance to unload or transfer contents
	Greater than 1/8 in. to 1/4 in. deep	Upright and unload or transfer contents without transport
	Greater than 1/4 in. deep	Reduce internal pressure immediately. Unload or transfer contents as soon as possible
Rail burn	Less than 1/8 in. deep	Rerail and transport a short distance to unload or transfer contents
	Greater than 1/8 in. deep	Upright and unload or transfer contents without transport

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12.4 Competencies — Implementing the Planned Response.

Most of the competencies in Section 12.4 require the demonstration of a task. These tasks require an in-depth knowledge of the tank car, its contents, and the specialized equipment needed to complete the task. Because these tasks must be done on actual tank cars, few training facilities are able to provide practical training and/or certification.

12.4.1 Implementing the Planned Response. Given an analysis of an incident involving tank cars and the planned response, technicians with a tank car specialty shall implement or oversee the implementation of the selected response options in a safe and effective manner and shall complete the following tasks:

The equipment and resources necessary for demonstrating the tasks in 12.4.1 are not readily available. Requests for training for the performance of these tasks should be directed to the local shipper, carrier, or contractor personnel in the community, possibly through the local emergency planning committee.

(1) Given a leaking manway cover plate (loose bolts), control the leak

The technician with a tank car specialty is required to demonstrate the ability to choose the appropriate tools and tighten the loose bolts on a leaking manway cover plate. This task should be performed using PPE appropriate for the material involved and for the working conditions.

(2) Given leaking packing on the following tank car fittings, control the leak:

(a) Gauging device packing nut

Note: Open gauging devices with a packing nut are no longer authorized for use on tank cars.

(b) Liquid or vapor valve packing nut

The technician with a tank car specialty is required by 12.4.1(2)(b) to choose the appropriate tools and tighten the liquid or vapor valve packing nuts or bolts, as appropriate for the specific make of valve. This task should be performed using PPE appropriate for the material involved and for the working conditions.

Things to remember about handling problems with valves and fittings — if open, close it; if loose, tighten it; if missing, replace it; if something else is wrong, talk to an allied professional.

(c) Top-operated bottom outlet valve packing gland

The technician with a tank car specialty is required by 12.4.1(2)(c) to choose the appropriate tools and tighten the packing gland on a top-operated bottom outlet valve, as appropriate for the specific make of valve. This task should be performed using PPE appropriate for the material involved and for the working conditions.

(3) Given an open bottom outlet valve with a defective gasket in the cap, control the leak

The technician with a tank car specialty is required by 12.4.1(3) to choose the appropriate tools, ensure that the bottom outlet valve is closed, and tighten the cap on a bottom outlet valve in a way

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appropriate for the specific make of valve. This task should be performed using PPE appropriate for the material involved and for the working conditions.

(4) Given a leaking top-operated bottom outlet valve, close valve completely to control the leak

The technician with a tank car specialty is required by 12.4.1(4) to close the top-operated bottom outlet valve in a way appropriate for the specific make of valve. This task should be performed using PPE appropriate for the material involved and for the working conditions.

(5) Given leaking fittings on a pressure tank car, repair the leak or use an applicable capping kit to control the leak

The technician with a tank car specialty is required by 12.4.1(5) to apply the capping kit to control a leaking combination pressure relief valve and leaking liquid and vapor valves on a chlorine tank car, following the instructions provided by the manufacturer of the capping kit or local standard operating procedures. This task should be performed using PPE appropriate for the material involved and for the working conditions.

(6) Given the following types of leaks on various types of tank cars, plug or patch those leaks:
   (a) Cracks, splits, or tears
   (b) Puncture

The technician with a tank car specialty is required by 12.4.1(6) to select and apply various methods of plugging and patching to control or stop leakage of the tank car's contents. This task should be performed using PPE appropriate for the material involved and for the working conditions.

(7) Given the following product transfer and recovery equipment demonstrate the safe and correct application and use of the following:
   (a) Portable pumps
   (b) Pressure differential
   (c) Vacuum

The technician with a tank car specialty is required by 12.4.1(7) to participate as a member of a team assigned to perform product removal. These tasks should be performed using PPE appropriate for the material involved and for the working conditions.

(8) Demonstrate the following types of product removal for tank cars:

The technician with a tank car specialty is required by 12.4.1(8) to perform these tasks in a manner appropriate to the rail equipment used. These tasks should be performed using PPE appropriate for the material involved and for the working conditions. The equipment and resources necessary for demonstrating these tasks are not readily available. Requests for training for the performance of these tasks should be directed to the railroad or shippers in the community, possibly through the local emergency planning committee.

   (a) Flaring of liquids and vapors
   (b) Transferring of liquids and vapors

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(c) Venting
(d) Venting vapors and neutralizing them through a scrubbing method

(9) Given the applicable resources, perform the following tasks:
(a) Set and release the hand brake on rail cars
(b) Shut off locomotives using the fuel shutoff and the battery disconnect
(c) Uncouple rail cars

(10)* Demonstrate grounding and bonding procedures for product transfer from tank cars, including the following:
(a) Selection of equipment
(b) Establishment of ground field
(c) Sequence of grounding and bonding connections
(d) Testing of ground field and grounding and bonding connections

A.12.4.1(10) When grounding and bonding are performed, a ground resistance tester and an ohmmeter should be used. The ground resistance tester measures the earth's resistance to a ground rod, and the ohmmeter measures the resistance of the connections to ensure electrical continuity. One ground rod might not be enough; more might have to be driven and connected to the first to ensure a good ground. Resistance varies with types of soils

Using the appropriate equipment, the technician with a tank car specialty should be able to verify the following:

- Ground rod resistance to earth
- Connections between ground rod and tank car and receiving container(s)
- Connections between ground rod(s) and main ground rod(s) and ground cable(s)

Local procedures for the tasks in 12.4.1(10) should be written and consistent with nationally accepted practices. The technician with a tank car specialty is required to participate as a member of a team assigned to set up bonding and grounding for the transfer of tank cars. These tasks should be performed using PPE appropriate for the material involved and for the working conditions.

N 12.5 Competencies — Evaluating Progress. (Reserved)

N 12.6 Competencies — Terminating the Incident. (Reserved)

References Cited in Commentary

1. *Field Guide to Tank Cars*, 3rd Edition, Association of American Railroads, 2017.
2. Title 29, Code of Federal Regulations, Part 1910.120, U.S. Government Publishing Office, Washington, DC.

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Additional References

"Damage Assessment of Tank Cars Involved in Accidents," Transportation Technology Center, Association of American Railroads for Federal Railroad Administration, Office of Research and Development, 1999.

"Field Product Removal Methods for Tank Cars," Transportation Test (Technology) Center, Association of American Railroads for the Federal Railroad Administration, Office of Research and Development, 1995.

Cote, Arthur E., Editor, *Fire Protection Handbook*, 20th ed., National Fire Protection Association, Quincy, MA, 2008.

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Competencies for Hazardous Materials Technicians with a Cargo Tank Specialty

13

This chapter specifies the competencies required of hazardous materials technicians with an intermodal tank specialty when responding to incidents involving intermodal tanks.

The first truck to travel coast to coast across the United States was a Sauger, a Swiss-built truck that traveled from Los Angeles to New York in 1911. Less than 50 years later, the government began to invest heavily in a national network of interstates. The highways and trucking industry have become essential to the U.S. supply chain and have remade the country's social and economic landscape. Manufacturers now treat interstate highways as if they are part of the assembly line, clustering factories near the access ramps so that parts and raw materials can arrive at the right moment. It is in this complex world of pavement, interchanges, and traffic that the hazardous materials technician with a cargo tank specialty must learn to conduct operations safely.

13.1 General.

13.1.1 Introduction.

13.1.1.1 The hazardous materials technician with a cargo tank specialty shall be that person who provides technical support pertaining to cargo tanks, provides oversight for product removal and movement of damaged cargo tanks, and acts as a liaison between technicians and outside resources.

Allied professional and specialized employees, including shippers, carriers, cargo tank builders and their repair personnel, and environmental contractors, can assist in aspects of cargo tank response.

Δ **13.1.1.2** The hazardous materials technician with a cargo tank specialty shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all competencies at the technician level *(see Chapter 7)*, and all competencies of this chapter.

Hazardous materials technician with a tank car specialty, hazardous materials technician with a cargo tank specialty, and hazardous materials technician with an intermodal tank specialty are levels that are above the Occupational Health and Safety Administration's (OSHA) technician and specialist levels and are not defined by the present OSHA regulations Title 29 CFR Part 1910.120 [1].

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Commentary Table I.1.1 in Part I of this handbook offers a comparison of the various levels described by NFPA and OSHA. Responders with the cargo tank specialty are required by 13.1.1.2 to demonstrate competency in performing these tasks. See the competency requirements in 13.4.1(7) for an example.

13.1.1.3 Hazardous materials technicians with a cargo tank specialty shall also receive training to meet governmental response and occupational health and safety regulations.

13.1.2 Goal.

13.1.2.1 The goal of competencies in this chapter shall be to provide the technician with a cargo tank specialty with the knowledge and skills to perform the tasks in 13.1.2.2 in a safe manner.

13.1.2.2 When responding to hazardous materials/WMD incidents, the hazardous materials technician with a cargo tank specialty shall be able to perform the following tasks:

(1) Analyze a hazardous materials/WMD incident involving cargo tanks to determine the complexity of the problem and potential outcomes by completing the following tasks:
   (a) Determine the type and extent of damage to cargo tanks
   (b) Predict the likely behavior of cargo tanks and their contents during an incident
(2) Plan a response for an incident involving cargo tanks within the capabilities and competencies of available personnel, personal protective equipment (PPE), and control equipment by determining the response options (offensive, defensive, or nonintervention) for a hazardous materials/WMD incident involving cargo tanks
(3) Implement or oversee the implementation of the planned response to a hazardous materials/WMD incident involving cargo tanks

13.1.3* 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.

A.13.1.3 Technicians operating within the bounds of their training as listed in Chapter 7 are able to intervene in cargo tank incidents. However, if a hazardous materials response team decides to train some or all of the technicians to have in-depth knowledge of cargo tanks, this chapter sets out the required competencies.

The committee wanted to make clear that existing and new responders at the hazardous materials technician level can still perform the operations on cargo tanks for which they have been qualified. This specialty level covers those highly technical skills and knowledge rarely needed except at major incidents. For example, the skills required by the competency in Section 13.4 are skills that the technician normally does not possess. A hazardous materials response team might have a few members trained to this level in accordance with 13.1.3.2, or a request can be made to the shipper, carrier, or an environmental contractor to provide a qualified individual with this specialty at the incident scene.

Programs covering these competencies are in place at a number of hazardous materials training centers, including the Association of American Railroads' Security and Emergency Response Training Center, the California Specialized Training Institute, Texas A&M, and others.

The committee also wants to be clear that this specialty level is not mandated for any hazardous materials response team or its members. Arrangements to request assistance to perform these operations are perfectly appropriate in these situations.

13.1.3.1 Hazardous materials technicians operating within the scope of their training as listed in Chapter 7 shall be able to intervene in cargo tank incidents.

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13.1.3.2 If a hazardous materials response team elects to train some or all of its hazardous materials technicians to have in-depth knowledge of cargo 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 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 complete the following tasks:

(1) Given the specification mark for a cargo tank and the reference materials, describe the tank's basic construction and features

In NFPA 472, cargo tank trucks are grouped into the following six categories:

1. MC-306/DOT-406 cargo tanks
2. MC-307/DOT-407 cargo tanks
3. MC-312/DOT-412 cargo tanks
4. MC-331 cargo tanks
5. MC-338 cargo tanks
6. CGA-341 cargo tanks

MC-306/DOT-406 cargo tanks are commonly used to transport liquid petroleum products at atmospheric pressures. Since 1995, all cargo tanks in this service must be built to the DOT-406 specification. These are nonpressurized (atmospheric pressure) tanks, with maximum working pressures of 3 psi to 5 psi (21 kPa to 34 kPa). Most of these cargo tanks are not insulated and have a capacity between 7500 gal and 10,000 gal (28,387 L and 37,850 L). MC-306/DOT-406 is found in 49 CFR Part 178 [2]. See Exhibit I.13.1.

EXHIBIT I.13.1

This is an example of a typical DOT-406 nonpressure cargo truck. (Courtesy of Charlie Wright)

MC-307/DOT-407 cargo tanks are commonly used to transport flammable and combustible liquids, mild corrosives, and chemicals with a vapor pressure of 18 psi (124 kPa) at 100°F (37.8°C) or greater but not more than 40 psi (276 kPa) at 170°F (76.7°C). Since 1995, all cargo tanks in this service must be built to the DOT-407 specification. Tank capacities range up to 7000 gal (26,495 L). MC-307/DOT-407 is found in 49 CFR 178 [2]. See Exhibit I.13.2.

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EXHIBIT I.13.2

This is an example of a typical DOT 407 cargo truck. (Courtesy of Charlie Wright)

MC-312/DOT-412 cargo tanks are commonly used to transport high-density liquids and strong corrosives, such as nitric and sulfuric acid. Since 1995, all cargo tanks in this service must be built to the DOT-412 specification. Tank design pressures range from 35 psi to 50 psi (241 kPa to 345 kPa), with maximum capacities of approximately 5000 gal to 6000 gal (18,925 L to 22710 L). MC-312/DOT-412 is found in 49 CFR 178 [2]. See Exhibit I.13.3.

EXHIBIT I.13.3

This is an example of a DOT 412 cargo truck. (Courtesy of Charlie Wright)

MC-331 cargo tanks are pressurized containers commonly used for the transportation of liquefied and compressed gases (MC-331 is available in 49 CFR 178 [2]). Design pressures range from 100 psi to 500 psi (690 kPa to 3448 kPa) with capacities ranging from 2500 gal to 11,500 gal (9463 L to 43, 528 L). See Exhibit I.13.4.

MC-338 cargo tanks are commonly used to transport cryogenic liquids such as liquid nitrogen and liquid helium. These are a tank-within-a-tank design with a typical working pressure of 100 psig (690 kPa). Inner tank pressures can range from 235 psi to 500 psi (162 kPa to 3448 kPa), depending on the product being transported. Tank capacities range from 5000 to 14,000 gal (18,925 L to 52,990 L). MC-338 is found in 49 CFR 178 [2].

CGA-341 cargo tanks are commonly used to transport nonflammable cryogenic liquids. They resemble an oversized thermos bottle that includes an internal tank within an outer jacket with insulation contained in the annular space. These cargo tanks may transport nonflammable cryogenic liquids such as argon, helium, nitrogen, and oxygen at pressures below 25.3 psig (174 kPa). They are allowed in 49 CFR 173 [3]. See Exhibit I.13.5 for a typical specification plate on a CGA-341 cargo tank.

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EXHIBIT I.13.4

This is an example of an MC-331 cargo tank. (Courtesy of Charlie Wright)

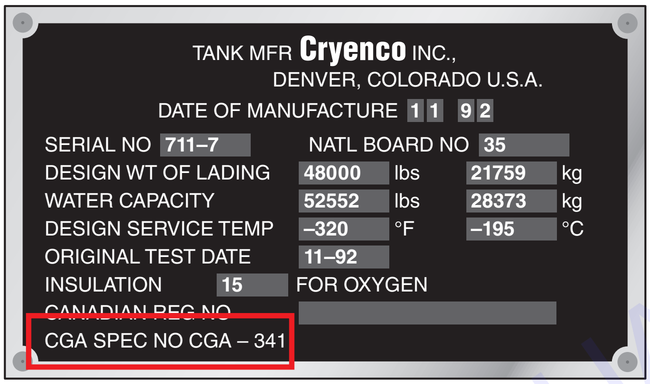

EXHIBIT I.13.5

This is an example of a CGA-341 cargo tank specification plate.

Under federal law, a cargo tank constructed to U.S. Department of Transportation (DOT) specifications must have a certification plate mounted on the cargo tank. On truck and trailer units, the certification plate is mounted on the left front of the tank. Tanks constructed prior to 1985 have the specification plate mounted on the right front of the tank. See Exhibit I.13.6.

The certification plate provides the DOT container specification number, date of manufacture and test, shell material, container pressure ratings, number of compartments and their capacity, and maximum product load.

Some cargo tanks are designed to multiple container specifications, which allow them to transport more than one commodity. Common multipurpose configurations are the combination MC-306/DOT-406/MC-307/DOT-407 unit and the MC-307/DOT-407/MC-312/DOT-412 unit.

EXHIBIT I.13.6

This is an example of a typical specification plate found on cargo tanks. (Courtesy of Charlie Wright)

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In addition to the manufacturer's specification plate, these cargo tanks have a second multipurpose plate that identifies the specification under which the cargo tank is operated. These plates are color-coded, as are the fittings that are added to make the cargo tank meet the respective specifications. Color codes are as follows:

- MC-306/DOT-406 plate and fittings = red
- MC-307/DOT-407 plate and fittings = green
- MC-312/DOT-412 plate and fittings = yellow
- Nonspecification (noncode) cargo tank = blue

(2) Given examples of cargo tanks (jacketed and not jacketed), identify the jacketed cargo tanks

Jacketed cargo tanks can be recognized by one or more of the following visual indicators:

- Flat appearance of cargo tank ends
- MC-307/DOT-407 cargo tanks with oval, noncircular shape
- Lightweight, bright or shiny aluminum outer jacket on MC-307/DOT-407 or MC-312/DOT-412 cargo tanks
- Rough, relatively narrow welds

(3) Given examples of the following types of cargo tank damage, identify the type of damage in each example:

(a) Corrosion (internal and external)

Corrosion is pitting of the tank metal, thus reducing the thickness and possibly the strength of the tank metal.

(b) Crack

A crack is a narrow split or break in the container metal that could penetrate the metal of the container. Cracks are typically associated with dents or other mechanical stresses and can cause failure because they can grow under stress.

(c) Dent

A dent is a deformation of the container metal caused by impact with a relatively blunt object. When a sharp radius of curvature is associated with the dent, the possibility of cracking exists.

(d) Flame impingement

Flame impingement is fire in direct contact with the surface of the tank, either in the liquid space or in the vapor space.

(e) Puncture

A puncture is a hole in the tank.

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(f) Scrape, score, gouge, or loss of metal

A score is a reduction in the thickness of the container shell. This damage 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.

A gouge is a reduction in the thickness of the container. This damage 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.

A scrape is a deformation in the shell of a cargo tank. This damage is a long dent that is inherently flat and generally caused by a container overturning and sliding some distance along an adjacent hard surface.

(4) Given examples of damage to an MC-331 cargo tank, determine the extent of damage to the heat-affected zone

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.

(5)* Given an MC-331 cargo tank containing a compressed liquefied gas, determine the amount of liquid in the tank

A.13.2.1(5) See A.12.2.1(15).

MC-331 measuring devices include the following:

- Magnetic float gauge with a rotary dial or roto-gauge that indicates quantity, by percentage, loaded in the tank
- Fixed-level gauge that indicates the specific quantity (See Exhibit I.13.7.)

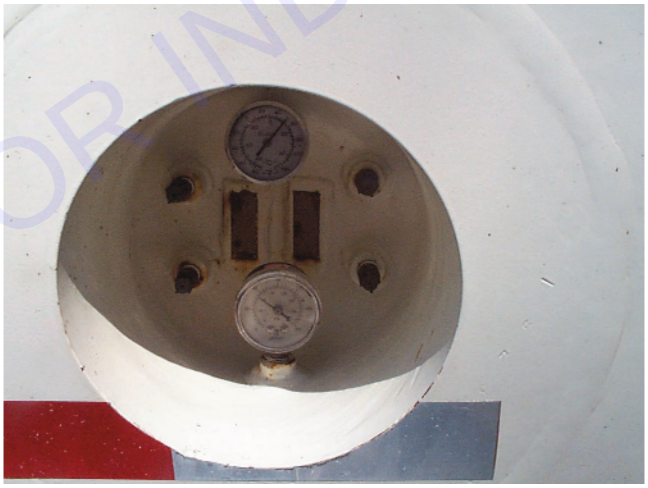

EXHIBIT I.13.7

This is an example of typical gauging devices found on MC-331 cargo tanks. (Courtesy of Charlie Wright)

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(6) Given MC-306/DOT-406, MC-307/DOT-407, and MC-312/DOT-412 cargo tanks, identify and describe the design, construction, and operation of each of the following safety devices:

(a) Dome cover design

EXHIBIT I.13.8

These are examples of an MC306/DOT406 dome cover. (Courtesy of Charlie Wright)

Dome cover and manhole assembly designs vary with the type of liquid cargo tank (e.g., MC-306/DOT-406 versus MC-312/DOT-412). Each compartment generally has one dome cover; however, in some instances a compartment can have more than one dome cover. Manhole assemblies for MC-306/DOT-406 cargo tanks usually incorporate other devices, such as the dome cover opening, fusible plug, and overfill sensor. (See Exhibit I.13.8.)

(b) Emergency remote shutoff device

Emergency remote shutoff devices, when actuated, automatically close all internal stop valves. The devices are primarily designed for use during product transfer operations when personnel cannot safely reach the discharge outlets and controls. These devices are normally found at the left front of the cargo tank and can, in some instances, also be found at the right front or right rear. See Exhibit I.13.9 for an example.

EXHIBIT I.13.9

This is an example of an emergency remote shutoff device on an MC-331 cargo tank. (Courtesy of Charlie Wright)

(c) Internal stop valve or external valve with accident protection, including method of activation (pneumatic, mechanical, and hydraulic)

Internal stop valves sit inside the tank and are in the closed position during transport to protect the valve against mechanical stress and accident damage. They are commonly found on MC-306/DOT-406 and MC-307/DOT-407 cargo tanks. Internal stop valves may be found on some MC-312/DOT-412 cargo tanks, but most of those tanks are top loaded. External valves with damage protection sit outside the tank and are surrounded with a metal framing to protect the valve against mechanical stress and accident damage.

Both internal stop valves and external valves are activated by pneumatic, mechanical, or hydraulic means and may be activated by the emergency remote shutoff device. Some cargo tanks equipped with mechanical (cable) operated valves are equipped with fusible links or nuts. In the event of a fire in or around a cargo tank, fusible links or nut assemblies will melt, releasing cable tension or air pressure and allowing the internal safety valve to close automatically.

All internal stop valves rely on air pressure, hydraulic pressure, or mechanical force to place the valve in the open position. If this pressure or force is removed, the internal safety valve closes automatically.

Emergency methods for activating the internal safety valve include use of the emergency remote shutoff device(s) and the activation of fusible devices in a fire situation. In a rollover situation, internal safety valves can also be opened manually; the method of activation varies with the type of valve and its method of actuation.

Exhibit I.13.10(a) shows an example of an external stop valve that is pneumatically actuated. Notice the shear groove in the valve just below the bolted flange. Exhibit I.13.10(b) shows an example of a hydraulically operated emergency remote shutoff.

(d) Pressure and vacuum relief protection devices

Common pressure relief devices include relief valves, breather vents, fusible plugs and caps, frangible discs, and pressure vents. Vacuum relief protection is designed to protect the integrity of the tank container during offloading operations. See Exhibit I.13.11.

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EXHIBIT I.13.10

(a) (b)

These are two examples of shutoff devices: (a) DOT-406 shear internal valve protection, and (b) DOT-407 hydraulic emergency shutoff. (Courtesy of Charlie Wright)

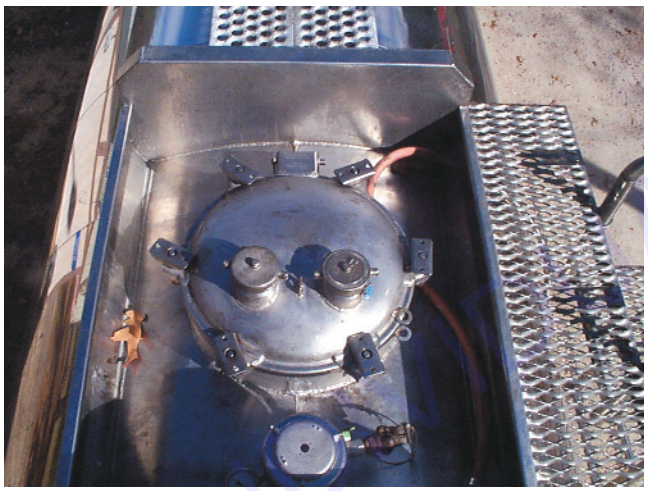

EXHIBIT I.13.11

This is an example of a typical DOT 407 cargo tank showing the combination pressure and vacuum relief device in the lower center of the image. (Courtesy of Charlie Wright)

(e) Shear-type breakaway valves and piping

Internal safety valves have a “shear cut” section of piping, within 4 in. (102 mm) of the tank shell, designed to break under mechanical stress. This shear cut reduces the thickness of the piping by about 20 percent. If an accident causes stress at the shear point, the piping should fail at the shear point while the internal valve remains intact within the compartment.

(f) Fusible caps, plugs, links, and nuts

(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) Emergency remote shutoff device

See the commentary following 13.2.1(6)(b).

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(b) Excess flow valve

Excess flow valves are designed to shut off the flow of product almost completely when the discharge valve is sheared off and/or the flow rate increases.

(c) Fusible link and nut assemblies

EXHIBIT I.13.12

This is an example of a fusible link assembly. (Courtesy of Charlie Wright)

In the event of a fire in or around a cargo tank, fusible links or nut assemblies will melt, releasing cable tension or air pressure and allowing the internal safety valve to close automatically. Fusible devices are required to actuate at temperatures not greater than 250°F (120°C). See Exhibit I.13.12 for an example of the fusible link and nut assemblies on a MC-331 cargo tank.

(d) Internal self-closing stop valve or external valve with accident protection, including method of activation (pneumatic, cable, and hydraulic)

See the commentary following 13.2.1(6)(c).

(e) Pressure relief protection devices

MC-331 cargo tanks are protected with spring-loaded pressure relief devices located along the top centerline of the container. MC-338 cargo tanks are a tank-within-a-tank design and have relief protection for both the inner and outer tanks. A combination of spring-loaded pressure relief devices and rupture discs is used.

(8) Given an MC-306/DOT-406 cargo tank, identify and describe the following normal methods of loading and unloading:
(a) Bottom loading

Bottom loading is the most frequently used method for the transfer of flammable liquids, including gasoline. Product is loaded into each compartment through its respective bottom discharge piping and internal safety valve.

(b) Top loading

Top loading is used primarily for the transfer of combustible liquids and low vapor pressure products (e.g., fuel oil), especially in rural areas. A fill stem tube is inserted into each compartment via the dome cover and the product is then transferred.

(c) Vapor recovery system

Vapor recovery systems are used to collect the product vapors generated as part of the transfer process. Each compartment has a vent connected to the vapor recovery piping system. These vents are connected either mechanically or pneumatically to each compartment's internal safety valve. When the internal valve is opened, the vent also opens automatically. This action provides both vacuum and pressure protection during transfer operations. Vapor recovery piping and connections are often marked by an orange color code.

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(d) Tank monitoring (Scully)

The Scully system is a system used at loading racks to prevent overfilling.

(9) Given the following types of cargo tank and tube trailers, 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

This includes CGA-341 cargo tanks.

(e) Compressed gas tube trailer
(f) Noncode trailers

This includes nonspecification cargo tanks.

(10) Describe the normal and emergency methods of activation for the following types of cargo tank valve systems:

All internal safety valves rely on air pressure, hydraulic pressure, or mechanical force to place the valve in the open position. If this pressure or force is removed, the internal stop valve closes automatically.

Emergency methods for activating the internal stop valve include use of the emergency remote shutoff device(s) and the activation of fusible devices in a fire situation. In a rollover situation, internal stop valves can also be opened manually; the method of activation varies with the type of valve and its method of actuation.

(a) Pneumatic

Air-activated valves are found on all types of cargo tanks. On some cargo tanks, normal activation of the internal stop valves might be a two-step process comprising the opening of a master air control valve and the opening of the respective compartment.

Pneumatically actuated valves are on MC-307/DOT-407 and MC-312/DOT-412 cargo tanks. A pneumatic control unit is near the discharge valves. To actuate the internal valve, the operator must increase the pneumatic system pressure using supplied air and open the respective internal stop valve. If pneumatic pressure is lost, the internal safety valve(s) closes automatically.

(b) Mechanical

Cable-actuated valves are found on all types of cargo tanks. Activation of a control handle moves the respective internal safety valve. If tension is released on the cable, such as when a fusible device is actuated, the internal safety valve automatically closes. A secondary safeguard found on MC-306/DOT-406 cargo tanks with cable-actuated systems is to close the compartment door on the right side of the tank where all internal valve controls are located. When the door is pushed closed, all internal stop control valve handles are forced to the vertical, or closed, position.

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(c) Hydraulic

Hydraulic-actuated valves are found on MC-307/DOT-407 and MC-312/DOT-412 cargo tanks. A hydraulic control unit is situated near the discharge valves. To actuate the internal valve, the operator must increase the hydraulic system pressure using a hand pump and open the respective internal safety valve. If hydraulic pressure is lost, the internal stop valve(s) closes automatically.

(11) Given a cargo tank involved in an incident, identify the factors to be evaluated as part of the cargo tank damage assessment process, including the following:
  (a) Amount of product released and amount remaining in the cargo tank
  (b) Stress applied to the cargo tank
  (c) Nature of the incident (e.g., rollover, vehicle accident, struck by object)
  (d) Number of compartments
  (e) Pressurized or nonpressurized
  (f) Type and nature of tank damage (e.g., puncture, dome cover leak, valve failure)
  (g) Type of cargo tank (MC, DOT, noncode specification)
  (h) Material of construction (e.g., aluminum, steel, composites)

13.2.2 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 complete the following tasks:

(1) Given the following types of cargo tanks, describe the likely breach and 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

This includes CGA-341 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

MC-306/DOT-406 cargo tanks are commonly constructed of aluminum, although MC-305 steel and stainless steel tanks built prior to 1967 can occasionally be found. In some areas, MC-306/DOT-406 cargo tanks made from fiberglass-reinforced plastic (FRP) have also been tested.

MC-307/DOT-407 cargo tanks can be constructed of steel, aluminum, stainless steel, titanium, Hastelloy C, and related alloys. Most MC-307/DOT-407 cargo tanks are then insulated with fiberglass and covered by a stainless steel jacket.

MC-312/DOT-412 cargo tanks can be constructed of steel, aluminum, stainless steel, titanium, or Hastelloy C. The tanks can also be constructed of FRP under an exemption. In some instances, the tank can be lined with a material (e.g., rubber, plastic) that is suitable to protect the tank against chemical attack.

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MC-331 cargo tanks are constructed of mild steel — nonquenched tempered (NQT) or high-tensile steel — quenched and tempered (QT).

MC-338 cargo tanks are a tank-within-a-tank design similar to a thermos bottle. The inner tank is typically constructed of special steel alloys compatible with the product to be transported and capable of withstanding extremely cold temperatures. The outer container is typically steel. The space surrounding the entire inner tank is evacuated of atmosphere and insulated with a multilayered Mylar™ film.

Compressed gas tube trailers consist of a group of stainless steel cylinders, 9 in. to 48 in. (229 mm to 1219 mm) in diameter, permanently mounted on a semitrailer.

(3) Describe the significance of the cargo tank jacket in assessing tank damage

An undamaged jacket can serve as a heat shield from radiated heat. Also, the jacket is not designed to hold the product, so mechanical damage to the jacket might not indicate the extent of damage to the tank itself.

(4) Describe the significance of each of the following types of damage on cargo tanks during damage assessment:

(a) Corrosion (internal and external)

Corrosion is pitting of the tank metal, thus reducing the thickness and, possibly, the strength of the tank metal.

(b) Crack

It is difficult to determine when a crack in a tank is critical, so accurate and timely decisions about a tank's condition must be made. The following guidelines can be helpful:

- Any crack found in a tank, no matter how small, is deemed critical and may require immediate action.
- Cracks in conjunction with a dent, score, or gouge are deemed critical and may require immediate action before movement of the cargo tank.
- The potential for a pressure increase within the cargo tank should be evaluated.

(c) Dent

Sharp dents in the shell of the cargo tank are the most serious; they can reduce the strength of the tank significantly. Dents should be evaluated using the following guidelines:

1. Dents with a sharp radius can develop cracks. Cracks usually develop on the convex side of a dent, usually inside the cargo tank where they cannot be readily detected.
2. Sharp dents in a cargo tank shell can significantly reduce the strength of a tank.
3. Cargo tanks with dents require additional evaluation if the following conditions exist:
   a. Presence of a crack within the dent
   b. Evidence of the dent crossing a weld
   c. Presence of a score or gouge
   d. Evidence of cold work

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(d) Flame impingement

The following points should be noted when evaluating flame impingement:

- If the tank also is weakened due to mechanical stress, the increase of internal pressure created by the thermal stress of flame impingement could overstress the tank and cause tank failure.
- Applying cooling water streams on the outer shell of an MC-338 cryogenic liquid cargo tank is ineffective because of the tank's heavy insulation. In addition, water might freeze and block pressure relief devices [4].

(e) Puncture

(f) Scrape, score, gouge, or other reduction in tank shell thickness

Using the depth of the indentation as a guideline, scores and gouges are evaluated in the following manner:

- Longitudinal scores are of greatest concern; however, circumferential (hoop) scores must be evaluated as well.
- Scores or gouges crossing a weld with removal of the crown metal only are not critical to the strength of the tank.
- Longitudinal scores or gouges that cross a weld and damage the heat-affected zone are potentially critical and require additional evaluation.

(5) Given examples of damage to the heat-affected zone on an MC-331 cargo tank, describe its significance

Because of this change in composition in the tank metal, the ductility of the steel in this heat-affected zone is reduced. The heat-affected zone is a likely origin for cracks.

13.3 Competencies — Planning the Response.

In Chapter 7, the hazardous material technician is required to identify appropriate response objectives (nonintervention, defensive, or offensive) for responders at that level. While the hazardous materials technician can stabilize an incident until industrial specialists arrive for final and complete mitigation, the technician with a cargo tank specialty can assist with or perform the highly technical, inherently dangerous, and offensive operations that lead to final mitigation of the incident, including the following tasks:

Note: Because most of these operations are rarely done at an actual incident, the technician with a cargo tank specialty should give a detailed briefing to the hazardous materials branch safety officer, branch officer, and the incident commander on the planned operations before staffing any operations.

1. Plan the operation as follows:
   a. Prepare a plan for setup, implementation, and termination of the operation.
   b. Develop and acquire the equipment necessary for the selected operation.
   c. Prepare a site safety plan.
2. Set up the operation as follows:
   a. Hold a safety briefing.
   b. Position the resources and equipment.
   c. Set up and activate the emergency shutoff system, if appropriate.

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3. Purge the liquid/vapor transfer hoses and test for leaks.
4. Implement product transfer and recovery operations as follows:
   a. Terminate product transfer and recovery operations.
   b. Purge the hoses and/or piping.
   c. Disassemble and decontaminate the equipment.
   d. Secure the cargo tank.
5. Implement uprighting operations.
6. Determine disposition of the cargo tank and prepare for transportation.

13.3.1 Determining the Response Options. Given the analysis of an incident involving cargo tanks, technicians with a cargo tank specialty shall determine the response options for each cargo tank involved and shall complete the following tasks:

(1) Given an incident involving a cargo tank, describe the methods, procedures, risks, safety precautions, and equipment required to implement spill and leak control procedures

The competency in 13.3.1(1) builds on the competencies of the hazardous materials technician.

The product removal methods in 13.3.1(1) are outside the legitimate responsibility of the local emergency response personnel. However, oversight of their planning and implementation is within the responsibilities of local emergency response agencies. Product removal procedures should be established in advance based on current industry standards and recommended practice. Only essential personnel — outlined, in most cases, in the overall incident management system of the hazardous materials branch — should be involved in the process.

(2) Given an overturned cargo tank, describe the factors to be evaluated for uprighting the overturned tank, including the following:

Attempts to upright an MC-306/DOT-406 cargo tank should be performed after offloading the tank to the maximum extent possible. For other types of cargo tanks, a detailed hazard and risk assessment should be conducted. Evaluation criteria are outlined in 13.3.1(2).

(a) Condition and weight of the cargo tank
(b) Lifting capabilities of wreckers and cranes
(c) Preferred lifting points
(d) Selection of lifting straps and air bags
(e) Site safety precautions
(f) Type and nature of stress applied to the cargo tank
(g) Type of cargo tank and material of construction

13.4 Competencies — Implementing the Planned Response.

13.4.1 Implementing the Planned Response. Given an analysis of an incident involving a cargo tank and the planned response, technicians with a cargo tank specialty shall implement or oversee the implementation of the selected response in a safe and effective manner and shall complete the following tasks:

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The equipment and resources necessary for demonstrating the tasks in 13.4.1 might not be available. Requests for training for the performance of these tasks should be directed to the local shipper, carrier, or contractor personnel in the community, possibly through the local emergency planning committee.

(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) Dome cover leak
  (b) Pressure relief devices (e.g., vents, rupture disc)
  (c) Puncture
  (d) Split or tear
  (e) Valves and piping

(2) Describe the methods for containing the following leaks in MC-331 and MC-338 cargo tanks:

The technician with a cargo tank specialty is required by 13.4.1(2) to evaluate tactical options and provide an appropriate method to control the release of contents. The technician with a cargo tank specialty should also describe the appropriate personal protective equipment (PPE) required for the material involved.

  (a) Crack
  (b) Failure of pressure relief device (e.g., relief valve, rupture disc)
  (c) Valves and piping
  (d) Puncture
  (e) Split or tear

(3)* Demonstrate grounding and bonding procedures for product transfer from cargo tanks, including the following:

A.13.4.1(3) See A.12.4.1(10).

Local procedures for the tasks in 13.4.1(3) should be written out and consistent with NFPA 77, *Recommended Practice on Static Electricity* [5]. The technician with a cargo tank specialty is required to participate as a member of a team assigned to set up bonding and grounding for the transfer of product from a cargo tank. These tasks should be performed using appropriate PPE for the material involved and for the working conditions.

  (a) Selection of equipment
  (b) Establishment of ground field
  (c) Sequence of grounding and bonding connections
  (d) Testing of ground field and grounding and bonding connections

A ground resistance test meter and an ohmmeter should be used when testing the bonding and grounding system. The ground resistance tester measures the earth's resistance to a ground rod, and the ohmmeter measures the resistance of the connections to ensure electrical continuity. One ground rod might not be enough; more might have to be driven and connected to the first to ensure a good ground. Resistance varies with types of soils. The technician with a cargo tank truck specialty should be able to verify (using the appropriate equipment) the following:

- Ground rod resistance to earth
- Connections between ground rod and cargo tank and receiving container(s)
- Connections between ground rod(s) and main ground rod(s) and ground cable(s)

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(4) Given the following product transfer and recovery equipment, demonstrate the safe application and use of each:

The purpose of transferring liquids and gases is often associated with removal from a damaged or potentially damaged containment vessel to one that is undamaged. The equipment varies with the type of vessel involved and the hazardous material being transferred. Transfer procedures are generally established in advance by good industry practice. Only essential personnel — in most cases, those who are outlined in the overall incident management system of the hazardous materials branch — should be involved in the process. A transfer is the movement of the contents of a damaged or overloaded cargo tank into a receiving tank (e.g., a tank car, cargo tank, intermodal tank, or fixed tank).

In highway transportation, transfers can be used when any of the following conditions exist:

- Site conditions that prevent uprighting the damaged cargo tank (e.g., the terrain does not permit use of cranes).
- Damage to leaking valves and fittings cannot be repaired.
- The tank is sound but cannot be moved safely.
- The cargo tank has been damaged to the extent that it cannot be uprighted safely.

Generally, cargo tank transfers should be performed only when the following conditions exist:

- Site safety precautions are in place.
- Delayed container rupture is not likely.
- Required valves are accessible and functioning.
- The tank is in a position that allows for the transfer.
- An appropriate receiving tank is available.
- The transfer equipment is available.
- Experienced personnel are on-site to perform the transfer.
- All ignition sources are removed and/or controlled.
- Appropriate PPE is used.

(a) Portable pumps (air, electrical, gasoline, and diesel)

The product removal method in 13.4.1(4)(a) uses a liquid pump to move the contents of a damaged or overloaded cargo tank into a receiving tank (e.g., a tank car, cargo tank, or portable tank). The material in the damaged or overloaded cargo tank is then pumped into the receiving tank. The use of a liquid pump does not increase the pressure in the damaged cargo tank. However, if another means of creating positive pressure differential is used, a pressure increase could occur.

In evaluating the use of portable and power-takeoff (PTO) driven pumps, consideration should be given to the following factors:

- Materials of construction. Although not as critical with hydrocarbon products, the pump and associated hoses, valves, and gaskets must be compatible with the product(s) involved. Product contamination might also be a concern.
- Power rating and pressure capacity of the pump, including lift and flow capabilities.
- Energy source and sparking potential of the pump.
- Grounding and bonding requirements.

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(b) Compressors or compressed gas

Several options for accomplishing a pressure transfer include the following:

- Compressed air or an inert gas product removal method
- Vapor pressure (with or without flaring) product removal method
- Vapor compressor product removal method
- Vapor compressor and a liquid pump product removal method

The compressed air or an inert gas product removal method uses a compressed gas (e.g., nitrogen or carbon dioxide) to move the contents of a damaged or overloaded cargo tank into a receiving tank (e.g., a tank car, cargo tank, or portable tank). The compressed gas creates a positive pressure differential in the damaged cargo tank that pushes the liquid into the receiving tank. Vapor from the receiving tank might have to be vented to the atmosphere or scrubbed. The use of the compressed gas results in a pressure increase in the damaged cargo tank. This transfer method should be used only when an increase in pressure in the damaged cargo tank is acceptable. The shipper should be consulted to determine the compatibility of the compressed gas to be used.

The vapor pressure (with or without flaring) product removal method uses the material's own vapor pressure to move the contents of a damaged or overloaded cargo tank into a receiving tank (e.g., a tank car, cargo tank, or portable tank). In addition, a vapor flare maintains the necessary positive pressure differential between the damaged or overloaded cargo tank and the receiving tank by burning off vapors in the receiving tank at the outlet of a flare pipe. The pressure in the receiving tank is kept as low as possible.

The vapor compressor product removal method uses a vapor compressor to move the contents of a damaged or overloaded pressurized cargo tank (e.g., MC-331, MC-338) into a receiving tank (e.g., a tank car, cargo tank, or portable tank). The vapor compressor pulls the vapors from the receiving tank, compresses them, and forces them into the damaged cargo tank. The higher pressure in the damaged cargo tank pushes the liquefied gas into the receiving tank. The use of the vapor compressor results in a pressure increase in the damaged cargo tank. The vapor compressor transfer method should be used only when an increase in pressure in the damaged cargo tank is acceptable.

The vapor compressor and a liquid pump product removal method uses a vapor compressor and a liquid pump to move the contents of a damaged or overloaded pressurized cargo tank (e.g., MC-331, MC-338) into a receiving tank (e.g., a tank car, cargo tank, or portable tank). The vapor compressor is used to accelerate the rate of transfer by withdrawing vapors from the receiving tank, compressing them, and forcing them into the damaged cargo tank. The higher pressure in the damaged cargo tank pushes the liquefied gas into the pump. The use of the vapor compressor results in a pressure increase in the damaged cargo tank. This transfer method should be used only when an increase in pressure in the damaged cargo tank is acceptable. This method is justified when the receiving tank is at a greater distance from the damaged or overloaded cargo tank or when there is significant elevation differences between containers.

(c) Vacuum trucks

Vacuum trucks are an efficient and expeditious tool for recovering flammable and combustible liquids. However, the vacuum truck is not inherently safe because the air surrounding the vacuum pump exhaust can become saturated with flammable vapors.

To minimize this flammability hazard, the following safety procedures should be used:

- The compatible vacuum truck for the product should be located upwind of any transfer point.
- An exhaust hose of sufficient length should be used to direct the flammable vapors to an area free of hazards and personnel, considering wind direction and velocity, terrain, exposures, and so forth.

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- Continuous air monitoring of the area should be conducted.
- The materials being loaded should be confirmed to be compatible with materials previously loaded and to ensure that mixing does not present a hazard.
- Adequate venting must be provided.
- Additional information on vacuum trucks can be found in API 2219, *Safe Operation of Vacuum Trucks in Petroleum Service* [6].

(d) Vehicles with power-takeoff (PTO) driven pumps

See the commentary for 13.4.1(4)(a).

(5) Given a scenario involving an overturned MC-306/DOT-406 cargo tank, demonstrate the safe procedures for the following methods of product removal and transfer:

The technician with a cargo tank specialty is required by 13.4.1(5) to participate as a member of a team assigned to perform product removal and transfer. These tasks should be performed using appropriate PPE for the material involved and for the working conditions. Additional information on these methods of product removal can be found in *Gasoline Tank Truck Emergencies: Responding to MC/306/DOT 406 Cargo Tank Trucks Transporting Gasoline/Ethanol Blends and Fuel Oils* [3].

(a) Drilling
(b) Internal self-closing stop valve
(c) Unloading lines
(d) Vapor recovery lines

(6) Given a scenario involving an overturned MC-307/DOT-407 cargo tank, demonstrate the safe procedures for the following methods of product removal and transfer:

The technician with a cargo tank specialty is required by 13.4.1(6) to participate as a member of a team assigned to perform product removal and transfer. These tasks should be performed using appropriate PPE for the material involved and for the working conditions.

(a) Cleanout cap
(b) Product loading and unloading outlet
(c) Product lines

(7) Given a scenario involving an overturned MC-331 cargo tank, demonstrate the safe procedures for product removal and transfer:

The technician with a cargo tank specialty is required by 13.4.1(7) to participate as a member of a team assigned to perform product removal and transfer. These tasks should be performed using appropriate PPE for the material involved and for the working conditions.

(a) Vapor line
(b) Liquid line
(c) Hot tap

(8) Given the necessary resources, demonstrate the flaring of an MC-331 flammable gas cargo tank

The technician with a cargo tank specialty is required by 13.4.1(8) to participate as a member of a team assigned to perform flaring operations. Flaring tasks should be performed using appropriate PPE for

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the material involved and for the working conditions. Flaring liquids and gases is a procedure that can be used to deplete the amount of hazardous material involved or to depressurize a vessel. Flaring should be performed only by persons who are trained in the technique.

Flaring is the controlled release and disposal of flammable materials by burning from the outlet of a flare pipe (horizontal or vertical). This method is used to reduce the pressure or dispose of the residual vapors in a damaged or overloaded cargo tank.

Flaring is used for the following three purposes:

1. Reduce the pressure inside a cargo tank
2. Dispose of vapors remaining in a pressurized cargo tank during or after transfer of the liquid
3. Burn off liquid where transfer is impractical

Flaring can also be used to expedite recovery operations or as an interim method until a transfer can begin. Vapor flaring is the burning of the vapors of a liquefied compressed gas at the outlet of a vertical flare pipe as the vapors exit the flare pipe. Liquid flaring is the vaporizing of a liquid product and burning of the vapors at the end of a horizontal flare pipe. A pit is used to contain any product that is not completely burned.

References Cited in Commentary

1. Title 29, Code of Federal Regulations, Part 1910.120, U.S. Government Publishing Office, Washington, DC.
2. Title 49, Code of Federal Regulations, Part 178, U.S. Government Publishing Office, Washington, DC.
3. Title 49, Code of Federal Regulations, Part 173, U.S. Government Publishing Office, Washington, DC.
4. Hildebrand, M., Noll, G., and Hand, B. *Gasoline Tank Truck Emergencies: Responding to MC/306/DOT 406 Cargo Tank Trucks Transporting Gasoline/Ethanol Blends and Fuel Oils*, Jones & Bartlett Learning, Burlington, MA, Fourth Edition.
5. NFPA 77, *Recommended Practice on Static Electricity*, National Fire Protection Association, Quincy, MA, 2014.
6. API Publication No. 2219, *Safe Operation of Vacuum Trucks in Petroleum Service*, American Petroleum Institute, Washington, DC, Second Edition, March 2012.

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Competencies for Hazardous Materials Technicians with an Intermodal Tank Specialty

14

Intermodal freight containers were introduced in North America in the middle of the 20th century. These containers are designed to be placed on or in transport vehicles or vessels and transported by air, highway, rail, and water. A sturdy, metal supporting framework with corner casting facilitates handling of the container by mechanical means. Common designs include freight containers, also called box containers, and tank containers.

Intermodal tanks, called UN portable tanks in international regulations, have been used since the early 1970s. Intermodal tanks transport a variety of nonhazardous and hazardous materials and will be found in each mode of transportation, as well as ports, intermodal yards, and other facilities. This chapter specifies the competencies required of hazardous materials technicians with an intermodal tank specialty when responding to incidents involving intermodal tanks.

14.1 General.

14.1.1 Introduction.

14.1.1.1 The hazardous materials technician with an intermodal tank specialty shall be that person who provides technical support pertaining to intermodal tanks, provides oversight for product removal and movement of damaged intermodal tanks, and acts as a liaison between the technicians and outside resources.

Allied professional and specialist employees including shippers, carriers, intermodal tank builders and their repair personnel, and environmental contractors can assist in aspects of intermodal tank response.

Δ **14.1.1.2** The hazardous materials technician with an intermodal tank specialty shall be trained to meet all competencies at the awareness level (see Chapter 4), all competencies at the operations level (see Chapter 5), all competencies at the technician level (see Chapter 7), and all competencies of this chapter.

Hazardous materials technician with an intermodal tank specialty, hazardous materials technician with a cargo tank specialty, and hazardous materials technician with an intermodal tank specialty are levels that are above the Occupational Health and Safety Administration's (OSHA) technician and specialist levels and are not defined by the present OSHA regulations 29 CFR Part 1910 [1].

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Commentary Table I.1.1 in Part I of this handbook compares the levels described by NFPA and OSHA. Responders with the intermodal tank specialty are required by 14.1.1.2 to demonstrate competency in performing these tasks. See the competency requirements in 14.4.1(7) for an example.

14.1.1.3 Hazardous materials technicians with an intermodal tank specialty shall also receive training to meet governmental response and occupational health and safety regulations.

14.1.2 Goal.

14.1.2.1 The goal of the competencies in this chapter shall be to provide the technician with an intermodal tank specialty with the knowledge and skills to perform the tasks in 14.1.2.2 in a safe manner.

14.1.2.2 When responding to a hazardous materials/WMD incident, the hazardous materials technician with an intermodal tank specialty shall be able to perform the following tasks:

(1) Analyze a hazardous materials/WMD incident involving an intermodal tank to determine the complexity of the problem and potential outcomes by completing the following tasks:
  (a) Determine the type and extent of damage to an intermodal tank

The type and extent of damage to intermodal tanks includes both damage to the valves and fittings (most commonly found in incidents) as well as damage to the tank.

  (b) Predict the likely behavior of an intermodal tank and its contents in an incident

(2) Plan a response for an incident involving an intermodal tank within the capabilities and competencies of available personnel, PPE, and control equipment by determining the response options (offensive, defensive, or nonintervention) for the incident

(3) Implement or oversee the implementation of the planned response to a hazardous materials/WMD incident involving intermodal tanks

14.1.3 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.

14.1.3.1 Hazardous materials technicians operating within the scope of their training as listed in Chapter 7 shall be able to intervene in intermodal tank incidents.

14.1.3.2 If a hazardous materials response team elects to train some or all its hazardous materials technicians to have in-depth knowledge of intermodal tanks, this chapter shall set out the minimum required competencies.

The committee wanted to make clear that existing and new responders at the hazardous materials technician level can still perform the operations on intermodal tanks for which they have been qualified. This specialty level covers those highly technical skills and knowledge rarely needed except at major incidents. For example, the skills required by the competency in Section 14.4 are skills that the technician normally does not possess. A hazardous materials response team might have a few members trained to this level in accordance with 14.1.3.2, or a request can be made to the railroad, shipper, or manufacturer to provide a qualified individual with this specialty at the incident scene.

Programs covering these competencies are in place at several hazardous materials training centers, including the Association of American Railroads' Security and Emergency Response Training Center, the California Specialized Training Institute, Texas A&M, and others.

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The committee also wants to state that this specialty level is not mandated for any hazardous materials response team or its members, as stated in 14.1.3. Arrangements to request assistance to perform these operations are perfectly appropriate and are encouraged in these situations.

14.2 Competencies — Analyzing the Incident.

Safety Considerations. Determining the type and extent of damage to intermodal tank fittings and the tank is inherently dangerous, so:

- Limit access to the danger area until it is safe to allow access.
- Certain conditions may preclude completing damage assessment tasks, such as:
  - Direct flame impingement on vapor space
  - Tank sitting in a pool fire
  - Operation of tank's pressure relief device
  - Bulging of tank
  - Tank being inaccessible (intermodal tank covered by other tanks or debris)
- Identify the tank's contents and hazards.
- Identify the tank's type.
- Review the tank's construction, safety systems, service equipment, and behavior.
- Consider the orientation of the car.
- Wear appropriate protective equipment during the inspection.

Request assistance from those experienced in damage assessment — such as intermodal hazardous material specialists, shipper personnel, and intermodal tank builders or repair personnel.

14.2.1 Determining the Type and Extent of Damage to Intermodal Tanks. Given examples of damaged intermodal tanks, the hazardous materials technician with an intermodal tank specialty shall describe the type and extent of damage to each intermodal tank and its fittings and shall complete the following tasks:

The intermodal tank is generally built as cylinder enclosed at the ends by heads. Other tank shapes (rectangular) and configurations (tube modules) are rare. Tanks with multiple compartments are also rare. The intermodal tank's capacity ordinarily ranges from 2378 gal (9,000 L) to 7130 gal (27,000 L) in the 40 ft version. The majority (95 percent) of intermodal tanks are 20 ft (6.058 m) long, 8 ft (2.438 m) wide, and 8 ft (2.438 m) or 8 ft 6 in (2.591 m) high. However, 40 ft (12.192 m) long intermodal tanks do exist, as do intermodal tanks in other heights, such as half-height tanks [4 ft (1.219 m) or 4 ft 3 in. (1.296 m) high]. Some 40 ft (12.192 m) intermodal tanks used in the United States are 6 ft 10 in. (2.082 m) high, and some intermodal tanks are 9 ft (2.743) or 9 ft 6 in. (1.981 m) high. Exhibit I.14.1 shows an intermodal tank that is in the process of changing modes between highway and rail transportation.

In NFPA 472, intermodal tanks are grouped into the following four types:

1. Nonpressure intermodal tanks
2. Pressure intermodal tanks
3. Cryogenic liquid intermodal tanks
4. Tube modules (multiple element gas containers)

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EXHIBIT I.14.1

This is an example of an intermodal tank changing modes. (Source: Provided by members of the Association of American Railroads)

Nonpressure intermodal tanks, called UN portable tanks or intermodal (IM) portable tanks, comprise over 90 percent of the total number of tank containers. These tanks transport liquids and solids (e.g., Class 3 flammable and combustible liquids, Class 4 flammable solids, spontaneously combustible materials, and dangerous when wet materials, Class 5 oxidizers and organic peroxides, Class 6 toxic (poisonous) materials, Class 8 corrosive materials, and Class 9 miscellaneous hazardous materials at maximum allowable working pressures (MAWP) of up to 150 psi (1034 kPa). Tanks are tested to 1.5 times their MAWP. In the DOT regulations, the following two groups of nonpressure intermodal tanks are common:

1. Nonpressure intermodal tanks, built to withstand MAWPs from 25.4 psi to 100 psi (175 kPa to 689 kPa), are known as UN portable tanks (T6 to T23 depending on the product transported), IM-101 intermodal tanks, or IMO Type 1 tank containers. They transport both nonhazardous and hazardous materials with flash points below 32°F (0°C).
2. Nonpressure intermodal tanks, built to withstand lower MAWPs from 14.5 psi to 25.4 psi (100 kPa to 175 kPa), are known as UN portable tanks (T1 to T5 depending on the product transported), IM-102 intermodal tanks, or IMO Type 2 tank containers. They transport materials such as whiskey, alcohols, some corrosives, pesticides, insecticides, resins, industrial solvents, and flammables with flash points between 32°F and 140°F (0°C and 60°C). More commonly, they transport nonregulated materials such as food-grade commodities.

Pressure intermodal tanks, built to withstand internal pressures ranging from 100 psi to 600 psi (689 kPa to 4136 kPa), are known as UN portable tanks T50, DOT Specification 51 intermodal tanks, and IMO Type 5 tank containers. They are less common in transport and generally transport nonrefrigerated liquefied compressed gases (Class 2) and chemicals under pressure, such as LP-Gas, anhydrous ammonia, methyl bromide, and chlorine.

Cryogenic liquid intermodal tanks, known as UN portable tanks T75 and IMO Type 7 tank containers, carry refrigerated liquefied gases (Class 2) like argon, oxygen, and helium.

Tube modules, known as multiple element gas containers (MEGC), transport nonrefrigerated compressed gases (Class 2) in high-pressure specification cylinders or tubes tested to 3000 psi or 5000 psi (20,680 kPa to 34,470 kPa) and are permanently mounted within an ISO frame. Elements may include cylinders, tubes, or bundles of cylinders.

(1) Given the specification mark for an intermodal tank and the reference materials, describe the tank's basic construction and features

The design, construction, and use of intermodal tanks must conform to the strict international standards and regulations. These standards are found in the United Nations *Recommendations on the Transport of Dangerous Goods — Model Regulations* [2] and have been adopted into DOT, TC, and IMO regulations. Since 2003, all intermodal tanks manufactured have been constructed and certified as UN portable tanks. The specification marking on the tank container is simply "UN PORTABLE TANK," which means it does not differentiate between nonpressure, pressure, and cryogenic.

Since 2003, construction and certification under DOT IM-101, DOT IM-102, and DOT Specification 51 and IMO Type 1, IMO Type 2, IMO Type 5, and IMO Type 7 is no longer authorized by UN standards, but tank containers previously built to these specifications may continue to transport hazardous materials if they conform to current international regulations for UN portable tanks.

UN portable tank instructions specify the requirements that apply to a portable tank when used for the transportation of a specific hazardous material. Instructions for construction of portable tank are listed as "T codes" in the Special Provisions column of DOT's Hazardous Materials Table (49 CFR 172 [3]). The "T" code may be stenciled on the tank after the wording "UN PORTABLE TANK."

- Portable tank instructions T1 through T22 (nonpressure intermodal tanks) specify the applicable minimum test pressure, the minimum shell thickness (in reference steel), bottom opening

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requirements, and pressure relief requirements for a tank container to transport a specific hazardous material. These instructions indicate additional requirements over and above those in DOT's regulations. For example, code "T11" provides instructions for the most common tank for liquids and solids, and code "T23" provides instructions for self-reactive materials (Division 4.1) and organic peroxides (Division 5.2).

- Liquefied compressed gases are assigned to portable tank instruction T50 (pressure tank containers).
- Refrigerated liquefied gases that are authorized to be transported in portable tanks are specified in tank instruction T75 (cryogenic liquid tank containers).

Tank provision (TP) codes, also found in the Special Provisions column of DOT's Hazardous Materials Table (49 CFR 172.101 [3]), indicate special features that apply to the tank containers for specific hazardous materials, such as linings or cladding, heating devices, and insulation requirements.

Tanks meeting these international standards have the specification markings or an exemption number displayed on both sides, generally near the tank's reporting marks (initials) and number. Examples of specification markings found include the following:

- Nonpressure intermodal tanks (IM-101, IM-102, IMO Type 1, IMO Type 2, UN portable tank (T1 to T23)
- Pressure intermodal tanks (DOT Specification 51, IMO Type 5, UN portable tank T50)
- Cryogenic liquid intermodal tanks (DOT Specification 51, IMO Type 7, UN portable tank 75)
- Tube modules [multiple element gas containers (MEGCs) specification of the gas container]

DOT authorizes special permits for packages, containers, and the preparation and offering of hazardous materials for shipment, in accordance with 49 CFR Part 173 [4]. In these cases, the outside of the package must be plainly and durably marked in 2 in. (51 mm) letters and numerals with the letters DOT-SP, followed by the number assigned (e.g., DOT-SP 8623).

Tank containers no longer have to conform to the requirements of Section C, Part III, "Specifications for Tank Cars" in the *Manual of Standards and Recommended Practices* from the Association of American Railroads (AAR) [5]. Previously, tanks meeting these requirements displayed the AAR 600 marking in 2 in. (51 mm) letters on both sides near the tank's reporting marks (initials) and numbers.

The European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) and Regulations Concerning the International Carriage of Dangerous Goods by Rail (RID) are used in Europe for the movement of intermodal tanks. ADR/RID markings can remain when the tank is transported in the United States. See Exhibit I.14.2 and Commentary Table I.14.1 for examples of specification markings.

EXHIBIT I.14.2

This is an example of specification markings on a tank. (Source: Provided by members of the Association of American Railroads)

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***COMMENTARY TABLE I.14.1** Comparison of Current Intermodal Tank Uses and Specifications*

Type	*Use*	*UN*	*Specifications*	*DOT*[1]	*IMO*[1]
Nonpressure	Certain hazardous liquids of low hazard and certain solids	UN T1 and T2 UN T3 and T4 UN T5	• MAWP: 1.5 Bar • PRV only required • MAWP: 2.65 Bar • PRV only required • MAWP: 2.65 Bar • PRV in series w/ rupture disk and pressure gauge	DOT IM-102	IMO Type 2
	Liquids and solids	UN T6 to T9 UN T10 UN T11 and 13 UN T12 and T14	• MAWP: 4 Bar • PRV only required • MAWP: 4 Bar • PRV in series w/ rupture disk and pressure gauge • MAWP: 6 Bar • PRV only required • MAWP: 6 Bar • PRV in series w/ rupture disk and pressure gauge	DOT IM-101	IMO Type 1
	Liquids and solids	UN T15, T17, and T21 UN T16, T18, T19, T20, and T22	• MAWP: 10 Bar • PRV only required • MAWP: 10 Bar • PRV in series w/ rupture disk and pressure gauge	DOT IM-101	IMO Type 1
	Class 5.2 materials and Class 4.1 self-reactive materials	UN T23	Depending on product transported	DOT IM-101[2]; DOT Spec 51	IMO Type 1[2]; IMO Type 5
Pressure	Nonrefrigerated liquefied compressed gases (Class 2) *(see UN Portable Tank Table for Liquefied Compressed Gases and Chemicals Under Pressure)*	UN T50	Depending on product transported	DOT Spec 51	IMO Type 5
Cryogenic Liquid	Refrigerated liquefied gases (Class 2)	UN T75	Depending on product transported	DOT Spec 51; Custom (ASME)	IMO Type 7
Tube Module (Multiple element gas container[3])	Nonrefrigerated compressed gases (Class 2) (high pressure equivalent tank container)		Depending on product transported		

[1] As information: New construction and certification of DOT Specifications IM-101, IM-102, and 51 and IM Specifications IMO Type 1, IMO Type 2, IMO Type 5, and IMO Type 7 are not authorized. However, tanks built to these specifications may continue to transport hazardous materials if they conform to current regulations for Specification UN portable tanks.
[2] With additional shell thickness and higher pressures
[3] Elements include cylinders, tubes, or bundles of cylinders.

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(2) Given examples of intermodal tanks (jacketed and not jacketed), identify the jacketed intermodal tanks

The technician with an intermodal tank specialty is required by 14.2.1(2) to be able to identify intermodal tanks with jackets. Tank containers are rarely uninsulated.

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(3) Given examples of various intermodal tanks, identify and describe the design and purpose of each of the following intermodal tank components, when present:

(a) Corner casting

Supporting frames for all intermodal containers, including intermodal tanks, are built to international standard with corner fittings called corner castings. This component is used to secure the tank and to lift it with standard container handling equipment. See Exhibit I.14.3 for examples of a corner casting.

EXHIBIT I.14.3

(a)

(b)

This is an example of (a) a corner casting on an intermodal tank and (b) the locking mechanism to which it is secured. (Source: Provided by members of the Association of American Railroads)

(b) Data plate

The corrosion-resistant data plate provides additional technical, approval, and operational data. The data plate is permanently attached to the tank or frame.

(c) Heater coils (steam and electric)

Steam or electric heating can also be found on some intermodal tanks, especially those where the commodity must be heated during transportation or unloading.

(d) Insulation

Insulation is used to moderate the effects of temperature on the commodity. Mineral wool, fiberglass, polyurethane foam, and polystyrene foam are used as insulating materials. Insulation is usually 3 in. to 4 in. (76 mm to 102 mm) thick. Tank containers are rarely uninsulated.

(e) Jacket

Insulation is always covered with a jacket (called cladding) with flashing to make it weathertight. This cladding is made of metal, at least 0.03937 in. (1 mm) thick, or an equivalent thickness of plastic, reinforced with either glass or fiber.

(f) Refrigeration unit

A refrigeration unit on an intermodal tank, listed in 14.2.1(3)(f), is used to moderate the temperature of the commodity during transportation.

(g) Supporting frame

The supporting frame of an intermodal tank, as listed in 14.2.1(3)(g), protects the tank and provides for stacking, lifting, and securing the tank. The frame also supports the walkways and ladders. The two basic supporting frames are the box type, which encloses the tank in a cagelike framework, and the beam type, which uses frame structures only at the ends of the tank. A grounding plug will be attached to the frame for grounding the tank during loading/unloading to dissipate static electricity. A document holder (sealed tube) is attached to carry pertinent documents like the certificate of analysis (COA) and cleaning certificates.

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(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, where present, in air line connections:

Note: The following list should have included "(a) Air line connections" with the explanation: "An air line connection, located on the tank's top, can be used for pressure unloading, vapor return, and blanketing the contents with an inert gas. The air line connection may be flanged or have a valve attached."

(a) Bottom outlet valve

EXHIBIT I.14.4

This shows a bottom outlet valve on a tank. (Source: Provided by members of the Association of American Railroads)

Bottom outlet valves, typically three closures connected in series with a gasket between them, are on the discharge end of the tank. A liquidtight closure on the external bottom outlet valve is also required. This closure may be a blind flange, a screw cap, or a cam-lock cap attached to the external valve. Exhibit I.14.4 provides an example of a bottom outlet valve.

(b) Gauging device

A dipstick can be inside the manhole. This component is used in conjunction with a calibration chart, known as a strapping chart, to measure the amount of commodity in the tank.

(c) Liquid or vapor valve

Intermodal tanks might have valves for loading and unloading liquids and vapors, depending on the characteristics of the commodity being transported.

(d) Thermometer

Some intermodal tanks have a built-in thermometer to measure the temperature of the commodity inside.

(e) Manhole cover

A manhole is on top of the tank, at the center, to allow access into the tank. The manhole cover is secured by six or eight wing nuts on a hinged and bolted lid fitted with a gasket.

(f) Pressure gauge

Some intermodal tanks have one or more pressure gauges to measure the pressure inside the tank.

(g) Sample valve

The sample valve provides a way to check the commodity.

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(h) Spill box

On nonpressure intermodal tanks, the top fittings are surrounded by a spill box, which protects the tank's shell from spillage. Spilled material as well as rainwater in the spill box will empty through one or more small open drain pipes. See Exhibit I.14.5 for an illustration of a spill box.

EXHIBIT I.14.5

A spill box is used to protect the tank from spilled material. (Source: Provided by members of the Association of American Railroads)

(i) Thermometer well

The thermometer well is a fitting on a pressure intermodal tank where the temperature of the commodity can be determined when a thermometer is placed into the well. The well is filled with permanent antifreeze. Such wells are not commonly found in new construction.

(j) Top outlet

Top-loading valves are attached to a removable eduction pipe (called a dip leg, dip tube, or siphon tube) running into the tank.

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(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, where present:

(a) Emergency remote shutoff device

In an incident, the internal valve or foot valve can be shut off from a remote location. Foot valve and internal valve are synonymous. The bottom outlet assembly for tank containers consists of three closures: a foot valve or internal valve, external butterfly valve, and threaded or flanged cover. Facing the discharge end of the tank, the emergency shutoff device is on the right-hand side near the far end.

(b) Excess flow valve

Excess flow valves can be attached inside the tank between the manway cover plate and the eduction line. These devices almost completely cut off the flow of product when the valve is sheared off in an accident. They operate by either product flow or, when the car is overturned, by gravity. Under normal conditions, gravity keeps the excess flow valves open, but higher flow rates associated with the valve being sheared off or a break in the hose closes them. When the intermodal tank is turned over, gravity closes the valves.

(c) Fusible link/nut assemblies

Fusible links or nuts can be found on cable-actuated remote control shutoff devices. Upon melting, the release of cable tension closes the valve.

(d) Regulator valve

Regulator valves are devices that control the release of vapors from the tank when the contents become heated.

(e) Rupture disc

Safety vents are pressure relief devices that use a frangible disc, also called a rupture disc, to seal the vent opening. The disc is designed to rupture at a predetermined pressure to relieve internal pressure. Once ruptured, the safety vent does not reclose. Rupture discs are made of metal, plastic, rubber, or a combination of metal, plastic, and rubber.

(f) Pressure relief valve

Pressure relief valves are devices with the valve held closed by one or more springs. When pressure in the valve exceeds the safety setting, the valve opens. The valve recloses when the tank pressure is reduced below the safety setting. A combination pressure relief valve is generally found in pairs on nonpressure intermodal tanks. The valve protects the tank from both overpressure and vacuum. In many cases, the relief valve has a rupture disc between the pressure relief valve spring and the commodity to protect the spring. The valve might also have a pressure gauge to determine if the disc is ruptured. See Exhibit I.14.6 for an illustration of a pressure relief valve.

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EXHIBIT I.14.6

A pressure relief valve such as this one is used to protect the tank from overpressure. (Source: Provided by members of the Association of American Railroads)

(6) Given the following types of intermodal tank damage, identify the type of damage in each example and explain its significance:

(a) Corrosion (internal and external)

Corrosion is pitting of the tank metal, thus reducing the thickness and, possibly, the strength of the tank metal.

(b) Crack

A crack is a narrow split or break in the container metal that can penetrate the metal of the container. Cracks are typically associated with dents.

(c) Dent

A dent is a deformation of the container metal. This damage is caused by impact with a relatively blunt object. When a sharp radius of curvature is associated with the dent, the possibility of cracking exists.

(d) Flame impingement

Flame impingement is fire in direct contact with the surface of the tank, either in the liquid space or the vapor space.

(e) Metal loss (gouge and score)

Scores and gouges equate to metal loss from the tank and potential weakening of the tank structure. A score is a reduction in the thickness of the container shell caused by a relatively blunt object. The scoring action relocates the tank and/or weld metal along the track of contact. A gouge is a reduction in the thickness of the container caused by a sharp, chisel-like object cutting and completely removing the tank and/or weld metal along the track of contact.

(f) Puncture

A puncture is a hole in the tank.

(7) Given three examples of damage to the framework of intermodal tanks, describe the damage in each example and explain its significance in the analysis process

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(8) Given an intermodal tank involved in an incident, identify the factors to be evaluated as part of the intermodal tank damage assessment process, including the following:

The technician with an intermodal tank specialty is required by 14.2.1(8) to be able to collect the information on a given intermodal tank involved in an incident. Where necessary for safety reasons, this task should be performed using appropriate personal protective equipment (PPE) for the material involved and for the working conditions.

(a) Amount of product released and amount remaining in the intermodal tank
(b) Container stress applied to the intermodal tank
(c) Nature of the incident
(d) Number of compartments
(e) Pressurized or nonpressurized
(f) Type and nature of tank damage
(g) Type of intermodal tank
(h) Type of tank metal

(9)* Given a pressurized intermodal tank containing a liquefied gas, determine the amount of liquid in the tank

A.14.2.1(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.

The technician with an intermodal tank specialty uses gauging devices to determine the innage (amount of liquid) or outage (amount of vapor space) in an intermodal tank, in accordance with 14.2.1(9).

(10)* Given examples of damage to a pressurized intermodal tank, determine the extent of damage to the heat-affected zone

Because of this change in composition in the tank metal, the ductility of the steel in this heat-affected zone is reduced. The heat-affected zone is a likely origin for cracks.

A.14.2.1(10) See A.12.2.1(10)(d).

14.2.2 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 complete the following tasks:

(1) Given the following types of intermodal tanks, describe the likely breach/release mechanisms:

The technician with an intermodal tank specialty is required to describe the types of breach/release mechanisms associated with the following intermodal tanks.

(a) IMO Type 1/IM-101

This includes UN portable tanks T6 to T23.

(b) IMO Type 2/IM-102

This includes UN portable tanks T1 to T5.

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(c) IMO Type 5/DOT-51

This includes UN portable tanks T50.

(d) DOT-56
(e) DOT-57
(f) DOT-60
(g) Cryogenic (IMO Type 7)

This includes UN portable tanks T75.

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

Ninety percent or more of intermodal tanks are built of stainless steel; the rest are typically built of mild steel, stainless steel — used to protect its contents from environmental concerns — and aluminum and magnesium alloy, which cannot be used in water transportation. Minimum head and shell thickness is measured in terms of "equivalent thickness in mild steel" after forming. For stainless steel tanks, the minimum thickness is less than ⅛ in. (3.2 mm) for nonregulated materials and less than 3½ in. (4.8 mm) for regulated materials. For steel tanks, the minimum thickness is ¼ in. (6.35 mm) for nonregulated materials and ⅜ in. (9.5 mm) for regulated materials. Most tanks are built to the pressure vessel standards of the American Society of Mechanical Engineers (ASME) with the welds x-rayed. Welds on carbon steel tanks are post-weld stress relieved. The shipper or the intermodal tank manufacturer is an excellent source of technical information on the stressing of the tank.

14.3 Competencies — Planning the Response.

In Chapter 7, the hazardous material technician is required to identify appropriate response objectives (nonintervention, defensive, and offensive) for responders at that level. While the hazardous materials technician can stabilize an incident until industrial specialists arrive for final and complete mitigation, the technician with an intermodal tank specialty can assist with or perform the highly technical, inherently dangerous, and offensive operations that lead to final mitigation of the incident.

Δ **14.3.1 Determining the Response Options.** Given the analysis of an incident involving intermodal tanks, technicians with an intermodal tank specialty shall determine the response options for each intermodal tank involved and shall complete the following tasks:

The competencies in 14.3.1 build on the competencies of the hazardous materials technician.

Because most of these operations are rarely done at an incident, the technician with an intermodal tank specialty should give a detailed briefing to the hazardous materials branch safety officer, branch officer, and incident commander on the planned operations before staffing any operations.

- Plan the operation as follows:

  1. Develop a list of required equipment for the selected operation
  2. Prepare a plan for set-up, implementation, and shutdown of the operation
  3. Prepare a site safety plan

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- Set up the operation as follows:
  1. Hold a safety briefing
  2. Position the equipment
  3. Set up and activate the emergency shutoff system, if used
  4. Purge the liquid and vapor hoses and test for leaks
- Implement the operation
- Shut down the operation as follows:
  1. Purge the hoses and/or piping
  2. Disassemble and decontaminate the equipment
  3. Secure cars
- Determine disposition of tank cars and prepare them for transportation

(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:

Extreme care must be exercised in a product removal operations and only after consultation with the shipper, carrier, or other intermodal tank specialist.

The product removal methods in 14.3.1(1) are outside the legitimate responsibility of local emergency response personnel. However, oversight of their planning and implementation is within the responsibilities of local emergency response agencies. Product removal procedures should be established in advance based on current industry standards and recommended practice. Only essential personnel — outlined, in most cases, in the overall incident management system of the hazardous materials branch — should be involved in the process.

(a) Flaring liquids and vapors

Flaring is the controlled release and disposal of flammable liquids or gases by burning from the outlet of a vertical or horizontal flare pipe. This product removal method is used to reduce the pressure within the tank, dispose of vapors remaining in the tank after transfer, or burn off liquid when transfer is impractical.

Vapor flaring is accomplished by burning the flammable vapors at the outlet of a vertical flare pipe.

Liquid flaring is accomplished by burning of flammable liquids or gases that vaporize at the end of a horizontal flare pipe. A pit is built at the end of the horizontal flare pipe to contain any liquid that is not vaporized immediately. It is used to dispose of the lading when another product removal method is not practical.

(b) Hot tapping

Hot tapping is a technique for providing access to the contents of a tank when either damage to the valves and fittings precludes their use or the valves and fittings are inaccessible. To make a hot tap, a threaded nipple(s) is welded to the intermodal tank (typically one in the vapor space and one in the liquid space). A ball valve is connected to each threaded nipple. Then, a hole is drilled or cut into the tank through the center of both the threaded nipple and attached valve with a drilling machine designed for the application. The drill is removed and hose/pipe is attached. After completing and testing the hot tap, transfer, flaring, or venting product removal, techniques can take place.

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Cold tapping serves the same purpose as hot tapping except that the attachment of the threaded nozzle to the tank is accomplished without welding by strapping or bolting the nozzle plate onto the tank.

(c) Transferring liquids and vapors (pressure and pump)

Transfer is the controlled movement of the contents of a damaged or overloaded tank into a receiving (undamaged) tank (i.e., tank car, cargo tank, intermodal tank, fixed tank, or other container); it is also known as *load reduction* when transferring product from an overloaded tank, or *transload* when receiving tank is from another mode of transportation or fixed facility.

The equipment varies with the type of container involved and the hazardous material being transferred. Transfer procedures are generally established in advance by good industry practice. Only essential personnel — outlined, in most cases, in the overall incident management system of the hazardous materials branch — should be involved in the process.

(d) Venting to atmosphere

Venting is the process of reducing the pressure in a tank containing nonflammable gas by releasing vapors from the tank directly to the atmosphere.

(e) Venting vapors through a treatment (scrubbing) process

In this case, venting is the process of reducing the pressure in a tank containing toxic gas by releasing vapor indirectly to the atmosphere through an appropriate treatment (scrubbing) system.

(2) Describe the inherent risks associated with, procedures for, equipment required to implement, and safety precautions for controlling leaks from various fittings on intermodal tanks

The technician with an intermodal tank specialty is required to describe the items in 14.3.1(2) before attempting to make repairs within his or her level of training.

Δ 14.4 Competencies — Implementing the Planned Response.

Given an analysis of an incident involving intermodal tanks and the planned response, technicians with an intermodal tank specialty shall implement or oversee the implementation of the selected response options in a safe and effective manner and shall complete the following tasks:

Most of the competencies in Section 14.4 require a demonstration of a task. These tasks require an in-depth knowledge of the intermodal tank, its contents, and the specialized equipment needed to complete the task. Because these tasks must be done on actual intermodal tanks, only a few training facilities are able to provide practical training and/or certification. Because some of the tasks in 14.4(1) require specialized resources that are not commonly available to local emergency response personnel, repairs beyond those indicated with each competency should be left to those with the specialized resources and training. Equipment and resources for these tasks may not readily available; therefore, requests for training on how to perform these tasks should be directed to the local shipper, carrier, or contractor personnel in the community, possibly through the local emergency planning committee.

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(1) Given leaks from the following fittings on intermodal tanks, control the leaks using approved methods and procedures:

(a) Bottom outlet
(b) Liquid/vapor valve
(c) Manway cover
(d) Pressure relief device
(e) Tank

(2) Given the applicable equipment and resources, demonstrate the following:

The technician with an intermodal tank specialty is required by 14.4(2) to perform these tasks in a manner appropriate to the equipment used. These product removal techniques should be performed only by persons trained in the technique using PPE appropriate for the material involved and for the working conditions.

(a) Flaring of liquids and vapors

Determination must be made that the flaring does not present a source of ignition to other spilled flammable substances.

(b) Transferring of liquids and vapors
(c) Venting

(3) Demonstrate approved procedures for the following types of emergency product removal:

(a) Gas and liquid transfer (pressure and pump)
(b) Flaring
(c) Venting

(4)* Demonstrate grounding and bonding procedures for the product transfer from intermodal tanks, including the following:

A.14.4(4) See A.12.4.1(10).

When grounding and bonding are performed, a ground resistance tester and an ohmmeter should be used. The ground resistance tester measures the earth's resistance to a ground rod, and the ohmmeter measures the resistance of the connections to ensure electrical continuity. One ground rod might not be enough; more might have to be driven and connected to the first to ensure a good ground. Resistance varies with types of soils.

Using the appropriate equipment, the technician with a tank car specialty should be able to verify the following:

- Ground rod resistance to earth
- Connections between ground rod and tank car and receiving container(s)
- Connections between ground rod(s) and main ground rod(s) and ground cable(s)

Local procedures for the tasks in 12.4.1(10) should be written and consistent with nationally accepted practices. The technician with an intermodal tank car specialty is required to participate as a member of a team assigned to set up bonding and grounding for the transfer of intermodal tanks. These tasks should be performed using PPE appropriate for the material involved and for the working conditions.

(a) Selection of equipment
(b) Establishment of ground field

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(c) Sequence of grounding and bonding connections
(d) Testing of ground field and grounding and bonding connections

(5) Demonstrate the methods for containing the following leaks on liquid intermodal tanks (e.g., IM-101 and IM-102 intermodal tanks):

In addition to IM-101 and IM-102 intermodal tanks, liquid intermodal tanks (nonpressure intermodal tanks) include UN portable tanks T1-T23 and IMO Type 1 and IMO Type 2 tank containers.

(a) Manway cover leak
(b) Irregular-shaped hole
(c) Pressure relief devices (e.g., vents, rupture disc)
(d) Puncture
(e) Split or tear
(f) Valves and piping

(6) Describe the methods for containing the following leaks in pressure intermodal tanks:

The technician with an intermodal tank specialty is required to select and apply appropriate procedures and/or methods of plugging and patching to control or stop leakage of the commodity. These tasks should be performed using appropriate PPE for the commodity involved and for the working conditions.

(a) Crack
(b) Failure of pressure relief device (e.g., relief valve, rupture disc)
(c) Valves and piping

(7) Given the following product transfer and recovery equipment, demonstrate the safe and correct application and use of the following:

The technician with an intermodal tank specialty is required to participate as a member of a team assigned to perform product removal. These tasks should be performed using appropriate PPE for the material involved and for the working conditions.

(a) Portable pumps (air, electrical, gasoline, and diesel)
(b) Pressure transfers
(c) Vacuum trucks
(d) Vehicles with power-takeoff driven pumps

(8)* Given a scenario involving an overturned liquid intermodal tank, demonstrate the safe procedures for product removal and transfer

A.14.4(8) See A.12.4.1(10)

The key word in the competency in 14.4(8) is demonstrate. The competency listed in 7.2.4 for the hazardous materials technician requires only the ability to identify. The technician with an intermodal tank specialty will become competent in performing the operation. The technician with an intermodal tank specialty participates as a member of a team assigned to perform product removal. These tasks should be performed using appropriate PPE for the material involved and for the working conditions.

Note: Liquid intermodal tanks (nonpressure intermodal tanks) include UN portable tanks T1-T23, IM-101 and IM-102 intermodal tanks, and IMO Type 1 and IMO Type 2 tank containers.

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(9)* Given a scenario involving an overturned pressure intermodal tank, demonstrate the safe procedures for product removal and transfer

A.14.4(9) See A.12.4.1(10)

Pressure intermodal tanks (nonpressure intermodal tanks) include UN portable tanks T50, DOT Specification 51 tanks, and IMO Type 5 tank containers.

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

A.14.4(10) See A.12.4.1(10).

References Cited in Commentary

1. Title 49, Code of Federal Regulations, Part 1910, U.S. Government Publishing Office, Washington, DC.
2. *Recommendations on the Transport of Dangerous Goods — Model Regulations*, 19th revised edition, UN Publications, United Nations Headquarters, New York, NY, 2009.
3. U.S. Department of Transportation, "Hazardous Materials Table," Title 49, Code of Federal Regulations, Part 172.101, U.S. Government Publishing Office, Washington, DC.
4. Title 49, Code of Federal Regulations, Part 173, U.S. Government Publishing Office, Washington, DC.
5. *AAR Manual of Standards and Recommended Practices*, Association of American Railroads, Washington, DC, 2000.

Additional References

A General Guide to Tank Containers, Hazardous Materials Management, Union Pacific Railroad, Omaha, NE, March 2007.

Hildebrand, M., Noll, G., and Hand, B., *Intermodal Container Emergencies*, Jones & Bartlett Learning, Burlington, MA, Second Edition.

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Competencies for Hazardous Materials Technicians with a Marine Tank and Non-Tank Vessel Specialty

15

Competencies for hazardous materials technicians with a marine tank vessel specialty was a new chapter in the 2008 edition of NFPA 472. Marine vessels, because of their structure and configuration, can present special challenges to the hazardous materials technicians. The Technical Committee on Hazardous Materials Response Personnel extends its gratitude to the U.S. Coast Guard's Chemical Transportation Advisory Committee (CTAC) for its assistance in the preparation of this chapter and commentary.

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15.1 General.

15.1.1* Introduction.

A.15.1.1 Marine vessels, to include tank vessels and non-tank vessels, are used to transport a wide range of different hazardous cargoes in bulk, including oils, chemicals, and liquefied gases. Many marine vessels are designed to carry a large number of segregated products simultaneously, and can carry significantly greater volumes of cargo than other modes of transport. The operation of marine vessels differs from of any other bulk cargo transportation operation. On a single voyage, a large number of cargoes with different properties, characteristics, and inherent hazards may be carried. Marine vessels are constructed in various types, sizes, and arrangements. Persons responding to hazardous material spills or releases from marine tank vessels face unique challenges. Marine vessels may or may not be located at a dock, pier, or anchorage or may be underway, presenting special logistics issues. Marine vessels may be crewed with diverse nationalities. Specialized equipment may be needed to properly respond to hazardous material spills and releases from marine vessels, both tank and non-tank. In areas where hazardous materials are transported on waterways, responders to hazardous material incidents require a minimum level of specialized competency.

For the purposes of this chapter, a marine tank vessel is defined as a vessel that is constructed or adapted to carry or carries oil or hazardous material in bulk as cargo or cargo residue and operates on international navigable waters or that transfers oil or hazardous material in a port or place subject to international jurisdiction.

The term *tank ship* means a self-propelled tank vessel constructed or adapted primarily to carry oil or hazardous material in bulk in the cargo spaces.

The term *tank barge* means a non-self-propelled tank vessel.

The term *chemical carrier* means a tank ship or tank barge constructed or adapted and used for the carriage in bulk of any hazardous product listed in Chapter 17 of the *International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk* (IBC Code).

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The term *liquefied gas carrier* means a tank ship or tank barge constructed or adapted and used for the carriage in bulk of any liquefied gas or other product listed in Chapter 19 of the *International Gas Carrier Code* (IGC Code).

15.1.1.1 Technicians with a marine tank and non-tank vessel 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.

For the purposes of this chapter, a marine tank vessel is defined as a vessel that is constructed or adapted to carry, or that carries, oil or hazardous material in bulk as cargo or cargo residue, and operates on the navigable waters of the United States; or transfers oil or hazardous material in a port or place subject to the jurisdiction of the United States.

The term *tank ship* refers to a self-propelled tank vessel constructed or adapted primarily to carry oil or hazardous material in bulk in the cargo spaces.

The term *tank barge* describes a non-self-propelled tank vessel.

The term *chemical tank ship* means a tank ship or tank barge constructed or adapted and used for the carriage in bulk of any hazardous material or hazardous product listed in Chapter 17 of the *International Bulk Chemical Code* [1], or as supplemented by the annual IMO circular, *Provisional Categorization of Liquid Substances*, MEPC.2/Circ.10 or later [2].

A *liquefied gas carrier* is a tank ship or tank barge constructed or adapted and used for the carriage in bulk of any liquefied gas or other product listed in Chapter 19 of the *International Gas Carrier Code* [3].

The transport of dangerous cargo in bulk in tanker ships on the ocean must follow the requirements of the International Maritime Organization (IMO). The ships are NOT required to have hazardous materials placards. The master of the ship will have a list of dangerous cargoes. They are required to know emergency response procedures, which can include *Emergency Response Procedures for Ships Carrying Dangerous Goods (EmS Guide)*, *Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG)*, and safety data sheets (SDSs) [4, 5]. If the cargo is a flammable liquid or gas, the required posting is as follows:

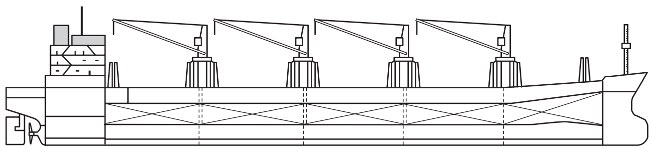
NO SMOKING
NO VISITORS
NO OPEN LIGHTS

These ships are required to notify the U.S. Coast Guard prior to entering port. The ship must provide the Coast Guard with information about the commodity being transported.

A *dry bulk carrier*, which is shown in Exhibit I.15.1, is designed to carry dry bulk cargo, such as coal, iron, and other ores; grains, fertilizers, animal feeds; scrap metal; or any other dry loose cargo. Dry bulk carriers typically have a flat deck with several waterproof hatches covering the cargo holds. Bulk carrier vessels vary greatly in size, depending on the intended cargo and regions served. This is an example of a non-tank vessel.

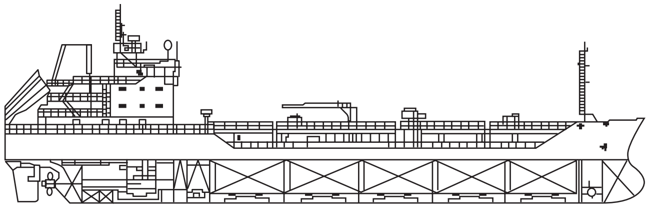
A *chemical tanker*, which is shown in Exhibit I.15.2, is designed to transport chemicals in bulk by a series of separate cargo tanks. These tanks are both integral (built into the hull form) and independent cylindrical tanks mounted on the main deck. A large chemical tanker can have up to 30 integral

EXHIBIT I.15.1



This is an example of a typical dry bulk carrier. (Courtesy of U.S. Coast Guard)

EXHIBIT I.15.2



A typical chemical tanker transports chemicals in bulk. (Courtesy of U.S. Coast Guard)

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cargo tanks. These cargo tanks are either stainless steel or coated, depending on the properties of the intended cargo. Typical chemical tanker cargoes include organic acids, vegetable oils, alcohols, and petrochemicals.

A *product tanker*, which is shown in Exhibit I.15.3, is designed to carry refined oil products, such as gasoline, diesel oil, and kerosene, in bulk. It is similar to a chemical tanker but has significantly less piping on deck, and the cargo tanks occupy more of the ship below deck. Product tankers typically have a large number of tanks to handle a variety of cargoes simultaneously and are usually double-hulled to help prevent any spillage in case of a collision or grounding.

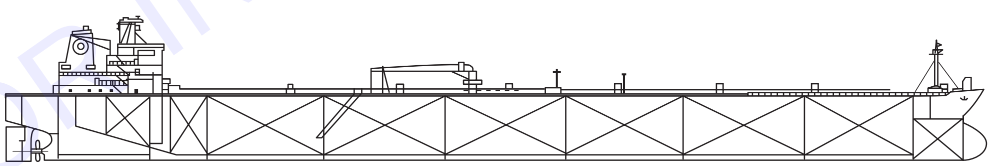
An *LNG carrier*, shown in Exhibit I.15.4, is designed to transport liquefied natural gas (LNG), which is mostly methane that has been cooled below its boiling point to an extremely low temperature of −260°F (−162°C) until it forms into liquid. Moss tanks (a) are self-supporting tanks, spherical in shape, and protrude above the ship's deck. Each sphere is housed in its own insulated double-hulled enclosure and is supported around its equator by a steel cylinder. Membrane tanks (b) consist of a primary barrier composed of metal "waffles," a layer of insulation, another liquid-proof layer referred to as the secondary barrier, and the outermost layer, more insulation. These layers are attached to the walls of the cargo hold, which is externally framed. Nitrogen gas is pumped between the primary and secondary barrier, to include the insulation spaces, as an inerting gas.

Materials transported on U.S. waterways are regulated by the Coast Guard. Barges transporting regulated materials are not placarded. Instead, barges transporting regulated cargo are required to have cargo signs facing outward on the port (left) and starboard (right) side of the barge. These signs must be rectangular in shape measuring 3 ft wide by 2 ft high. Lettering must be black on white 3 in. high with a 2 in. border. The following information must be printed on the signs:

WARNING	
DANGEROUS CARGO	(if the cargo is a listed material)
NO VISITORS	
NO SMOKING	(for flammable or combustible liquids)
NO OPEN LIGHTS	(for flammable or combustible liquids)

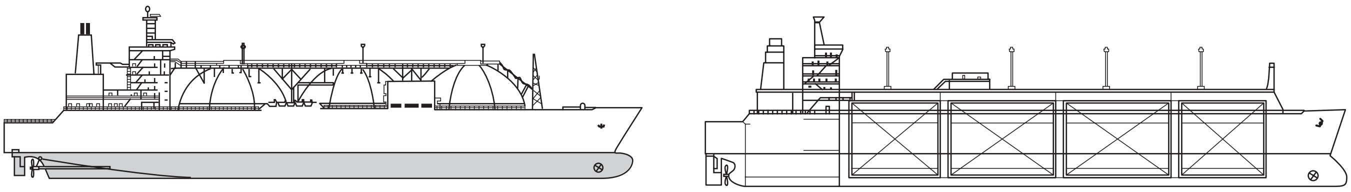
Additionally, barges with regulated cargo will be equipped with a red flag. The red flag is typically of metal construction and must be visible on all sides of the barge.

EXHIBIT I.15.3



A product tanker carries refined oil products. (Courtesy of U.S. Coast Guard)

EXHIBIT I.15.4



(a) (b)

These are two types of LNG carriers: (a) one with moss tanks and (b) one with membrane tanks. (Courtesy of U.S. Coast Guard)

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A cargo information card will be on the bridge or pilothouse of the power unit and near the cargo sign. This is a laminated card that is 7 in. by 9 ½ in. (178 mm by 241 mm). The card will list the identity of the cargo and its characteristics, emergency procedures, fire-fighting procedures, and surveillance requirements. The cargo information card on the barge can be found in a document holder, which may be a mailbox or watertight tube.

A *barge* is designed mostly for the transport of heavy goods in bulk, whether they are in solid or liquid form. Two examples of a barge are shown in Exhibit I.15.5. They have a flat bottom and most are not self-propelled. For barges without self-propulsion, they can be moved by towboats either pulling them or pushing them by their flush stern. Typical bulk solid barges carry grains, sand, coal, ore, and scrap metal in holds that are either covered or uncovered. A tank barge carries liquid cargo in bulk, such as petroleum or chemical products, and is usually double-hulled to prevent spillage in case of a collision or grounding. Tank barges typically have a small structure on deck to house the cargo transfer pump.

A cargo information card will be on the bridge or pilothouse of the power unit and near the cargo sign. This is a laminated card 7 in. by 9 ½ in. (178 mm by 241 mm). The card will list the identity of the cargo and its characteristics, emergency procedures, fire-fighting procedures, and surveillance requirements. The cargo information card on the barge can be found in a document holder, which may be a mailbox or watertight tube.

Note that the exhibits shown in this chapter depict only the most general shapes of marine vessels. Emergency response personnel must be aware that marine vessels vary widely in construction, fittings, purpose, and size. In attempting to determine the product carried by a particular vessel, its shape should be considered as the last resort if the product cannot be identified by any other means.

15.1.1.2* The technician with a marine tank and non-tank vessel specialty also shall receive any additional training to meet applicable USCG, DOT, EPA, OSHA, and other governmental occupational health and safety regulatory requirements.

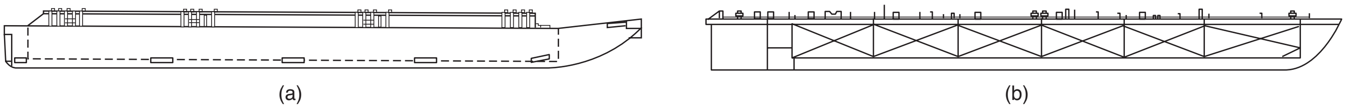
A variety of situations and expertise could be needed in responding to an incident. In most situations, no single person will be able to provide all of the information to respond adequately to an incident. It is important to draw on the expertise of personnel who can provide that input and assistance in dealing with the incident. Personnel who may have expertise to support the response include the following:

1. Vessel person-in-charge, such as a tankerman from a barge or a chief mate, master, or other officer from a tank ship
2. Barge representative
3. Towing vessel operator
4. Facility person-in-charge
5. Response organization
6. Qualified individual (QI) and/or responsible party
7. Marine chemist and/or certified industrial hygienist (CIH)

Δ **A.15.1.1.2** Marine tank vessel responders should be familiar the following:

(1) Title 33, Code of Federal Regulations — U.S. Coast Guard — navigation
(2) Title 46, Code of Federal Regulations — U.S. Coast Guard — shipping

EXHIBIT I.15.5



These are two tank barges, which typically transport heavy goods in bulk: (a) a single compartment tank barge and (b) a multi-compartment tank barge. (Courtesy of U.S. Coast Guard)

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(3) International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)
(4) International Convention for Safety of Life at Sea (SOLAS)
(5) OSHA HAZWOPER Regulation (29 CFR 1910.120)
(6) Resources applicable for marine tank vessels include:
   (a) *Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk* (BCH Code)
   (b) *International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk* (IBC Code)
   (c) *International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk* (IGC Code)
   (d) NFPA 1405
   (e) NFPA 1005
(7) Resources applicable for marine non-tank vessels include:
   (a) *International Maritime Dangerous Goods Code* (IMDG Code)
   (b) Local emergency response plan (LERP)
   (c) Area contingency plan
   (d) NFPA 1405
   (e) NFPA 1005
(8) Additionally, the following maritime industry standards and codes of practice will provide useful information regarding marine tank vessels, including but not limited to:
   (a) *International Safety Guide for Oil Tankers and Terminals*
   (b) *International Chamber of Shipping Tanker Safety Guide* (chemicals)
   (c) *International Chamber of Shipping Tanker Safety Guide* (liquefied gases)
   (d) SIGTTO *Ship to Ship Transfer Guide for Petroleum, Chemicals, and Liquefied Gases* (petroleum) (liquefied gases)
   (e) SIGTTO *Liquefied Gas Handling Principles on Ships and in Terminals*
   (f) *Provisional Categorization of Liquid Substances*, MEPC.2/Circ.10
(9) Additionally the following resources may provide useful information:
   (a) DOT *Emergency Response Guidebook*
   (b) *Bulk Chemical Data Guide*
   (c) Chemical Hazards Response Information System (CHRIS)
   (d) U.S. Coast Guard Bulk Cargo Finding Aid
   (e) Material safety data sheet
   (f) CAMEO (Computer Aided Management of Emergency Operations)
   (g) CHEMTREC
   (h) National Institute for Occupational Safety and Health (NIOSH) *Pocket Guide to Chemical Hazards*
   (i) ACGIH

15.1.1.3 Hazardous materials technicians with a marine tank vessel specialty shall also receive training to meet governmental response and occupational health and safety regulations.

Marine tank vessel responders should be familiar with the following publications:

1. Title 33 CFR, U.S. Coast Guard, "Navigation and Navigable Waters" [6]
2. Title 46 CFR, U.S. Coast Guard, "Shipping" [7]
3. International Convention for Prevention of Pollution from Ships (MARPOL) [8]
4. International Convention for Safety of Life at Sea (SOLAS) [9]
5. *International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code)* [10]
6. *International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)* [11]

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7. Title 29 CFR Part 1910.120, OSHA "Hazardous Waste Operations and Emergency Response (HAZWOPER)" [12]

Additional maritime industry standards and codes of practice can also provide useful information, including the following resources:

1. *International Safety Guide for Oil Tankers and Terminals* (ISGOTT) [13]
2. Society of International Gas Tanker and Terminal Operators (SIGTTO) publications [14]
3. International Chamber of Shipping *Tanker Safety Guide: Chemicals (ICSTSG)* [15]
4. "Chemical Hazard Response Information System (CHRIS)," which includes CHRIS+ and www.chrismanual.com [16]

15.1.2 Goal.

15.1.2.1 The goal of the competencies in this chapter shall be to provide the hazardous materials technician with a marine tank and non-tank vessel specialty with the knowledge and skills to perform the tasks in 15.1.2.2 in a safe manner.

15.1.2.2 In addition to being competent at the hazardous materials technician level, the technician with a marine tank and non-tank vessel specialty shall be able to perform the following tasks:

(1) Analyze a hazardous materials incident involving marine tank and non-tank vessels 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 marine tank and non-tank vessels and its cargo systems
   (b)* Predict the likely behavior of marine tank and non-tank vessels and its contents in an emergency
   (c)* Establish initial appropriate controls

(2) Plan a response for an emergency involving marine tank vessels 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 marine tank vessels
   (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 marine tank vessels

Other issues to be addressed include the following:

1. Develop a site safety plan, which would include the personal protective equipment (PPE) that would be required for each response level and sufficient training for personnel on the vessel and for maintenance of gear.
2. Identify other agencies/organizations that may be better equipped for responding to a high-level incident (i.e., U.S. Coast Guard Strike Team, mutual aid organizations, or response organizations).
3. Conduct plume models (air, water, etc.) using in-house or external modeling resources (i.e., scientific support coordinator).

The technician is a part of the team responding to the incident and will work in concert with other members of the response organization.

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A.15.1.2.2(1)(b) External parameters that could affect the incident, including, but not limited to, weather, currents, and tides, should be monitored.

A.15.1.2.2(1)(c) Examples of appropriate controls in the marine environment include securing the vessel (i.e., anchoring or mooring), stabilizing the vessel, establishing exclusion zones, and precautions for public and personnel safety.

A hazardous materials response team responding to or preparing for an incident with a marine tank vessel should be aware of information that the local Coast Guard officer in charge of marine inspections (OCMI) and other local authorities will require. Before a vessel can continue on the intended route, move to another location, or complete temporary repairs, the OCMI will require specific information and plans to determine the feasibility and safety implications of the proposal. Some items that need to be considered during an incident include the following:

1. Identity of the cargo or cargoes involved, identified by the trade name and proper shipping name under the bulk marine classification system — do not use a local nickname of the cargo — the actual chemical name and CHRIS code
2. Nearest facility that could take the material, and nearest location where the cargo could be trans-shipped (vessel to vessel)
3. Nearest location where the vessel could be repaired, including a shipyard
4. Agencies to be contacted, including the National Response Center and other local agencies
5. Requirement for Coast Guard approval prior to moving the vessel, and possibility that a classification society (e.g., the American Bureau of Shipping) might also be required to assess damage and develop a plan for repairs
6. Logistical issues related to transferring cargo and/or moving the vessel
7. Stress and stability issues that could affect the safety of the vessel, including situations that could change those conditions
8. Ability to stop leaks, contain released material, or make temporary repairs that might be necessary before moving the vessel or transferring cargo
9. Development of transfer plans, transit plans, and repair proposals
10. Need for evacuation and ensuring the safety of the vessel crew, responders, and the public

15.1.3 Mandating of Competencies. This standard shall not mandate that hazardous materials response teams performing offensive operations on marine tank vessels have technicians with a marine tank and non-tank vessel specialty.

Personnel responding to incidents with marine tank vessels should be aware of the particular issues and limitations associated with responding to incidents on this type of equipment and/or in the maritime environment. Where responders do not have specific knowledge of these issues and limitations, they should consult with other, experienced personnel who can provide that guidance (see 15.1.1.2).

15.1.3.1 Hazardous materials technicians operating within the bounds of their training as listed in Chapter 7 shall be able to respond to marine vessel incidents.

15.1.3.2* If a hazardous materials response team desires to train some or all its technicians to have in-depth knowledge of marine tank and non-tank vessels, this chapter shall set out the minimum required competencies.

Responders need to be trained only in the competencies to address the types of marine tank vessels to which they are expected to respond. For example, if a company ships cargo only by barges, its personnel need to be trained only in the competencies appropriate for barges and not to meet the competencies on other types of vessels. Competencies for responders are divided into tank barges and tank ships.

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A.15.1.3.2 Responders who acquire the marine tank and non-tank vessel specialty are best prepared to respond to hazardous material incidents on a wide variety of marine vessel types. However, there may be occasions where a responder may only be expected to respond to an incident for a select type of marine vessel that is operating within the area of the authority having jurisdiction. For example, if a company only ships cargo by barges, their responders only need to be trained to the tank vessel competencies, and need not be trained to meet the competencies for non-tank vessels.

15.2 Competencies — Analyzing the Incident.

15.2.1 Determining the Type and Extent of Damage to Marine Vessels, Tank and Non-Tank. Given examples of damaged marine vessels, the technician with a marine tank and non-tank vessel specialty shall describe the type and extent of damage to each marine vessel and its cargo ballast systems and shall meet the following related requirements:

Responders to hazardous material incidents involving marine tank vessels should acquire all available information related to the physical characteristics of the vessel. The OCMI and classification society might require the following information before temporary repairs can be completed and the vessel can continue on the intended route. This information includes, but is not limited to, the following:

1. Vessel name and official numbers?
2. Is the vessel still aground? Is the vessel on ground or an object?
3. Is there ingress of water, what location?
4. Can you see any damage?
5. Are there other vessels in the area to assist?
6. If a barge, what is the tow configuration?
7. Stability of vessel?

Information regarding a particular vessel can be found in, but not limited to, the following sources on the vessel:

1. General Arrangement Plan
2. Capacity Plan
3. *Procedures & Arrangements (P&A) Manual*
4. Certificate of Fitness (foreign flag vessels) or Certificate of Inspection (U.S. flag vessels)
5. Cargo/Ballast Piping Plan
6. Vessel Response Plans and/or Shipboard Marine Pollution Emergency Plan
7. Fire and Emergency Plan

(1)* Given examples of marine vessels, describe a marine vessel's basic construction and arrangement features, for marine tank and non-tank vessels

(2)* Given examples of various marine vessels, point out and explain the design and purpose of each of the various types of marine vessel cargo/ballast compartment design, structure, and components, when present

(3)* Given examples of various fittings arrangements for marine tank and non-tank vessels, point out and explain the design, construction, and operation of each

(4) Given a marine tank and non-tank vessel, identify and describe the normal methods of cargo transfer

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Examples of normal methods of cargo transfer include the following:

1. Deepwell pump
2. Pressuring cargo off
3. Over-the-top loading
4. Vapor return and/or vapor balancing

Other examples of transfers include the following:

1. Vessel to shore
2. Vessel to vessel (i.e., barge to ship, barge to barge, ship to ship, etc.)

(5) Given a marine non-tank vessel, describe the following systems processes used in conjunction with cargo transfer:

(a) Cargo transfer system (including liquid and vent piping arrangements)
(b) Mechanical systems (cranes, booms, belts, etc.)
(c) Pressure systems
(d) Vacuum systems
(e) Cargo securing system components (tie-downs, lashings, twist-locks, etc.)

(6) Given a marine tank vessel, describe the following systems/processes used in conjunction with cargo transfer:

(a) Cargo transfer system (including liquid and vent piping arrangements)
(b) Vapor recovery system
(c) Vapor balancing
(d) Pressuring cargo
(e) Vacuum systems
(f) Purging with an inert medium prior to transfer
(g) Padding tanks
(h) Inert gas system (tank vessel only)
(i) Cargo monitoring systems (tank levels/alarms, tank pressures, pump controls, cargo line pressures, and cargo temperatures)

(7) Given the following types of cargo compartment damage on marine vessels, identify the type of damage in each example and explain its significance:

(a) Crack, puncture, slit, or tear
(b) Dent
(c) Flame impingement
(d) Over- or underpressurization
(e) Brittle fracture
(f) Pinhole or corrosion
(g) Damage to a heat-affected zone (i.e., welded areas)

The following is information that the responders, local agencies, Coast Guard OCMI, and classification society will need for the previously mentioned types of damage:

1. Vessel name and official numbers
2. Location of damage on the vessel
3. Size, vertical/horizontal, location with waterline
4. Whether there is ingress of water and what location
5. Whether any damage can be seen or whether it is located below water/cargo
6. Whether other vessels are in the area to assist
7. If a barge, the tow configuration
8. Stability of vessel

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(8) Given examples of the types of emergency situations a marine vessel may experience that may result in damage to the vessel or its cargo transfer system, describe the following types of marine vessel emergencies and explain their significance related to the vessel's seaworthiness and cargo containment:

(a) Grounding
(b) Stranding

The following is information and items that vessel representatives and responders need to know when passing along information to U.S. Coast Guard and/or classification society.

1. Are there other vessels in the area to assist, take you under tow, or push you in?
2. Can the vessel weigh anchor? What is company policy on requesting assistance and preventing the vessel from grounding or alliding/colliding with another vessel or object?

(c) Allision/collision

Information and items that vessel representatives and responders will need to know when passing along information to U.S. Coast Guard and/or classification society include the following:

1. Does the space with the damage still have ingress of water? What is the location?
2. Can the vessel representative or responder see any damage? What is a description of the damage?
3. Are there other vessels in the area to assist?
4. If a barge, what is the tow configuration?
5. Stability?

(d) Foundering

Details vessel representatives and responders need to include when communicating to local agencies, U.S. Coast Guard, and/or classification society include the following:

1. Are there other vessels in the area to assist the vessel in distress, take the vessel in tow, or push it in?
2. Will the company policy allow this?
3. Can it weigh anchor?

(e) Heavy weather damage

The responder should be aware of conditions that could affect the stress and stability of a vessel, which include the following:

1. Wind, waves, tides, and currents
2. Movement of nearby vessels
3. Shifting, adding, or removing weight
4. Reduction of reserve buoyancy
5. Free surface effects in ballast or cargo compartments
6. Free communication effects in a flooded compartment
7. Downflooding

(f) Fire

Details vessel representatives and responders will need to include when communicating to local agencies, U.S. Coast Guard, and/or classification society include the following:

1. Is the fire out?
2. Does the crew have proper PPE and training to fight the fire?

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3. Is the vessel able to maintain power or is it dead in the water (DIW)?
4. What is the stability of the vessel after water was used to fight the fire? Are voids and cargo spaces filled with water, causing a free-water effect?

(g) Explosion/BLEVE
(h) Polymerization and/or chemical reaction
(i) Cargo shifting or fluidization/liquefaction

(9) Given a marine vessel involved in an emergency, identify the factors to be evaluated as part of the marine vessel damage assessment process, including the following:

(a) Type of marine vessel
(b) Type and location of damage
(c) Fire control, stability, and ventilation plans/documentation
(d) Dangerous cargo manifest
(e) Stowage plan
(f) Ingress and egress and potential restrictions due to security arrangements
(g) Bilge and ballast arrangements
(h) Pressurized or nonpressurized systems
(i) Cargo pumping arrangements (tank vessels only)
(j) Number and location of cargo compartments
(k) Cargo transfer and monitoring control system/location
(l) Location/arrangement of void spaces in cargo area
(m) Type/characteristics of cargoes in the damaged cargo system
(n) Type/characteristics of other cargoes on the marine non-tank vessel (outside the damaged area)
(o) Cargo compatibility
(p) Stability and stresses applied to the marine non-tank vessel
(q) Type and nature of cargo system damage
(r) Amount of product both released and remaining in the cargo compartment

The local agencies, OCMI, and classification society will need to know the following:

1. Void spaces on the vessel/barge: Are the spaces dry or is there ingress of water? (What are the sights and sounds to be listening for to determine whether water is coming in?)
2. Cargo tank configuration, locations of cargo tanks and how they are arranged.
3. If there is water in the void/space, at what level is the water or cargo? When was the last time the tanks were sounded?
4. Appropriate SDS from the facility that loaded the cargo. Too many times variations do not match the actual cargo on board the vessel.
5. Temporary repairs/permanent repairs that will need to be made to allow the vessel to continue on transit.
6. Transit plan.

(10) Given a cargo system containing a bulk liquid, determine the amount of liquid in the cargo tank

A.15.2.1(1) Examples of marine vessels include the following:

(1) Certain bulk dangerous cargo ships

(a) Chemical tank ships
(b) Sophisticated parcel chemical tank ships
(c) Specialized chemical tank ships
(d) Chemical tank barges

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(2) Liquefied gas tank ships
 (a) Fully pressurized tank ships
 (b) Semi-pressurized tank ships
 (c) Ethylene (LPG and chemical gas) ships
 (d) Fully refrigerated tank ships
 (e) Liquefied natural gas (LNG) ships
 (f) Liquefied gas barges

(3) Tank ships
 (a) Oil tank barges
 (b) Oil tank ships

(4) Cargo and miscellaneous vessels
 (a) Container vessels
 (b) Break bulk
 (c) Roll on roll off (RoRo) vessels
 (d) Dry bulk cargo ships or barges

(5) Offshore supply vessels

(6) Passenger vessels
 (a) Cruise ship
 (b) Ferries

(7) Other vessels
 (a) Tug boats
 (b) Fishing vessels
 (c) Crew boat
 (d) Mobile offshore drilling unit

Examples of marine vessels include the following:

1. Tank ships
   - **a.** Oil/chemical tank ships
   - **b.** Sophisticated parcel chemical tank ships
   - **c.** Specialized chemical tank ships
2. Liquefied gas tank ships
   - **a.** Fully pressurized tank ships
   - **b.** Semipressurized tank ships
   - **c.** Ethylene (LPG and chemical gas) ships
   - **d.** Fully refrigerated tank ships
   - **e.** Liquefied natural gas (LNG) ships
3. Tank barges
   - **a.** Oil/chemical tank barges
   - **b.** Liquefied gas barges
4. Cargo vessels (Title 46 CFR, Subchapter I, Part 90-105) [7]
   - **a.** Dry cargo barge
   - **b.** Offshore supply vessel (OSV)

A.15.2.1(2) Types of marine tank vessel cargo compartments include the following:

(1) Barge cargo compartments
 (a) Oil/chemical tank barges
 (b) Liquefied gas barges

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(2) Oil/product ship cargo compartments

(3) Chemical ship cargo compartments
  (a) Typical tank construction
  (b) Irregular-shaped tank construction
  (c) Tank-within-a-tank construction
  (d) Baffled tank construction

(4) Liquefied gas ship cargo compartments
  (a) Independent type A
  (b) Independent type B
  (c) Independent type C
  (d) Membrane
  (e) Semimembrane
  (f) Internal insulation type 1
  (g) Internal insulation type 2
  (h) Integral

(5) Cargo compartment containment types (for barges and tank ships)
  (a) Coated, lined, uncoated, or cladded
  (b) Stainless steel or carbon steel
  (c) Insulated/thermal protection

(6) Other spaces (for barges and tank ships)
  (a) Cofferdams
  (b) Double bottoms and/or double sides
  (c) Pump rooms
  (d) Other void spaces adjacent to the cargo area

Responders to hazardous materials spills and releases from marine tank vessels should acquire all available information related to the physical characteristics of the vessel. In most cases, responders should work closely and consult with individuals who are experts in the construction of the vessel, its tanks, and other applicable details (the owner, operator, officers, crew, cargo owner, or other individuals as appropriate). Sources of information regarding a particular vessel can include, but are not limited to, the following:

(1) General arrangement plan
(2) Procedures and arrangement (P&A) manual
(3) Fire and emergency plan

The following are all vessel container/compartment types:

1. Container cell
2. Cargo hold
  a. General cargo hold
  b. Bulk cargo hold
  c. Barge hopper
  d. Roll on/roll off vessel
3. Weather decks
  a. Vehicle
  b. Railcar
  c. Container
  d. General
4. Other spaces
  a. Cofferdams
  b. Double bottoms and/or double sides

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- **c.** Pump rooms
- **d.** Other void spaces adjacent to or within the cargo area
- **e.** Refrigeration spaces
- **f.** Ship stores
- **g.** Fuel tanks
- **h.** Deep tanks
- **i.** Pipe tunnel
- **j.** Duct keel
- **k.** Ballast tanks

Types of marine tank vessel cargo compartments include the following:

1. Tank barge cargo compartments
   - **a.** Integral gravity tank
   - **b.** Independent gravity tank
   - **c.** Pressure vessels
2. Oil/product tank ship cargo compartments (integral gravity tank)
3. Chemical tank ship cargo compartments
   - **a.** Independent gravity deck tank
   - **b.** Integral gravity tank
4. Liquefied gas ship cargo compartments
   - **a.** Cylindrical
   - **b.** Spherical
   - **c.** Membrane/semimembrane
5. Cargo compartment containment types (for barges and tank ships):
   - **a.** Coated, lined, uncoated, or cladded
   - **b.** Stainless steel or carbon steel
   - **c.** Insulation/thermal protection
6. Other spaces for barges and tank ships
   - **a.** Cofferdams
   - **b.** Double bottoms and/or double sides
   - **c.** Pump rooms
   - **d.** Other void spaces adjacent to or within the cargo area

Δ **A.15.2.1(3)** Examples of fittings arrangements for tank vessels include the following:

(1) Cargo system valves
  (a) Gate valves
  (b) Globe valves
  (c) Butterfly valves
  (d) Ball valves
  (e) Check valves
  (f) Angle valves
  (g) Pneumatic, hydraulic, or electrically operated valves

(2) Cargo pipeline systems
  (a) Single loop (single line connected to all tanks)
  (b) Branch (multiple lines capable of operating in a segregated or common system of tanks)
  (c) Single tank (dedicated, fully segregated piping system)

(3) Cargo pumps
  (a) Centrifugal
  (b) Positive displacement

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   (c) Screw drive
   (d) Deepwell
   (e) Portable emergency/backup pumps
   (f) Stripping systems
   (g) Systems for providing power to the pumps — hydraulic, electric, steam, direct diesel

(4) Cargo compartment fittings
   (a) Tank hatch/expansion trunk
   (b) Tank gauging/sampling points
   (c) Vents
   (d) Pressure gauges
   (e) Cleaning ports (Butterworth hatches)
   (f) Spill valves

(5) Emergency shutdown systems
   (a) Manual or automatic/integrated
   (b) Electrical
   (c) Pneumatic
   (d) Remote-actuated/radio
   (e) Thermal

(6) Pressure relief systems
   (a) Safety relief valves
   (b) Pressure relief valves
   (c) Vacuum relief valves
   (d) Regulator valves
   (e) Rupture discs

(7) Cargo temperature control systems
   (a) Steam/water
   (b) Thermal oil
   (c) Liquefaction systems (e.g., glycol)
   (d) Heat exchanger

(8) Cargo cooling (chemical ships) or refrigeration systems (liquefied gas ships)

(9) Cargo compressors (liquefied gas ships)

(10) Cargo vapor handling systems and piping

(11) Inert systems
   (a) Flue gas (tank ships only)
   (b) Inert gas generator (tank ships only)
   (c) Nitrogen generation/bottle supplied systems

(12) Measurement and sampling systems
   (a) Open gauging systems
   (b) Closed gauging systems
   (c) Restricted gauging systems
   (d) Automatic gauging and high level alarm systems
   (e) Level indicating devices (slip tubes, sticks, etc.)
   (f) Closed sampling systems

(13) Fire-fighting and fire protection equipment (see NFPA 1405)

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Examples of fittings on marine tank vessels include the following:

1. Valves
   a. Gate valves
   b. Globe valves
   c. Butterfly valves
   d. Ball valves
   e. Check valves
   f. Angle valves
   g. Pneumatic, hydraulic, or electrically operated valves
   h. Sluice valves
2. Above-deck and below-deck pipeline systems
   a. Single loop (single line connected to all tanks)
   b. Branch (multiple lines capable of operating in a segregated or common system of tanks)
   c. Single tank (dedicated, fully segregated piping system)
3. Pumps
   a. Centrifugal
   b. Positive displacement
   c. Screw drive
   d. Deepwell
   e. Portable emergency/backup pumps
   f. Stripping systems
   g. Pumping power systems (hydraulic, electric, steam, direct diesel)
4. Compartment fittings
   a. Tank hatch/expansion trunk
   b. Hatch covers
   c. Tank gauging/sampling points/high-level alarms
   d. Vents
   e. Pressure gauges
   f. Cleaning ports (Butterworth hatches)
   g. Drop-line connections
   h. Spill valves
   i. Fixed tank cleaning machines
   j. Pontoons
   k. Doors, elevators, and ramps
   l. Sounding tubes
   m. Sight gauge
5. Emergency shutdown systems
   a. Manual or automatic/integrated
   b. Electrical
   c. Pneumatic
   d. Remote-actuated/radio
   e. Thermal
   f. Hydraulic
6. Pressure relief systems
   a. Safety relief valves
   b. Pressure relief valves
   c. Vacuum relief valves
   d. Regulator valves
   e. Rupture discs

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7. Cargo temperature control systems
   a. Steam/water
   b. Thermal oil
   c. Cooling systems (i.e., glycol, ammonia, Freon™)
   d. Heat exchanger
   e. Electrical systems
8. Cargo cooling (chemical ships) or refrigeration systems (liquefied gas ships)
9. Cargo compressors (liquefied gas ships)
10. Cargo vapor handling systems and piping
11. Inert systems
    a. Flue gas (tank ships only)
    b. Inert gas generator (tank ships only)
    c. Nitrogen generation/bottle-supplied systems
    d. CO_2 systems
12. Measurement and sampling systems
    a. Open gauging systems
    b. Closed gauging systems
    c. Restricted gauging systems
    d. Automatic gauging and high-level alarm systems
    e. Level indicating devices (slip tubes, sticks, etc.)
    f. Closed sampling systems
13. Fire-fighting and fire protection equipment (see NFPA 1405, *Guide for Land-Based Fire Fighters Who Respond to Marine Vessel Fires*, for more details [17])

15.2.2 Predicting the Likely Behavior of the Marine Vessel and Its Contents. The hazardous materials technician with a marine tank and non-tank vessel specialty shall understand the likely behavior of both marine tank vessels and marine non-tank vessels, as well as the vessel's contents, and meet the following related requirements:

(1) Given the following types of marine vessels, provide examples of probable causes of releases:
   (a) Certain bulk dangerous cargo ships (46 CFR Subchapter O, Parts 150–153)
      i. Chemical tank ships
      ii. Sophisticated parcel chemical tank ships
      iii. Specialized chemical tank ships
      iv. Chemical tank barges
   (b) Liquefied gas tank ships (46 CFR Subchapter O, Parts 151 or 154)
      i. Fully pressurized tank ships
      ii. Semipressurized tank ships
      iii. Ethylene (LPG and chemical gas) ships
      iv. Fully refrigerated tank ships
      v. Liquefied natural gas (LNG) ships
      vi. Liquefied gas barges
   (c) Tank ships (46 CFR Subchapter D, Parts 30–39)
      i. Oil tank barges
      ii. Oil tank ships
   (d) Cargo and miscellaneous vessels (46 CFR Subchapter I, Parts 90–105)
      i. Container vessels
      ii. Break bulk
      iii. Roll on/roll off (RoRo) vessels
      iv. Dry bulk cargo ships or barges

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Responders and agencies should be aware of the possibility of incompatible cargoes aboard a vessel, along with the free surface effects. These problems can be magnified with reduction in liquid cargo volume and intensity of wave height.

Responders and agencies should also be aware that aboard an LNG/LPG carrier, any hull damage may result in loss of refrigeration of the cargo, and rapid boil-off may occur resulting in a highly flammable area.

(e) Offshore supply vessels (46 CFR Subchapter L, Parts 125–134)
(f) Passenger vessels (46 CFR Subchapter H, Parts 70–79)
   i. Cruise ship
   ii. Ferries
(g) Other vessels
   i. Tug boats (46 CFR Subchapter C, Parts 24–27)
   ii. Fishing vessels (46 CFR Subchapter C, Parts 24–28)
   iii. Crew boat (46 CFR Subchapter T, Parts 175–185)
   iv. Mobile offshore drilling unit (46 CFR Subchapter I-A, Parts 107–109)

(2)* Describe the significance of internal and external forces on a marine vessel's stress and stability in assessing marine vessel damage

(3) Given examples of the resulting damages to the cargo compartments and cargo transfer systems on marine vessels, describe the significance in the risk analysis process:
   (a) Cargo spills or releases
   (b) Tank leakage within the vessel
   (c) Overpressure/vacuum damage
   (d) Shifting cargo
   (e) Cargo/container securing systems

(4) Describe the significance of the following when assessing marine tank vessel damage:
   (a) Lining and cladding on cargo compartments
   (b) Coated and uncoated cargo compartments
   (c) Insulation or thermal protection
   (d) Heating or refrigeration coils in cargo compartments

A.15.2.2(2) The stress and stability of a vessel may be affected by the following, which the responder should be aware of:

(1) Wind, waves, tides, and currents
(2) Movement of nearby vessels
(3) Shifting, adding, or removing weight
(4) Reduction of reserve buoyancy
(5) Free surface effects in ballast or cargo compartments
(6) Free communication effects in a flooded compartment
(7) Down flooding

15.3 Competencies — Planning the Response.

15.3.1 Determining the Response Options. Given the analysis of an emergency involving marine vessels, the technician with a marine tank and non-tank vessel specialty shall determine the response options for each marine vessel involved and shall meet the following related requirements:

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(1) Describe the methods, procedures, risks, safety precautions, and equipment that are required to implement hazardous cargo incident control procedures for various types of incidents and marine vessels

(2) Describe the purpose of, potential risks associated with, procedures for, equipment required to implement, and safety precautions for the following product removal techniques for hazardous materials in all forms, including bulk, non-bulk, solids, liquids, and gases:
   (a) Vessel to/from shore transfer
   (b) Vessel-to-vessel transfer
   (c) Vessel to/from tank truck transfer
   (d) Vessel to/from rail car transfer
   (e) Internal transfer within the vessel
   (f) Jettisoning of cargo
   (g) Other types of transfers (e.g., frac/portable tanks)

(3) Describe the purpose of, procedures for, and risks associated with controlling leaks from various fittings on marine vessel cargo systems, including equipment needed and safety precautions

(4) Describe the hazards associated with working with vessels and marine property during emergencies

Responding to an incident on a marine tank vessel presents unique challenges with regard to personnel safety, including access to and egress from the vessel, entry into confined spaces, and slipping/tripping hazards.

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15.4 Competencies — Implementing the Planned Response.

15.4.1 Implementing the Planned Response. Given an analysis of an emergency involving marine vessels and the planned response, the technician with a marine tank and non-tank vessel specialty shall implement or oversee the implementation of the selected response options in a safe and effective manner and shall meet the following related requirements:

(1) Given a release from the following fittings on marine tank vessels, describe appropriate methods and procedures for controlling the release:
   (a) Tank hatch/expansion trunk
   (b) Valve or fitting
   (c) Cargo compartment vent/access hatch/door
   (d) Pressure/relief device (pressure and vacuum)
   (e) Manifold or pipeline
   (f) Transfer hoses and connections
   (g) Other deck penetrations
   (h) Bulk and non-bulk packaging

(2) Describe approved procedures for the following types of emergency cargo removal on board marine tank vessels:
   (a) Gas/liquid transfer (pressure/pump)
   (b) Flaring
   (c) Venting
   (d) Jettisoning of cargo

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(3) Describe appropriate procedures for the following types of emergency cargo removal on board marine non-tank vessels:
  (a) Cranes and other lifting equipment
  (b) Unloading systems
  (c) Ramps and other vehicular methods
  (d) Gas/liquid transfer (pressure/pump)
  (e) Venting
  (f) Jettisoning of cargo

(4) Describe the importance of bonding, grounding, or isolation procedures for the transfer of flammable and combustible cargoes, or other products that can give off flammable gases or vapors when heated or contaminated

(5) Demonstrate the methods for containing the following leaks on marine vessels:
  (a) Puncture
  (b) Irregular-shaped hole
  (c) Split or tear
  (d) Dome/hatch cover leak
  (e) Valves and piping failure
  (f) Pressure relief devices (e.g., vents, burst/rupture disc)

When attempting to contain leaks on marine tank vessels, ensure that temporary repairs that are installed will be approved by the appropriate agency(s), such as the U.S. Coast Guard or a classification society. Depending on the situation (nonemergency), it is advisable to get temporary repair approval prior to installation. If the U.S. Coast Guard or classification society does not approve of the repairs, they will have to be removed and reinstalled to their satisfaction.

Also, ensure that a permanent repair proposal is approved prior to barge moving, and ensure that the appropriate agency(s) clears the repairs and allows the barge to go back into service.

(6) Given the following product transfer and recovery equipment, describe the safe and correct application and use of the following:
  (a) Portable pumps (air, electrical, hydraulic, gasoline/diesel)
  (b) Vehicles with power-take-off driven pumps
  (c) Vehicles, such as fork lifts
  (d) Pressure liquid transfer equipment
  (e) Vacuum trucks
  (f) Cranes
  (g) Ramps
  (h) Conveyors

(7)* Given the necessary resources, describe the flaring of a pressure flammable gas from a liquefied gas tank vessel (ship or barge, as applicable)

(8) Given a scenario involving flammable liquid spill from a marine tank vessel, describe the procedures for site safety and fire control during cleanup and removal operations

A.15.4.1(7) See A.12.4.1(10).

References Cited in Commentary

1. *International Bulk Chemical Code*, International Maritime Organization (IMO), London.
2. *Provisional Categorization of Liquid Substances*, MEPC.2/Circ.10, 2010, International Maritime Organization (IMO), London.

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3. *International Gas Carrier Code*, International Maritime Organization (IMO), London.
4. *Emergency Response Procedures for Ships Carrying Dangerous Goods (EmS Guide)*, U.S. Environmental Protection Agency, Washington, DC.
5. *Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG),* International Maritime Organization (IMO), London.
6. Title 33, Code of Federal Regulations, U.S. Coast Guard, "Navigation and Navigable Waters," U.S. Government Publishing Office, Washington, DC, 2005.
7. Title 46, Code of Federal Regulations, U.S. Coast Guard, "Shipping," U.S. Government Publishing Office, Washington, DC, 2006.
8. *International Convention for Prevention of Pollution from Ships (MARPOL),* International Maritime Organization (IMO), London, 1978.
9. *International Convention for Safety of Life at Sea (SOLAS),* International Maritime Organization (IMO), 1974.
10. *International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code)*, International Maritime Organization, London, 2005.
11. *International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)*, International Maritime Organization (IMO), London, 1993.
12. Title 29, Code of Federal Regulations, Part 1910.120, OSHA "Hazardous Waste Operations and Emergency Response (HAZWOPER)", U.S. Government Publishing Office, Washington, DC, 2006.
13. *International Safety Guide for Oil Tankers and Terminals (ISGOTT),* International Chamber of Shipping, London, 2005.
14. Society of International Gas Tanker and Terminal Operators International Chamber of Shipping (ICS), www.sigtto.org.
15. *Tanker Safety Guide: Chemicals, International Chamber of Shipping, London, 2014.*
16. "Chemical Hazard Response Information System (CHRIS)," CHRIS+ and www.chrismanual.com, U.S. Department of Transportation and U.S. Coast Guard, 2002.
17. NFPA 1405, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, National Fire Protection Association, 2016.

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Competencies for Hazardous Materials Technicians with a Flammable Liquids Bulk Storage Specialty

16

In previous editions of NFPA 472, the competencies for hazardous materials technicians (HMTs) with a flammable liquids bulk storage specialty were part of the nonmandatory annex material. With this edition, the Technical Committee on Hazardous Materials Response Personnel determined that these competencies should be rewritten in mandatory language and moved to the body of NFPA 472. The significant hazards presented by flammable liquids in bulk storage require a unique set of competencies beyond those required of the HMT. In this chapter, special consideration is given to tank configurations and the types of damage they could experience, the physical and chemical properties of hydrocarbons and solvents typically stored in bulk tanks, and how these liquids are moved and transferred at terminals, in pipelines, vapor recovery systems, refineries, and other bulk storage facilities.

The HMT with a flammable liquids bulk storage specialty has to be familiar with both atmospheric and low-pressure storage tanks as well as primary and secondary spill containment measures, and has to be able to determine the behavior of storage tanks and their contents in the event of a fire or explosion. Finally, the HMT with a flammable liquids bulk storage specialty must know how to determine response options to incidents involving flammable liquid bulk storage tanks and conduct or oversee the implementation of the selected response option safely and effectively.

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16.1 General.

16.1.1 Introduction.

16.1.1.1 The hazardous material technician with a flammable liquids bulk storage specialty shall be that person who, in incidents involving bulk flammable liquid storage tanks and related facilities, provides support to the hazardous materials technician and other emergency response personnel, provides strategic and tactical recommendations to the on-scene incident commander, provides oversight for fire control and product removal operations, and acts as a liaison between technicians, response personnel, and outside resources. For the purposes of this chapter, flammable liquid bulk storage tanks also include the related pipelines, piping, transfer pumps, additive tanks, and loading racks commonly found in a flammable liquid bulk storage tank facility.

Δ **16.1.1.2** The hazardous materials technician with a flammable liquids bulk storage specialty shall be trained to meet all requirements at the awareness level *(see Chapter 4)*, all

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competencies at the operations level *(see Chapter 5)*, all competencies at the technician level *(see Chapter 7)*, and all competencies of this chapter.

16.1.1.3 Hazardous materials technicians with a flammable liquids bulk storage specialty shall also receive training to meet governmental response and occupational health and safety regulations.

16.1.1.4 The hazardous materials technicians with a flammable liquids bulk storage specialty are expected to use appropriate personal protective clothing (PPE) and specialized fire, leak, and spill control equipment.

16.1.2 Goals.

16.1.2.1 The goal of the competencies in this chapter shall be to provide the hazardous materials technician with a flammable liquid bulk storage specialty with the knowledge and skills to perform the tasks in 16.1.2.2 in a safe manner.

16.1.2.2 In addition to being competent at the hazardous materials technician level, the hazardous materials technician with a flammable liquids bulk storage specialty shall 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, PPE, and control equipment by completing the following tasks:
   (a) Determine the response options (offensive, defensive, and nonintervention) for a hazardous materials/WMD incident involving flammable liquid bulk storage tanks
   (b) Ensure that the options are within the capabilities and competencies of available personnel, PPE, and control equipment
(3) Implement the planned response to a hazardous materials/WMD incident involving a flammable liquid bulk storage tank

16.1.3 Mandating of Competencies. This standard shall not mandate that hazardous materials response teams performing offensive operations on flammable liquids bulk storage tanks and related facilities have hazardous materials technicians with a flammable liquids bulk storage specialty.

16.1.3.1 Hazardous materials technicians operating within the bounds of their training as listed in Chapter 7 shall be able to respond to incidents involving flammable liquids bulk storage tanks and related facilities.

16.1.3.2 If a hazardous materials response team desires to train some or all of its hazardous materials technicians to have in-depth knowledge of flammable liquid products, bulk storage tanks, and related facilities, this chapter shall set out the minimum required competencies.

16.2 Competencies — Analyzing the Incident.

16.2.1 Determining the Type and Extent of Damage to the Bulk Storage Tank. Given examples of incidents involving bulk flammable liquid storage tanks, technicians with a flammable liquids bulk storage specialty shall describe the type of storage tank and the type

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and extent of damage to the tank and its associated valves, piping, fittings, and related equipment by completing the tasks in 16.2.1.1 through 16.2.1.6.

16.2.1.1 Given examples of various hydrocarbon and polar solvent fuels, technicians with a flammable liquids bulk storage specialty shall describe their physical and chemical properties and their impact upon the selection, application, and use of Class B extinguishing agents for spill and fire scenarios.

16.2.1.2 Given examples of various flammable liquid bulk storage operations, technicians with a flammable liquids bulk storage specialty shall be able to identify and describe the procedures for the normal movement and transfer of product(s) into and out of the facility and storage tanks. Examples shall be based on local or regional facilities and could include marketing terminals, pipeline operations and terminals, refineries, and bulk storage facilities.

16.2.1.3* Given examples of the following atmospheric pressure bulk liquid storage tanks, technicians with a flammable liquids bulk storage specialty shall describe each tank's basic 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

Δ **A.16.2.1.3** According to NFPA 30, atmospheric tanks are defined as storage tanks operating at pressures from atmospheric through a gauge pressure of 6.9 kPa (1.0 psi). 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.

16.2.1.4* Given examples of the following types of low pressure horizontal and vertical bulk liquid storage tanks, the technician shall be able to describe the tank's basic uses and design and construction features:

(1) Horizontal tank
(2) Dome roof tank

Δ **A.16.2.1.4** According to NFPA 30, low pressure tanks are defined as storage tanks operating at internal pressure above a gauge pressure of 1.0 psi (6.9 kPa) but not more than 15 psi or 1 bar gauge (103.4 kPa).

16.2.1.5 Given examples of various atmospheric and low pressure bulk liquid storage tanks and related facilities (e.g., loading racks), technicians with a flammable liquids bulk storage specialty shall describe the design and purpose of each of the following storage tank components, where 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 and pressure relief devices
(5) Tank valves
(6) Tank gauging devices
(7) Tank overfill device
(8) Secondary containment methods (as applicable)
(9) Transfer pumps (horizontal or vertical)
(10) Tank piping and piping supports
(11) Vapor recovery units (VRU) and vapor combustion units (VCU)
(12) Truck loading rack additive tanks
(13) Loading rack product control and spill control systems
(14) Fixed or semifixed fire protection system

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Δ **16.2.1.6** Given examples of primary and secondary spill confinement measures, technicians with a flammable liquids bulk storage specialty shall describe the design, construction, and incident response considerations associated with each method provided.

16.2.2 Predicting the Likely Behavior of the Bulk Storage Tank and Contents. Technicians with a flammable liquids bulk storage specialty shall predict the likely behavior of the tank and its contents by completing the tasks in 16.2.2.1 through 16.2.2.4.

16.2.2.1 Given examples of different types of flammable liquid bulk storage tank facilities, technicians with a flammable liquids bulk storage specialty shall identify the impact of the following fire and safety features on the behavior of the products during an incident:

(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

16.2.2.2 Given a flammable liquid bulk storage tank involved in a fire, technicians with a flammable liquids bulk storage specialty shall identify the factors to be evaluated as part of the analysis 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, full-surface fire)
(5) Tank spacing and exposures
(6) Fixed or semifixed fire protection systems present

16.2.2.3* Given examples of scenarios involving flammable liquid bulk storage tanks, technicians with a flammable liquids bulk storage specialty shall describe the likely fire and spill behavior for each incident.

A.16.2.2.3 Examples of fire and spill incidents include tank overfills, seal fires on floating roof tanks, floating roof with a sunken internal roof, tank or piping failures, and full-surface fire.

16.2.2.4* Technicians with a flammable liquids bulk storage specialty shall describe the causes, hazards, and methods of handling the following conditions as they relate to fires involving flammable liquid bulk storage tanks and the related products:

(1) Frothover
(2) Slopover
(3) Boilover

A.16.2.2.4 For additional information, see NFPA 30 and API 2021, *Guide for Fighting Fires in and Around Flammable and Combustible Liquid Atmospheric Petroleum Storage Tanks*.

16.3 Competencies — Planning the Response.

Given an analysis of an incident involving flammable liquid bulk storage tanks, technicians with a flammable gases bulk storage specialty shall determine response options for the storage tank involved by completing the tasks in 16.3.1 through 16.3.11.

16.3.1 Technicians with a flammable liquids bulk storage specialty shall describe the factors to be considered in evaluating and selecting Class B fire-fighting foam concentrates for use on flammable liquids.

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16.3.2 Technicians with a flammable liquids bulk storage specialty shall describe the factors to be considered for the portable application of Class B fire-fighting foam concentrates and related extinguishing agents for the following types of incidents:

(1) Flammable liquid spill (no fire)
(2) Flammable liquid spill (with fire)
(3) Flammable liquid storage tank fire

Δ **16.3.3** Given examples of types of flammable liquid bulk storage tanks, technicians with a flammable liquids bulk storage specialty shall identify and describe the application, use, and limitations of the types of fixed and semifixed fire protection systems that can be used, including the following:

(1) Foam chambers
(2) Catenary systems
(3) Subsurface injection systems
(4) Fixed foam monitors
(5) Foam and water sprinkler systems

16.3.4 Technicians with a flammable liquids bulk storage specialty shall describe the hazards, safety procedures, and tactical guidelines for handling an accumulated (in-depth) flammable liquid-spill fire.

16.3.5 Technicians with a flammable liquids bulk storage specialty shall describe the hazards, safety procedures, and tactical guidelines for handling the product and water drainage and runoff problems that can be created at a flammable liquid bulk storage tank fire.

16.3.6 Technicians with a flammable liquids bulk storage specialty shall describe the hazards, safety procedures, and tactical guidelines for handling a flammable liquid bulk storage tank with a sunken floating roof.

16.3.7 Given a flammable liquid bulk storage tank fire, technicians with a flammable liquids bulk storage specialty shall 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
(8) Pump seal fire

16.3.8* Given the size, dimensions, and products involved for a flammable liquid spill fire, technicians with a flammable liquids bulk storage specialty shall determine the following:

(1) Applicable extinguishing agent(s)
(2) Approved application method (both portable and fixed system applications)
(3) Approved application rate and duration based on NFPA 11 or other guidance used by the AHJ
(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

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Δ **A.16.3.8** For additional information, see NFPA 11.

16.3.9* Given the size, dimensions, and product involved for a flammable liquid bulk storage tank fire, technicians with a flammable liquids bulk storage specialty shall determine the following:

(1) Applicable extinguishing agent(s)
(2) Approved application method (both portable and fixed system applications)
(3) Approved application rate and duration based on NFPA 11 or other guidance used by the AHJ
(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
(6) Recommendations for controlling product and water drainage and runoff

A.16.3.9 See A.16.3.8.

16.3.10* Given the size, dimensions, and product involved for a fire involving a single flammable liquid bulk storage tank and its dike area, technicians with a flammable liquids bulk storage specialty shall determine the following:

(1) Applicable extinguishing agent(s)
(2) Approved application method (both portable and fixed system applications)
(3) Approved application rate and duration based on NFPA 11 or other guidance used by the AHJ
(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
(6) Recommendations for controlling product and water drainage and runoff

A.16.3.10 See A.16.3.8.

16.3.11* Given the size, dimensions, and product involved for multiple flammable liquid bulk storage tanks burning within a common dike area, technicians with a flammable liquids bulk storage specialty shall determine the following:

(1) Applicable extinguishing agent(s)
(2) Approved application method (both portable and fixed system applications)
(3) Approved application rate and duration based on NFPA 11 or other guidance used by the AHJ
(4) Amount of Class B foam concentrate and water required
(5) Volume and rate of application of water for cooling involved and exposed tanks
(6) Recommendations for controlling product and water drainage and runoff

A.16.3.11 See A.16.3.8.

Δ 16.4 Competencies — Implementing the Planned Response.

Given an analysis of an incident involving flammable liquid bulk storage tanks, technicians with a flammable liquids bulk storage specialty shall implement or oversee the implementation of the selected response options completing the tasks in 16.4.1 and 16.4.2 in a safe and effective manner.

16.4.1 Given a scenario involving a flammable liquid fire, technicians with a flammable liquids bulk storage specialty shall demonstrate the safe and effective methods for extinguishing the following types of fires by using portable application devices:

(1) Valve and flange fires
(2) Pump fire (horizontal or vertical)

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(3) Pressure vent fire
(4) Large spill fire
(5) Loading rack fire
(6) Storage tank fire

Δ **16.4.2** Given a scenario involving a three-dimensional flammable liquid fire, technicians with a flammable liquids bulk storage specialty shall demonstrate the safe and effective method for controlling and extinguishing the fire.

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Competencies for Hazardous Materials Technicians with a Flammable Gases Bulk Storage Specialty

17

In previous editions of NFPA 472, the competencies for hazardous materials technicians (HMTs) with a flammable gases bulk storage specialty were part of the nonmandatory annex material. With this edition, the Technical Committee on Hazardous Materials Response Personnel determined that these competencies should be rewritten in mandatory language and moved to the body of NFPA 472. The significant hazards presented by flammable gases in bulk storage require a unique set of competencies beyond those required of the HMT. In this chapter, special consideration is given to pipelines, transfer pumps, additive tanks, and loading racks commonly found in a flammable gases bulk storage facility.

The HMT with a flammable gases bulk storage specialty has to know how to determine the type of bulk storage tank and the extent of damage, and the likely behavior of the tank and its contents in an incident. With these types of tanks, high pressure also presents a significant hazard, and the HMT with a flammable gases bulk storage specialty must be familiar with liquid and vapor valves, pressure-relief valves, gauging devices, transfer pumps, monitoring and detection systems, and perhaps, most importantly, fixed or semifixed fire protection systems. Finally, the HMT with a flammable gases bulk storage specialty must know how to determine response options to both fire and non-fire incidents involving flammable gases bulk storage tanks and conduct or oversee the implementation of the selected response option safely and effectively.

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17.1 General.

17.1.1 Introduction.

Δ **17.1.1.1** The hazardous material technician with a flammable gases bulk storage specialty shall be that person who, in incidents involving bulk flammable gases storage tanks and related facilities, provides support to the hazardous materials technician and other personnel, provides strategic and tactical recommendations to the on-scene incident commander, provides oversight for fire control and product removal operations, and acts as a liaison between technicians, response personnel, and outside resources. For the purposes of this chapter, flammable gases bulk storage tanks also include the related pipelines, piping, transfer pumps, and loading racks commonly found in a flammable gases bulk storage tank facility.

Δ **17.1.1.2** The hazardous materials technician with a flammable gases bulk storage specialty shall be trained to meet all requirements at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all competencies at the technician level *(see Chapter 7)*, and all competencies of this chapter.

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17.1.1.3 Hazardous materials technicians with a flammable gases bulk storage specialty shall also receive training to meet governmental response and occupational health and safety regulations.

17.1.1.4 The hazardous materials technicians with a flammable gases bulk storage specialty are expected to use appropriate PPE and specialized fire, leak, and spill control equipment.

17.1.2 Goal.

17.1.2.1 The goal of the competencies in this chapter shall be to provide the hazardous materials technician with a flammable gases bulk storage specialty with the knowledge and skills to perform the tasks in 17.1.2.2 in a safe manner.

17.1.2.2 In addition to being competent at the hazardous materials technician level, the hazardous materials technician with a flammable gases bulk storage specialty shall be able to perform the following tasks:

(1) Analyze an incident involving a flammable gas bulk 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, PPE, and control equipment by completing the following tasks:
   (a) Determine the response options (offensive, defensive, and nonintervention) for a hazardous materials/WMD incident involving flammable gas bulk storage tanks
   (b) Ensure that the options are within the capabilities and competencies of available personnel, PPE, and control equipment
(3) Implement the planned response to a hazardous materials/WMD incident involving a flammable gas bulk storage tank

17.1.3 Mandating of Competencies. This standard shall not mandate that hazardous materials response teams performing offensive operations on flammable gases bulk storage tanks and related facilities have hazardous materials technicians with a flammable gases bulk storage specialty.

17.1.3.1 Hazardous materials technicians operating within the bounds of their training as listed in Chapter 7 shall be able to respond to incidents involving flammable gases bulk storage tanks and related facilities.

17.1.3.2 If a hazardous materials response team desires to train some or all its hazardous materials technicians to have in-depth knowledge of flammable gas products and bulk storage tanks and related facilities, this chapter shall set out the minimum required competencies.

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17.2 Competencies — Analyzing the Incident.

17.2.1 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 shall describe the type of storage tank and extent of damage to the tank and its associated piping and fittings by completing the tasks in 17.2.1.1 through 17.2.1.3.

17.2.1.1 Given examples of various flammable gas bulk storage operations, technicians with a flammable gases bulk storage specialty shall identify and describe the procedures for the

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normal movement and transfer of product(s) into and out of the facility and storage tanks. Examples include distribution terminals, pipeline operations, loading/unloading facilities, gas plants, and petrochemical facilities.

17.2.1.2* Given examples of the following types of high pressure bulk gas storage tanks, technicians with a flammable gases bulk storage specialty shall describe the tank's uses and design and construction features:

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

Δ **A.17.2.1.2** Additional information on the design and construction of high pressure bulk gas storage tanks can be referenced from NFPA 58 and API 2510-A, *Fire Protection Considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities*.

17.2.1.3 Given examples of various high pressure bulk gas storage tanks, technicians with a flammable gases bulk storage specialty shall point out and explain the design and purpose of each of the following storage tank components and fittings:

(1) Liquid valve and vapor valve
(2) Excess flow valves
(3) Pressure relief valve
(4) Gauging device
(5) Tank piping and piping supports
(6) Transfer pumps
(7) Monitoring and detections systems
(8) Fixed or semifixed fire protection system

17.2.2 Predicting the Likely Behavior of the Bulk Storage Tank and Contents. Technicians with a flammable gases bulk storage specialty shall predict the likely behavior of the tank and its contents by completing the tasks in 17.2.2.1 through 17.2.2.3.

17.2.2.1 Given examples of different types of bulk flammable gas storage tank facilities, technicians with a flammable gases bulk storage specialty shall identify the impact of the following fire and safety features on the behavior of the products during an incident:

(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

17.2.2.2 Given examples of different types of flammable gas bulk storage tanks, technicians with a flammable gases bulk storage specialty shall identify and describe the application, use, and limitations of the types of fixed and semifixed fire protection systems that can be used, including the following:

(1) Water spray systems
(2) Fixed water monitors
(3) Fixed hydrocarbon monitoring systems

17.2.2.3 Given a flammable gas bulk storage tank and its associated piping, technicians with a flammable gases bulk storage specialty shall describe the likely breach or release mechanisms and fire scenarios.

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17.3 Competencies — Planning the Response.

Given an analysis of an emergency involving flammable gas storage tanks, technicians with a flammable gases bulk storage specialty shall determine response options for the storage tank involved. The technician with a flammable gases bulk storage specialty shall be able to perform the tasks in 17.3.1 through 17.3.5.

17.3.1 Technicians with a flammable gases bulk storage specialty shall 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)

17.3.2 Given a flammable gas storage tank with a liquid leak from the pressure relief valve, technicians with a flammable gases bulk storage specialty shall describe the hazards, safety, and tactical considerations for controlling this type of leak.

17.3.3 Technicians with a flammable gases bulk storage specialty shall 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

17.3.4 Technicians with a flammable gases bulk storage specialty shall describe the concept of autorefrigeration and the effect that flaring or venting of gas or liquid has on tank pressure (flammable gas or flammable liquid product).

17.3.5 Technicians with a flammable gases bulk storage specialty shall describe the hazards, safety procedures, and tactical guidelines for handling product and water drainage and runoff problems that can be created at a flammable gas bulk storage facility incident.

17.4 Competencies — Implementing the Planned Response.

Given an analysis of an emergency involving flammable gas bulk storage tanks, technicians with a flammable gases bulk storage specialty shall implement or oversee the implementation of the selected response options in a safe and effective manner by completing the tasks in 17.4.1 through 17.4.4.

17.4.1 Given a scenario involving a flammable gas incident, technicians with a flammable gases bulk storage specialty shall demonstrate the safe and effective methods 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)

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17.4.2 Given a scenario involving the simultaneous release of both flammable liquids and flammable gases, technicians with a flammable gases bulk storage specialty shall 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

17.4.3 Technicians with a flammable gases bulk storage specialty shall demonstrate grounding and bonding procedures for the transfer of flammable gases, including the following:

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

17.4.4 Given a scenario involving a flammable gas incident from a bulk storage tank or pipeline, technicians with a flammable gases bulk storage specialty shall describe the procedures for site safety and fire control during cleanup and removal operations.

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Competencies for the Hazardous Materials Technician with a Radioactive Material Specialty

18

In previous editions of NFPA 472, the competencies for hazardous materials technicians with a radioactive material specialty have been part of the nonmandatory annex material. With this edition, the Technical Committee on Hazardous Materials Response Personnel determined that these competencies should be rewritten in mandatory language and moved to the body of NFPA 472. The significant hazards presented by radioactive materials require a unique set of competencies beyond those required of the hazardous materials technician. In this chapter, special consideration is given to the use of radiation detection instruments, controlling radiation exposure, and conducting hazard assessments.

The hazardous materials technician with a radioactive material specialty must be familiar with nuclear science and radioactivity and have an understanding of the terms and units used to describe radiation and radioactive materials. In addition, the hazardous materials technician with a radioactive material specialty must understand the biological effects of radiation on the human body, be familiar with radiation detector theory, and understand how radioactive materials are transported. In response planning, knowing how to calculate exposure rate and stay times is critical. Additionally, techniques for minimizing exposure and calculating shield thickness must be understood. The hazardous materials technician with a radioactive specialty must also be trained in the use of radiation survey instrumentation, know how to implement the planned response, control contamination, and decontaminate personnel.

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18.1 General.

18.1.1 Introduction.

18.1.1.1 The hazardous materials technician with a radioactive material specialty shall be that person who provides support to the hazardous materials technician on the use of radiation detection instruments, manages the spread of contamination and control of radiation exposure, conducts hazards assessment, and acts as a liaison between hazardous materials technicians at incidents involving radioactive materials.

Δ **18.1.1.2** The hazardous materials technician with a radioactive material specialty shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all competencies at the hazardous materials technician level *(see Chapter 7)*, and the competencies of this chapter.

18.1.1.3 Hazardous materials technicians with a radioactive material specialty shall also receive training to meet governmental response and occupational health and safety regulations.

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18.1.1.4 The hazardous materials technicians with a radioactive material specialty shall be expected to use specialized protective clothing and survey instrumentation.

18.1.2 Goal.

18.1.2.1 The goal of the competencies in this chapter shall be to provide the hazardous materials technician with a radioactive material specialty with the knowledge and skills to perform the tasks in 18.1.2.2 in a safe manner.

18.1.2.2 In addition to being competent at the hazardous materials technician level, the hazardous materials technician with a radioactive material specialty shall be able to perform the following tasks:

(1) Analyze a hazardous materials/WMD incident involving radioactive materials to determine the complexity of the problem and potential outcomes
(2) Plan a response for an emergency involving radioactive material 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/WMD incident involving radioactive material

18.1.3 Mandating of Competencies. This standard shall not mandate that hazardous materials response teams performing offensive operations on radioactive material incidents have hazardous materials technicians with a radioactive material specialty.

18.1.3.1 Hazardous materials technicians operating within the bounds of their training as listed in Chapter 7 shall be able to respond to incidents involving radioactive materials.

18.1.3.2 If a hazardous materials response team elects to train some or all its hazardous materials technicians to have in-depth knowledge of radioactive materials, this chapter shall set out the minimum required competencies.

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18.2 Competencies — Analyzing the Incident.

Δ **18.2.1 Understanding Nuclear Science and Radioactivity.** Technicians with a radioactive material specialty shall have an understanding of nuclear science and radioactivity, including the units and terms used to describe radiation and radioactive material by completing the following tasks:

(1) Define the following terms:
   (a) Ionization
   (b) Nucleon
   (c) Nuclide
   (d) Isotope
   (e) Excitation
   (f) Bremsstrahlung
   (g) Fission
   (h) Fusion
   (i) Criticality
   (j) Curie
   (k) Becquerel
   (l) Specific activity
   (m) Half-life
   (n) Exposure
   (o) Absorbed dose

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(p) Dose equivalent
(q) Quality factor
(r) Roentgen
(s) Rad/gray
(t) Rem/sievert

(2) Identify the basic principles of the mass-energy equivalence concept.
(3) Identify how the neutron-to-proton ratio is related to nuclear stability.
(4) Define the following terms related to nuclear stability:

(a) Radioactivity
(b) Radioactive decay

(5) Explain the characteristics of alpha, beta, gamma, and neutron radiations and the methods by which they interact with matter.
(6) Define the term *radiation dispersal device (RDD)*.
(7) Define the term *radiation exposure device (RED)*.
(8) Define the term *improvised nuclear device (IND)*.
(9) Using reference documents or computer applications, identify the following for a given nuclide:

(a) Atomic number
(b) Atomic mass
(c) Stability
(d) Half-life
(e) Types and energies of radioactive emissions
(f) The decay chain and stable end-product of a radioactive nuclide

(10) Name examples of materials best suited as shielding from the following types of radiation:

(a) Alpha
(b) Beta
(c) Gamma
(d) Neutron

(11) Explain the concept of linear energy transfer (LET).

Δ **18.2.2 Understanding the Biological Effects of Ionizing Radiation.** Technicians with a radioactive material specialty shall have an understanding of how ionizing radiation affects the human body by completing the following tasks:

(1) Define the law of Bergonie and Tribondeau
(2) Describe factors that affect the radiosensitivity of cells
(3) Given a list of types of cells, identify which are the most and which are the least radiosensitive
(4) Define the following terms and give examples of each:

(a) Stochastic effect
(b) Nonstochastic effect

(5) Describe the $LD_{50/30}$ value for humans
(6) Identify the possible somatic and genetic effects of an acute and chronic exposure to radiation
(7) Explain the three classic syndromes and four stages of the acute radiation syndrome, and identify the exposure levels and symptoms associated with each
(8) Describe the risks of radiation exposure to a developing embryo and fetus
(9) Distinguish between the terms *somatic* and *heritable* as they apply to biological effects

Δ **18.2.3 Radiation Detector Theory.** Technicians with a radioactive material specialty shall have an understanding of radiation detector theory in order to select the correct type of

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radiological survey instrument at a hazardous materials/WMD incident involving radioactive material by completing the following tasks:

(1) Given a graph of the gas amplification curve, identify the regions of the curve
(2) Identify the characteristics of a detector operated in each of the useful regions of the gas amplification curve
(3) Describe the methods employed with gas-filled detectors to discriminate among various types of radiation and various radiation energies
(4) Explain how a scintillation detector and associated components operate to detect and measure radiation
(5) Explain how neutron detectors detect neutrons and provide electrical signals
(6) Explain the fundamental mechanism by which isotope identification detectors operate and the advantages and disadvantages of the types of systems available

18.2.4 Radioactive Material Transportation. Technicians with a radioactive material specialty shall have an understanding of how radioactive material is transported and how to identify this material at a hazardous materials/WMD incident by completing the following tasks:

(1) List the applicable agencies that have regulations governing the transport of radioactive material
(2) Identify the types of packages used in the transport of radioactive material and list examples of material shipped in each type of shipping package
(3) Identify terminology and acronyms associated with shipments of radioactive material
(4) Describe methods that can be used to determine the radionuclide contents of a package
(5) Identify the information contained on shipping papers used for transporting radioactive material
(6) Describe the radiation and contamination surveys that are performed on radioactive material packages, and state the applicable limits
(7) Describe the radiation and contamination surveys that are performed on exclusive-use vehicles, and state the applicable limits
(8) Identify the approved placement of placards on a transport vehicle

18.3 Competencies — Planning the Response.

Δ **18.3.1 External Exposure Control.** Given the analysis of an incident involving radioactive material, technicians with a radioactive material specialty shall be able to determine the response options needed to minimize external exposure to radioactive material by completing the following tasks:

(1) Calculate the gamma exposure rate for specific radionuclides using equations or by using a computer application
(2) Using the stay time equation, calculate an individual's remaining allowable dose equivalent or stay time
(3) Identify distance to radiation sources techniques for minimizing personnel external exposures
(4) Using the point source equation (inverse square law), calculate the exposure rate or distance for a point source of radiation
(5) Define *unit of density thickness*
(6) Calculate shielding thickness or exposure rates for gamma and x-ray radiation using the equations or by using a computer application

18.3.2 Internal Exposure Control. Given the analysis of an incident involving radioactive material, technicians with a radioactive material specialty shall determine the response

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options needed to minimize internal exposure to radioactive material by completing the following tasks:

(1) Define the terms *annual limit on intake (ALI)* and *derived air concentration (DAC)*
(2) Define the term *reference man*
(3) Describe three factors that govern the behavior of radioactive materials in the body
(4) Explain the two natural mechanisms that reduce the quantity of a radionuclide in the body
(5) Explain the relationship of physical, biological, and effective half-lives
(6) Given the physical and biological half-lives, calculate the effective half-life
(7) Describe methods used to increase the elimination rate of radioactive materials from the body

18.3.3 Radiation Survey Instrumentation. Given the analysis of an incident involving radioactive material, technicians with a radioactive material specialty shall be able to determine the correct instrument to use for radiation and contamination monitoring by completing the following tasks:

(1) Describe the following features of and specifications for commonly used instruments:
  (a) Types of detectors or probes available for use
  (b) Operator-adjustable controls
  (c) Specific limitations and characteristics
(2) Describe the factors that affect the selection of a portable radiation survey instrument and identify appropriate instruments for external radiation surveys
(3) Identify the following features of and specifications for exposure rate instruments:
  (a) Types of detectors available for use
  (b) Detector shielding and window
  (c) Types of radiation detected and measured
  (d) Gamma energy response characteristics
  (e) Markings for detector effective center
  (f) Specific limitations and characteristics
(4) List the factors that affect the selection of a portable contamination monitoring instrument
(5) Describe the following features of and specifications for commonly used count rate meter probes:
  (a) Types of detectors available for use
  (b) Detector shielding and window
  (c) Types of radiation detected and measured
  (d) Gamma energy response characteristics
  (e) Specific limitations and characteristics

18.4 Competencies — Implementing the Planned Response.

18.4.1 Radiological Incidents. Given an analysis of an incident involving radioactive material and the planned response, technicians with a radioactive material specialty shall implement or oversee the response to a given radiological emergency by completing the following tasks:

(1) Describe the general response and responsibilities of a specialist during any radiological incident
(2) Describe the specialist's response to personnel contamination
(3) Describe the specialist's response to off-scale or lost dosimetry
(4) Describe the specialist's response to rapidly increasing or unanticipated radiation levels
(5) Describe the specialist's response to a radioactive material spill

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(6) Describe the specialist's response to a fire in a radiological area or involving radioactive materials
(7) Identify the available federal responder resources and explain the assistance that each group can provide

Δ **18.4.2 Contamination Control.** Given an analysis of an incident involving radioactive material and the planned response, technicians with a radioactive material specialty shall be able to implement or oversee contamination control techniques to minimize the spread of radiological contamination by completing the following tasks:

(1) Define the terms *removable surface contamination* and *fixed surface contamination*, state the difference between them, and explain the common methods used to measure each
(2) State the basic principles of contamination control and list examples of implementation methods
(3) State the purpose of using protective clothing in radiologically contaminated areas
(4) Describe the basic factors that determine protective clothing requirements for personnel protection

Δ **18.4.3 Personnel Decontamination.** Given an analysis of an incident involving radioactive material and the planned response, technicians with a radioactive material specialty shall be able to implement or oversee decontamination techniques for equipment and personnel by completing the following tasks:

(1) Describe how personnel, PPE, apparatus, and tools become contaminated with radioactive material
(2) State the purpose of radioactive material decontamination
(3) Describe field decontamination techniques for equipment
(4) Describe three factors that determine the actions taken in decontamination of personnel
(5) Describe methods and techniques for performing personnel decontamination

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Competencies for Hazardous Materials Technicians with an Advanced Monitoring and Detection Specialty

19

Chapter 19 is a new chapter in the 2018 edition of the standard. In Chapter 19, the committee wanted to ensure that responders certified at the technician level according to Chapter 7 would have the ability to use basic tools to protect themselves and the public. These devices would provide the ability to recognize the various hazard categories and allow the technician to function on a response team. The previous version of Chapter 7 had the technology and devices now listed in this chapter, which meant that in many training programs there may not have been enough time to become competent with the basic devices. Teams that have enhanced detection and monitoring capabilities may use this chapter for identifying a technician with an advanced monitoring and detection specialty.

N 19.1 General.

N 19.1.1 Introduction.

N **19.1.1.1** The technician level responder assigned to perform advanced monitoring and detection shall be that person, competent at the technician level, who is assigned to implement advanced monitoring and detection operations at hazardous materials/WMD incidents.

Chapter 7 of NFPA 472 lists the basic devices that technicians should have the knowledge and skills to use so that they can identify the basic hazard categories. At the advanced level, technicians should have the knowledge and skills to use the devices in 19.3.6.

N **19.1.1.2** The technician level responder assigned to perform advanced monitoring and detection at hazardous materials/WMD incidents shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all competencies at the technician level *(see Chapter 7)*, and all competencies in this chapter.

N **19.1.1.3** The technician level responder assigned to perform advanced monitoring and detection at hazardous materials/WMD incidents shall receive the additional training necessary to meet specific needs of the jurisdiction.

N 19.1.2 Goal.

N **19.1.2.1** The goal of the competencies in this chapter shall be to provide the technician level responder assigned to advanced monitoring and detection at hazardous materials/WMD

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incidents with the knowledge and skills to perform the tasks in 19.1.2.2 in a safe and effective manner.

N **19.1.2.2** When responding to hazardous materials/WMD incidents, the technician level responder assigned to perform advanced monitoring and detection shall be able to perform the following tasks:

(1) Plan the monitoring and detection activities within the capabilities and competencies of available personnel, PPE, and response equipment.

> The plan should include the technologies and skills outlined in Chapter 7.

(2) Describe the monitoring and detection options available to the technician level responder in accordance with the emergency response plan or standard operating procedures.
(3) Implement the monitoring and detection activities as specified in the IAP.

N 19.2 Competencies — Analyzing the Incident. (Reserved)

N 19.3 Competencies — Planning the Response.

N **19.3.1** Given the monitoring and detection equipment provided by the AHJ, the technician level responder assigned to perform monitoring and detection shall select the detection or monitoring equipment suitable for detecting or monitoring solid, liquid, or gaseous hazardous materials/WMD.

N **19.3.2** Given the monitoring and detection equipment provided by the AHJ, the technician level responder assigned to perform monitoring and detection shall survey the hazardous materials/WMD incident to presumptively identify or classify unknown materials and to verify the presence and concentrations of hazardous materials.

> In Chapter 7, the technician is asked to identify the basic hazard category that may be present. In this chapter, the technician is asked to presumptively identify or classify unknown materials. Only an approved laboratory can identify an unknown material, which is why the standard uses the term *presumptively*.

N **19.3.3** Given examples of hazardous materials/WMD incidents, the hazardous materials technician shall, given the necessary equipment, presumptively identify or classify unknown materials involved, verify the identity of the hazardous materials/WMD involved, and determine the concentration of hazardous materials, by completing the requirements of 19.3.4 through 19.3.10.

N **19.3.4** The hazardous materials technician shall identify the steps in an analysis process for characterizing and presumptively identifying an unidentified contaminant in the atmosphere.

> In Chapter 7, the technician is asked to classify hazardous materials/WMD by the basic categories; verify the presence of hazardous material; determine the concentration of hazardous materials in the atmosphere; and collect samples of solids, liquids, and gases. In this chapter, the technician is asked to use advanced equipment to presumptively identify an unknown contaminant.

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N **19.3.5** The hazardous materials technician shall identify the type(s) of monitoring technology used to determine the following potential hazards:

(1) Corrosivity
(2) Flammability
(3) Fluorine potential
(4) Oxidation potential
(5) Oxygen deficiency
(6) Pathogenicity
(7) Radioactivity
(8) Toxicity
(9) Thermal indicating device

N **19.3.6** 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:

The hazardous materials technician must understand that with advances in technology and developments in usability and functionality, monitoring and sampling devices and techniques will evolve and change. It is incumbent upon the AHJ and the technician to remain current and knowledgeable of these evolutions and changes. The items associated with 19.3.6 represent the most current available at the time this handbook was printed. The technician needs to be proficient only in the use of equipment supplied by the AHJ. However, the technician must be knowledgeable about all of the technologies to know what may be available for a specific purpose.

(1) Biological immunoassay indicators
(2) Colorimetric indicators [colorimetric detector tubes, indicating papers (pH paper, potassium iodide-starch paper, fluoride paper, and water finding paper), reagents, test strips]
(3) Flammable gas indicator
(4) DNA fluoroscopy

DNA fluoroscopy is a nonspecific biodetection technology that detects the presence of any type of DNA (e.g., human, plant, or animal) and requires the use of a fluorescence optical reader. General biological screening tests detect a broad range of biological and organic materials, but do not confirm the presence of a specific biothreat agent. Therefore, while many of the biological indicator tests are relatively rapid and inexpensive, they should be used as a screening tool in conjunction with more specific tests. In general, biological indicator tests have low specificity (i.e., not unusual for a false positive result) and many have low sensitivity (i.e., may result in a false-negative result). [1]

(5) Electrochemical cells
(6) Flame ionization detector
(7) Gas chromatograph/mass spectrometer (GC/MS)

There are several lab-based and field-based GC/MS systems commercially available today. New technology on the market also includes field-based high-pressure mass spectrometers that are not combined with gas chromatography but are able to detect threat materials of interest to the hazardous materials technician.

(8) Infrared spectroscopy
(9) Ion mobility spectroscopy
(10) Gamma spectrometer [radioisotope identification device (RIID)]

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A radioactive isotope identifier or radiation isotope identification device (RIID) is a radiation detection instrument capable of identifying gamma-emitting isotopes. Many include a dose rate measurement feature, and some are equipped with neutron detection capability. In addition to giving the user the name of the gamma-emitting isotope (e.g., Co-60, Ir-192), many RIID devices will tell the user what the material is commonly used for (e.g., medical, industrial, natural).

(11) Metal oxide sensor
(12) Photoionization detectors
(13) Polymerase chain reaction (PCR)
(14) Radiation detection and measurement instruments
(15) Raman spectroscopy
(16) Surface acoustical wave (SAW)

In NFPA 472, this technology should be surface acoustic wave (SAW) but due to an editing error was listed as acoustical.

(17) Ultrasound detection
(18) Wet chemistry
(19) Thermal indicating device (i.e., infrared thermometer)

N **19.3.7** Given three hazardous materials/WMD, one of which is a solid, one a liquid, and one a gas, and using equipment, test strips, and reagents, provided by the AHJ as applicable, the hazardous materials technician shall select from the following equipment and demonstrate the correct techniques to identify the hazards (corrosivity, flammability, oxidation potential, fluorine component, oxygen deficiency, radioactivity, toxicity, explosivity, and pathogenicity):

(1) Carbon monoxide sensor
(2) Colorimetric tubes
(3) Flammable gas indicator
(4) Oxygen sensor
(5) Passive dosimeters
(6) pH indicators
(7) Photoionization and flame ionization detectors
(8) Radiation detection instruments
(9) Reagents
(10) Test strips
(11) Thermal indicating device
(12) WMD detectors (explosive, chemical, and biological)
(13) Other equipment provided by the AHJ

If the AHJ has other equipment, training should be provided to personnel assigned to use other equipment not listed here.

N **19.3.8** The hazardous materials technician shall demonstrate methods for collecting samples of the following:

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

N **19.3.9** Given detection and monitoring device(s) provided by the AHJ, the technician level responder assigned to perform monitoring and sampling shall describe the operation,

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capabilities and limitations, local monitoring procedures, field testing, calibration, and maintenance procedures associated with each device.

N **19.3.10** Given detection and monitoring device(s) provided by the AHJ, the technician level responder shall describe the correction factors and other information that could impact the accuracy of the results associated with the devices.

N **19.3.11 Selecting Personal Protective Equipment (PPE).** Given the PPE provided by the AHJ, the technician level responder assigned to perform monitoring and sampling shall select the PPE required to support monitoring and sampling at hazardous materials/WMD incidents based on local procedures.

N 19.4 Competencies — Implementing the Planned Response.

N **19.4.1** Given a scenario involving hazardous materials/WMD and detection and monitoring devices provided by the AHJ, the technician level responder assigned to perform monitoring and detection shall demonstrate the field test and operation of each device and interpret the readings based on local procedures.

N **19.4.2** The technician level responder assigned to perform monitoring and detection shall describe local procedures for decontamination of themselves and their detection and monitoring devices upon completion of the monitoring mission.

N 19.5 Competencies — Evaluating Progress. (Reserved)

References Cited in Commentary

1. "Biodetection Technologies for First Responders: 2015 Edition," PNNL-24321, National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA, https://www.ntis.gov/ordering.htm.

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Competencies for Hazardous Materials Technicians with a Consequence Analysis and Planning Specialty

20

Chapter 20 is a new chapter in the 2018 edition of the standard. This chapter was created after the committee determined that this was an area that was missing from NFPA 472. A number of response teams were providing training and ensuring competencies in the areas covered by Chapter 20. The decision was made to make this a new chapter because the committee did not want to burden the technician who is learning the basic competencies in Chapter 7 with this additional information. Response teams should have personnel that have advanced capabilities in consequence analysis and planning specialty.

N 20.1 General.

N 20.1.1 Introduction.

N **20.1.1.1** The technician level responder assigned to perform consequence analysis and planning shall be that person, competent at the technician level, who is assigned to implement consequence analysis and planning operations at hazardous materials/WMD incidents.

N **20.1.1.2** The technician level responder assigned to perform advanced risk assessment and analysis at hazardous materials/WMD incidents shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all competencies at the technician level *(see Chapter 7)*, and all competencies in this chapter.

N **20.1.1.3** The technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall receive the additional training necessary to meet specific needs of the jurisdiction.

N 20.1.2 Goal.

N **20.1.2.1** The goal of the competencies in this chapter shall be to provide the technician level responder assigned to perform consequence analysis utilizing technology systems and technical reference data to share current hazard information and the area of impact, predict future hazards or estimate the area of impact, formulate recommendations for public protective actions, and assist in developing IAPs at hazardous materials/WMD incidents.

N **20.1.2.2** The goal of the competencies in this chapter shall be to provide the technician level responder assigned to perform consequence analysis and planning with the knowledge and skills to perform the tasks in Sections 20.2 through 20.7 in a safe and effective manner.

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N 20.2 Competencies — Analyzing the Incident.

N **20.2.1** Given a scenario, the technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall use, produce, and interpret printed and electronic maps to describe a risk analysis, which includes the following:

(1) Hazards
(2) Affected areas
(3) Incident information related to the scenario

It would be preferred for the technician to perform the required analysis for hazardous materials facilities within the AHJ response area, and to conduct pre-incident planning for at-risk areas in the event of a transportation incident.

N **20.2.2** Given a scenario that includes a map, the technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall perform the following skills:

(1) Orient the map
(2) Determine the scale
(3) Identify the hazard zone and incident facilities (command, staging, and shelters)

N **20.2.3** The technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall describe the following maps and map terms:

(1) Topographical features
(2) Coordinate/geo-reference systems
    (a) Longitude/latitude
    (b) Military Grid Reference System (MGRS)
    (c) Universal Transverse Mercator (UTM)
    (d) United States National Grid (USNG)
(3) FRA railroad marking system
    (a) Mile markers
    (b) Cross markers
(4) Electronic maps
(5) Commercially available and free Internet mapping products
(6) Accessing AHJ Global Information System (GIS) data
(7) Overhead photography
(8) U.S. Department of Transportation (DOT) National Pipeline Mapping System (NPMS)
(9) Global positioning system

N **20.2.4** Given a scenario, the technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall describe the following weather and meteorological conditions and their impacts:

(1) Potentially hazardous weather
(2) Weather effects on hazardous materials and chemical dispersion
    (a) Water-reactive chemicals
    (b) Solubility

N **20.2.5** Given a scenario, the technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall describe potential sources of weather forecasting information, including the limitations of open source weather stations.

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N **20.2.6** Given a scenario, the technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall describe the process to deploy an incident weather station.

N **20.2.7** Given a scenario, the technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall describe the process to make local weather observations (manual weather).

N **20.2.8** Given a scenario, the technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall describe potential sources of modeling software and the following modeling terms:

(1) Air dispersion modeling
(2) Modeling types
  (a) Forward model
  (b) Reverse model
  (c) Modeling liquefied compressed gases
    (i) Liquefied compressed gas clouds
    (ii) Expansion ratio
    (iii) Autorefrigeration
(3) Water spill model
(4) Radiant heat model
(5) Tank burn time estimation
(6) Boiling liquid expanding vapor explosion (BLEVE) model
(7) Explosion model
(8) Static standoff distances
(9) Radiological dispersion

N 20.3 Public Protection Actions.

N **20.3.1** Given a scenario, the technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall describe the following public protective action terms for hazard levels:

(1) Emergency Response Planning Guideline (ERPG)
(2) Emergency Action Guidance Level (EAGL)
(3) Temporary Emergency Exposure Levels (TEEL)
(4) Protective Action Criteria (PAC)

N **20.3.2** Given a scenario, the technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall describe the following activities:

(1) Isolation distances
(2) Evacuation planning and procedures
(3) Selecting safe shelter locations
(4) Shelter-in-place planning and procedures
  (a) Shelter-in-place considerations
  (b) Sharing shelter-in-place instructions
(5) Coordination with the public information officer (PIO) and the joint information center (JIC)
  (a) Crisis communications
  (b) Hazard communications

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(6) Emergency notification
(7) AHJ community notification system
(8) BLEVE estimation
(9) General Hazardous Materials Behavior Model (GHMBO)

N 20.4 Wide Area Monitoring and Sampling.

N **20.4.1** Given a scenario, the technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall describe the wide area monitoring and sampling strategies, develop a plan, and describe the following:

(1) Resources and agencies for conducting wide area monitoring and sampling
(2) Indications for implementing wide area monitoring and sampling
   (a) Unable to model release scenario
   (b) Validate model
   (c) Use as model input
   (d) Document exposure levels
   (e) Responder safety
(3) Air monitoring
   (a) Wireless chemical detection
   (b) Air sampling
   (c) Water samples
(4) Wide area biological detection or sampling
(5) Wide area radiological detection

This wide-area monitoring is intended for two scenarios: one for an incident that would affect an area beyond the incident's immediate area and the other for an incident affecting an entire community. The most likely scenario is one that affects downwind populations.

N 20.5 Drinking Water Contamination.

N **20.5.1** Given a scenario, the technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall describe the potential impact to a water system, describe the AHJ plan regarding drinking water contamination, and describe the following:

(1) Current threat assessment
(2) Response procedures
(3) Notification procedures

Hazardous materials technicians should establish a working relationship with the local water authority. Facilities that provide drinking water may store hazardous materials that could have community impact. It is also possible that an incident outside the facility could affect the water supply. As this is an at-risk facility, there should be an established relationship.

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N 20.6 Open Sources Information.

N **20.6.1** Given a scenario, the technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall describe potential sources of open source incident information.

N **20.6.2** The technician shall describe the benefits and limitations of these sources and verification procedures for the following:

(1) Social media
(2) Traffic cameras
(3) Street views
(4) Tax records
(5) Building maps
(6) Shipper websites

N 20.7 Operational Security (OPSEC).

N **20.7.1** Given a scenario, the technician level responder assigned to perform consequence analysis and planning at hazardous materials/WMD incidents shall describe operational security and the following terms and concepts:

(1) Threats and adversaries
(2) Intelligence methods used by adversaries
(3) Operational security process
(4) Threat assessment
(5) Countermeasures

A number of training programs on the subject of OPSEC are available at this site: https://www.iad.gov/ioss.

N 20.8 Competencies — Evaluating Progress. (Reserved)

N 20.9 Competencies — Terminating the Incident. (Reserved)

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Competencies for Hazardous Materials Technicians with an Advanced Chemical Risk Assessment and Analysis Specialty

21

Chapter 21 is a new chapter in the 2018 edition of the standard. In Chapter 21, the committee wanted to ensure that a responder certified at the technician level according to Chapter 7 would have basic knowledge to protect themselves and the public. The previous version of Chapter 7 had chemistry terms that are now listed in this chapter, which meant that in many training programs there may not have been enough time to become competent with the basic terminology. Many response teams send their personnel to the National Fire Academy's Chemistry of Hazardous Materials course, which covers many of the objectives in this chapter.

N 21.1 General.

N 21.1.1 Introduction.

N **21.1.1.1** The technician level responder assigned to perform advanced chemical risk assessment and analysis shall be that person, competent at the technician level, who is assigned to implement advanced chemical risk assessment and analysis operations at hazardous materials/WMD incidents.

N **21.1.1.2** The technician level responder assigned to perform advanced chemical risk assessment and analysis at hazardous materials/WMD incidents shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all competencies at the technician level *(see Chapter 7)*, and all competencies in this chapter.

N **21.1.1.3** The technician level responder assigned to perform advanced chemical risk assessment and analysis at hazardous materials/WMD incidents shall receive the additional training necessary to meet specific needs of the jurisdiction.

N 21.1.2 Goal.

N **21.1.2.1** The goal of the competencies in this chapter shall be to provide the technician level responder assigned to perform advanced chemical risk assessment and analysis at hazardous materials/WMD incidents with the knowledge and skills to perform the tasks in 21.2.1 through 21.2.6 in a safe and effective manner.

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N 21.2 Competencies — Analyzing the Incident.

N **21.2.1** The technician level responder assigned to perform advanced chemical risk assessment and analysis shall include the use of chemical and physical properties in their decision-making process.

N **21.2.2** The technician level responder assigned to perform advanced chemical risk assessment and analysis shall describe the following terms and their impact on the risk assessment process:

(1) Periodic table
(2) Metals and nonmetals
(3) Transition metals
(4) Metalloids
(5) Electropositive and electronegative
(6) Noble gases
(7) Halogens
(8) Alkali metals
(9) Alkali earth metals
(10) Organic and inorganic

N **21.2.3** The hazardous materials technician assigned to perform advanced chemical risk assessment and analysis shall describe the following types of salts and explain their significance in the analysis process:

(1) Binary salt and binary oxide
(2) Hydroxide
(3) Peroxide
(4) Cyanide
(5) Sulfide salt
(6) Oxy-salt
(7) Ammonium salt

N **21.2.4** The hazardous materials technician assigned to perform advanced chemical risk assessment and analysis shall describe the following hydrocarbons and explain their significance in the analysis process:

(1) Saturated
(2) Unsaturated
(3) Aromatic
(4) Isomers

N **21.2.5** The hazardous materials technician assigned to perform advanced chemical risk assessment and analysis shall describe the following inorganic nonsalts and explain their significance in the analysis process:

(1) Binary nonsalt
(2) Binary acids
(3) Oxyacids
(4) Hydrogen peroxide
(5) Bases

N **21.2.6** The hazardous materials technician assigned to perform advanced chemical risk assessment and analysis shall describe the following hydrocarbons and hydrocarbon derivatives and explain their significance in the analysis process:

(1) Alcohols
(2) Amines

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(3) Carboxylic acids
(4) Esters
(5) Aldehydes
(6) Ketones
(7) Ethers
(8) Nitrogen-based compounds (nitrates, nitrites, nitro compounds)
(9) Halogenated hydrocarbons
(10) Organic peroxides
(11) Nitriles
(12) Thiols and mercaptans
(13) Isocyanates
(14) Carbamates

N 21.3 Competencies — Planning the Response.

N **21.3.1** The hazardous materials technician assigned to perform advanced chemical risk assessment and analysis shall describe the following terms and explain their significance in the analysis process:

(1) Chemical reaction
(2) Disassociation

In NFPA 472, this term should have been spelled *dissociation* but due to an editing error it was misspelled.

(3) Exothermic
(4) Endothermic
(5) Ionic and covalent bonds
(6) Molecular weight
(7) Oxidation and reduction
(8) Oxidation potential
(9) Partition coefficient
(10) Persistence
(11) Pyrophoric
(12) Water reactive
(13) Air reactive
(14) Aerosols

N **21.3.2** The hazardous materials technician assigned to perform advanced chemical risk assessment and analysis shall describe the heat transfer process that occurs as a result of a cryogenic liquid spill.

N **21.3.3** The hazardous materials technician assigned to perform advanced chemical risk assessment and analysis shall describe the following chemical reaction types:

(1) Oxidation and reduction
(2) Decomposition
(3) Replacement reactions
(4) Neutralization
(5) Polymerization

N **21.3.4** The hazardous materials technician assigned to perform advanced chemical risk assessment and analysis shall describe the use of ionization potential when planning a detection and monitoring strategy.

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N **21.3.5** The hazardous materials technician assigned to perform advanced chemical risk assessment and analysis shall describe the risks within the four categories of oxidizers as well as the following oxidizers and the risks associated with each of them:

(1) Ammonium nitrate
(2) Hydrogen peroxide >91 percent by weight
(3) Ammonium permanganate
(4) Ammonium perchlorate
(5) Perchloric acid >72.5 percent by weight
(6) Tetranitromethane
(7) Nitric acid fuming concentration >86 percent
(8) Calcium chlorate

N 21.4 Competencies — Evaluating Progress. (Reserved)

N 21.5 Competencies — Terminating the Incident. (Reserved)

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Competencies for Hazardous Materials Technicians with an Advanced Product Control Specialty

22

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Chapter 22 is a new chapter in the 2018 edition of the standard. In Chapter 22, the committee wanted to ensure that a responder certified at the technician level according to Chapter 7 would have the ability to use the basic product control techniques and tools to protect themselves and the public. This capability would allow the technician to function on a response team. The previous version of Chapter 7 included the product control techniques now listed in this chapter, which meant that in many training programs there may not have been enough time to become competent with the basic techniques. Technicians who work with teams that have advanced capabilities could enhance their knowledge and skills by meeting the objectives in this chapter.

N 22.1 General.

N 22.1.1 Introduction.

N **22.1.1.1** The technician level responder assigned to perform advanced product control shall be that person, competent at the technician level, who is assigned to apply advanced knowledge of product control applications, technology, and procedures during response to hazardous materials/WMD incidents.

N **22.1.1.2** The technician level responder assigned to perform advanced product control shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, the operations level mission-specific competencies for product control *(see Section 6.6)*, all competencies at the technician level *(see Chapter 7)*, and all competencies in this chapter.

N **22.1.1.3** The technician level responder assigned to perform advanced product control shall receive the additional training necessary to meet specific needs of the jurisdiction.

N 22.1.2 Goal.

N **22.1.2.1** The goal of the competencies in this chapter shall be to provide the technician level responder assigned to perform advanced product control with the knowledge and skills to perform the tasks in 22.1.2.2 in a safe and effective manner.

N **22.1.2.2** When responding, the technician level responder assigned to perform advanced product control shall be able to perform the following tasks:

(1) Describe the advanced product control options available to the technician level responder in accordance with the emergency response plan or standard operating procedures

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(2) Implement advanced product control response activities as specified in the emergency response plan or standard operating procedures

N **22.1.2.3** Given the selected product control technique and the tools and equipment, PPE, and control agents and equipment provided by the AHJ at a hazardous materials/WMD incident, the hazardous materials technician shall confine and contain the release from bulk pressure containers and their closures and bulk liquid containers/closures, following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards, by completing the requirements in 22.1.2.3.1 and 22.1.2.3.2.

N **22.1.2.3.1 Product Control.** Given a hazardous materials/WMD incident with release of product, an assignment in an IAP, results of the incident analysis, policies and procedures for product control, response objectives and options for the incident, and approved tools, equipment, control agents, and PPE, the hazardous materials technician shall perform the control techniques by completing the following requirements:

(1) Identify and implement the following product control techniques to confine released hazardous materials/WMD:
   (a) Absorption
   (b) Adsorption
   (c) Damming
   (d) Diking
   (e) Dilution
   (f) Diversion
   (g) Flaring
   (h) Retention
   (i) Transfer
   (j) Vapor dispersion
   (k) Vapor suppression
(2) Identify the application and purpose of, advantages and limitations of, procedures for, required tools and equipment for, and safety precautions for each of the control techniques for confining released materials

N **22.1.2.3.2 Controlling Leaks from Containers.** Given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; three scenarios, including a leak from a bulk pressure container or its closures and a leak from a bulk liquid container or its closures; policies and procedures for controlling leaks from containers and/or their closures; and approved tools, equipment, and PPE, the hazardous materials technician shall control leaks from the containers and their closures, monitoring for hazards as necessary, by completing the following requirements:

(1) Identify the following product control techniques to contain leaking hazardous materials/WMD:
   (a) Patching
   (b) Plugging
   (c) Repositioning the container
   (d) Sealing closures
   (e) Remote valve shutoff
(2) Identify types of containers and their closures and the way in which the containers and their closures develop leaks

N **22.1.2.4** Given the selected product control technique and the tools and equipment, PPE, and control agents and equipment provided by the AHJ at a hazardous materials/WMD incident, the hazardous materials technician shall confine and contain large-scale releases from

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containers, pipelines, or bulk transportation containers, following safety procedures, protecting exposures and personnel, and avoiding or minimizing hazards, by completing the requirements in 22.1.2.4.1.

N **22.1.2.4.1 Product Control.** Given a hazardous materials/WMD incident with release of product, an assignment in an IAP, results of the incident analysis, policies and procedures for product control, response objectives and options for the incident, and approved tools, equipment, control agents, and PPE, the hazardous materials technician shall perform the control techniques by completing the following requirements:

(1) Identify and implement the following product control techniques to confine released hazardous materials/WMD:
   (a) Absorption
   (b) Adsorption
   (c) Damming
   (d) Diking
   (e) Dilution
   (f) Diversion
   (g) Retention
   (h) Removal
   (i) Vapor dispersion
   (j) Vapor suppression

(2) Identify the application and purpose of, advantages and limitations of, procedures for, required tools and equipment for, and safety precautions for each of the control techniques for confining released materials

N 22.2 Competencies — Analyzing the Incident. (Reserved)

N 22.3 Competencies — Planning the Response. (Reserved)

N 22.4 Competencies — Implementing the Planned Response. (Reserved)

N 22.5 Competencies — Evaluating Progress. (Reserved)

N 22.6 Competencies — Terminating the Incident. (Reserved)

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Competencies for Hazardous Materials Technicians with a Weapons of Mass Destruction Specialty

23

Chapter 23 is a new chapter in the 2018 edition of the standard. In Chapter 23, the committee wanted to ensure that a responder certified at the technician level according to Chapter 7 would have basic knowledge to protect themselves and the public. The committee felt that all responders needed to have a background in weapons of mass destruction (WMD), which are covered in Chapter 5. The previous version of Chapter 7 included WMD terms now listed in this chapter or in Chapter 5, which meant that in many training programs there may not have been enough time to become competent with the basic terminology. Many response teams send their personnel to advanced courses that specifically focus on WMD. Teams that desire to have advanced training in the field of WMD response should meet the objectives in this chapter.

N 23.1 General.

N 23.1.1 Introduction.

N **23.1.1.1** The technician level responder assigned to respond to weapons of mass destruction (WMD) incidents shall be that person, competent at the technician level, who is assigned to apply advanced knowledge of WMD agents, response equipment, and response procedures during the intentional release of hazardous materials or WMD.

N **23.1.1.2** The technician level responder assigned to respond to WMD incidents shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all competencies at the technician level *(see Chapter 7)*, and all competencies in this chapter.

N **23.1.1.3** The technician level responder assigned to respond to WMD incidents shall receive the additional training necessary to meet specific needs of the jurisdiction.

N 23.1.2 Goal.

N **23.1.2.1** The goal of the competencies in this chapter shall be to provide the technician level responder assigned to respond to WMD incidents with the knowledge and skills to perform the tasks in 23.1.2.2 in a safe and effective manner.

N **23.1.2.2** When responding, the technician level responder assigned to respond to WMD incidents shall be able to perform the following tasks:

(1) Respond within the capabilities and competencies of available personnel, PPE, and response equipment

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(2) Describe the WMD response options available to the technician level responder in accordance with the emergency response plan or standard operating procedures
(3) Implement the WMD response activities as specified in the emergency response plan or standard operating procedures

N 23.2 Competencies — Analyzing the Incident.

N **23.2.1** Given examples of the following military chemical warfare agent categories, the technician level responder assigned to respond to WMD incidents shall generally describe the potential for illicit use, chemical properties, physical properties, toxicity, and health effects for each category listed:

(1) Nerve agents
(2) Blood agents
(3) Blister agents
(4) Choking agents
(5) Harassing (riot control) agents
(6) Incapacitating agents

N **23.2.2** Given examples of the following toxic industrial chemicals, the technician level responder assigned to respond to WMD incidents shall describe the potential for illicit use, chemical properties, physical properties, toxicity, and health effects for each hazard classification listed:

(1) Division 2.1 Flammable gases
(2) Division 2.2 Nonflammable gases
(3) Division 2.3 Poison gases
(4) Class 3 Flammable liquids
(5) Class 6 Poison (inhalation hazard)

N **23.2.3** Given examples of radioactive material and radiation exposure devices, the technician level responder assigned to respond to WMD incidents shall describe the potential for illicit use and potential health effects from each.

N **23.2.4** Given examples of the following explosive materials, the technician level responder assigned to respond to WMD incidents shall describe the potential for illicit use and physical properties for each explosive type listed:

(1) High-velocity explosives (velocity >3300 ft/sec)
(2) Low-velocity explosives (velocity <3300 ft/sec)
(3) Peroxide-based explosives

N **23.2.5** Given examples of the following biological agents, the technician level responder assigned to respond to WMD incidents shall describe the potential for illicit use, vectors, and health effects for each biological agent listed:

(1) *Bacillus anthracis*
(2) *Yersinia pestis*
(3) *Francisella tularensis*
(4) *Salmonella enterica*
(5) *Variola major*
(6) *Clostridium botulinum*
(7) Ricin toxin
(8) Abrin toxin

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N 23.3 Competencies — Planning the Response.

N **23.3.1** Given an incident involving the intentional use of hazardous materials/WMD, the technician level responder assigned to respond to WMD incidents shall describe the importance of the following response safety considerations:

(1) Suspected presence of improvised explosive devices (IEDs)
(2) Presence of secondary explosive devices at bombing scenes
(3) Active radiological monitoring during response to suspected WMD incidents
(4) Active air monitoring of the incident command post, bases, and other operational areas during suspected intentional incidents

N **23.3.2** Given the detection, monitoring, and sampling equipment provided by the AHJ, the technician level responder assigned to respond to WMD incidents shall describe the application and limitations of the following types of WMD detection and monitoring equipment:

(1) Ion mobility spectroscopy
(2) Surface acoustic wave
(3) Flame photo spectrometry
(4) Fourier transform infrared spectroscopy
(5) Raman spectroscopy
(6) Colorimetric tubes
(7) Gas chromatography/mass spectroscopy

Several lab-based and field-based gas chromatography/mass spectroscopy systems are commercially available today. New technology on the market also includes field-based high-pressure mass spectrometers that are not combined with gas chromatography but are able to detect threat materials that are of interest to hazardous materials technicians.

(8) Polymerase chain reaction
(9) Immunological assays
(10) Protein tests
(11) Nuclide identification devices
(12) Ultrasound detection

N **23.3.3** Given examples of hazardous materials/WMD incidents requiring the collection of samples, the hazardous materials technician assigned to respond to WMD incidents shall describe the difference between the collection of samples for public safety purposes and the collection of evidence for law enforcement purposes.

N **23.3.4** Given an example of an intentional WMD incident, the hazardous materials technician assigned to respond to WMD incidents shall describe the following response considerations while operating at a crime scene:

(1) Notification of law enforcement
(2) Coordination with law enforcement within the site incident management system
(3) Support of law enforcement investigative operations at the incident site
(4) Responsibility for operational security (OPSEC)
(5) Potential restrictions on photography and release of investigative information
(6) Understand the potential for future testimony on any actions or observations at the incident site
(7) Coordination with strategic law enforcement management efforts at multiagency coordination centers

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N **23.3.5 Selecting Personal Protective Equipment (PPE).** Given the PPE provided by the AHJ, the technician level responder assigned to respond to WMD incidents shall select the PPE required to support site operations, including the collection of public safety samples.

N 23.4 Competencies — Implementing the Planned Response.

N **23.4.1** Given a scenario involving hazardous materials/WMD, the technician level responder assigned to respond to WMD incidents shall demonstrate the AHJ procedures for conducting field screening of suspicious biological materials for entry into the Laboratory Response Network (LRN) to include the following:

(1) Coordinate with Hazardous Device Technicians to clear letters or packages of potential explosive devices

> Hazardous Device Technicians will perform field screening to eliminate explosives hazards in suspected letters or packages.

(2) Screen for alpha, beta, and gamma radiation
(3) Screen for flammable materials
(4) Screen for corrosive liquids

> For corrosive powders, use the proper protocols for corrosive testing.

(5) Screen for strong oxidizers
(6) Screen for volatile organic compounds
(7) Document all field screening findings for LRN and law enforcement personnel

N **23.4.2** Given a scenario involving hazardous materials/WMD, the technician level responder assigned to respond to WMD incidents shall demonstrate the AHJ procedures for response to a suspicious powder associated with a threat to include the following:

(1) Conduct a hazard risk assessment
(2) Select the appropriate PPE for contaminated areas
(3) Select the appropriate atmospheric monitoring equipment and techniques
(4) Coordinate operations with appropriate law enforcement agencies
(5) Field screen visible powders and letters, envelopes, and so forth for entry into the LRN

> The LRN will handle only suspected biological samples; there are federal, state, and local labs for other unidentified powders.

(6) Under the direction of law enforcement, collect the bulk of visible powders and associated letters, envelopes, and so forth for submission to the LRN
(7) Perform any additional public safety testing on the remainder of the visible powder as required by the AHJ
(8) Assist law enforcement with preparation of samples for LRN submission as defined by the AHJ

> The AHJ shall ensure that the samples are prepared according to LRN guidelines.

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N **23.4.2.1** The technician level responder assigned to respond to WMD incidents shall describe local procedures for decontamination of themselves and their detection and monitoring devices upon completion of the sampling mission.

N **23.4.3** The technician level responder assigned to respond to WMD incidents shall describe the AHJ procedures for response to a post-blast scene involving the potential use of hazardous materials to include the following:

(1) Identify the governmental authorities with either jurisdictional or legislative responsibilities for presence in the incident command post
(2) Describe the AHJ procedures for coordination between hazardous materials, hazardous devices, law enforcement, medical, rescue, fire suppression, and emergency management personnel and agencies
(3) Describe the AHJ procedures to assess the incident scene for additional threats to public safety personnel
(4) Describe the AHJ procedures to establish access control and decontamination corridors at the incident scene
(5) Describe the AHJ procedures to transition from the emergency operational phase to the crime scene phase of the incident

N **23.4.4** The technician level responder assigned to respond to WMD incidents shall describe the AHJ procedures during response to an incident involving the potential criminal use of hazardous materials to include the following:

(1) Describe the AHJ procedures for preserving response documentation
(2) Describe the AHJ procedures for maintaining OPSEC
(3) Describe the AHJ procedures for coordination with Hazardous Device Technicians to ensure the absence of IEDs
(4) Describe the AHJ procedures for transitioning from the operational phase (to include rescue/life safety efforts and incident stabilization) to the crime scene phase
(5) Describe the AHJ procedures for supporting law enforcement during the crime scene phase of the incident

N 23.5 Competencies — Evaluating Progress. (Reserved)

N 23.6 Competencies — Terminating the Incident. (Reserved)

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Competencies for Hazardous Materials Technicians with an Advanced Decontamination Specialty

24

Chapter 24 is a new chapter in the 2018 edition of the standard. With the objectives in Chapter 24, the committee felt that this was an area where some teams needed advanced techniques not covered by Chapter 5 and Chapter 7. A number of response teams were providing training and ensuring competencies in the areas covered by these chapters. This chapter also covers emerging technologies in decontamination, which were known at the time the standard was being revised. The decision was made to make this a new chapter because the committee did not want to burden the technician learning the basic competencies in Chapter 7.

N 24.1 General.

N 24.1.1 Introduction.

N **24.1.1.1** The technician level responder assigned to perform advanced decontamination shall be that person, competent at the technician level, who is assigned to apply advanced knowledge of decontamination applications, technology, and procedures during response to hazardous materials/WMD incidents.

N **24.1.1.2** The technician level responder assigned to perform advanced decontamination shall be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, the operations level mission-specific competencies for mass decontamination *(see Section 6.3)* and technical decontamination *(see Section 6.4)*, all competencies at the technician level *(see Chapter 7)*, and all competencies in this chapter.

N **24.1.1.3** The technician level responder assigned to perform advanced decontamination shall receive the additional training necessary to meet specific needs of the jurisdiction.

N 24.1.2 Goal.

N **24.1.2.1** The goal of the competencies in this chapter shall be to provide the technician level responder assigned to perform decontamination with the knowledge and skills to perform the tasks in 24.1.2.2 in a safe and effective manner.

N **24.1.2.2** When responding, the technician level responder assigned to perform decontamination shall be able to perform the following tasks:

(1) Describe the advanced decontamination options available to the technician level responder in accordance with the emergency response plan or standard operating procedures

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(2) Implement advanced decontamination response activities as specified in the emergency response plan or standard operating procedures

N 24.2 Competencies — Analyzing the Incident.

N **24.2.1** Given examples of the following contamination types, the technician level responder assigned to perform decontamination shall generally describe the decontamination options and decontamination technologies available for each category listed:

(1) Flammable materials
(2) Corrosive materials
(3) Toxic materials
(4) Biological materials
(5) Radiological materials

N **24.2.2** Given examples of the following decontamination technologies, the technician level responder assigned to perform advanced decontamination shall describe the application and limitations for each decontamination technology listed:

(1) Quaternary ammonium solutions
(2) Sporicidal solutions
(3) Fiber technologies
(4) Disclosure technologies
(5) Compressed air application devices
(6) Electrostatic application devices
(7) Other decontamination technologies utilized by the AHJ

N 24.3 Competencies — Planning the Response.

N **24.3.1** Given an incident involving hazardous materials/WMD, the technician level responder assigned to perform advanced decontamination shall describe the following types of advanced decontamination procedures as used by the AHJ:

(1) Advanced decontamination solutions
(2) Dry decontamination
(3) Remote location (limited water) decontamination
(4) Tactical (law enforcement) decontamination
(5) Canine (law enforcement and search) decontamination
(6) Equine (law enforcement) decontamination
(7) Decontamination of collected sample packaging

N **24.3.2** Given the detection, monitoring, and disclosure technologies provided by the AHJ, the technician level responder assigned to perform advanced decontamination shall describe the procedures for confirming the effectiveness of decontamination.

N 24.4 Competencies — Implementing the Planned Response.

N **24.4.1** Given a scenario involving hazardous materials/WMD, the technician level responder assigned to perform advanced decontamination shall demonstrate the AHJ procedures for decontamination to include the deployment and operation of the following:

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(1) Decontamination shelters or trailers

Consideration should be given to the flow rates and pressures that should be used for an emergency shower to provide water as a physical removal process. Standard showers have a 2.5 gpm flow rate, but 2.0 gpm has been determined to be adequate for low flow showers. The standard pressure of 45 psi is generally used, but can range from 20 psi to 80 psi with commensurate changes in flow rate. This covers a technician for emergency decontamination and the standard for emergency showers (drenching/flushing facility). [1]

(2) Decontamination solutions
(3) Decontamination solution application devices
(4) Specialized decontamination corridors used by the AHJ

N **24.4.2** Given a scenario involving hazardous materials/WMD, the technician level responder assigned to perform advanced decontamination shall describe local procedures for decontamination of themselves and their decontamination equipment upon completion of the operation.

N 24.5 Competencies — Evaluating Progress. (Reserved)

N 24.6 Competencies — Terminating the Incident. (Reserved)

Reference Cited in Commentary

1. ANSI/ISEA Z358.1-2014, *American National Standard for Emergency Eyewash and Shower Equipment*. International Safety Equipment Association, 2014.

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ANNEX

A

Explanatory Material

For the convenience of the readers the material contained in Annex A of the 2018 edition of NFPA 472 is interspersed throughout the text of Chapters 1 through 24 in Part I of this handbook, placed immediately after the mandatory text to which it applies. Therefore, it is not repeated here.

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Competencies for Operations Level Responders Assigned Biological Agent–Specific Tasks

ANNEX

B

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.

B.1.1.1 The operations level responder assigned biological agent–specific tasks by the AHJ at hazardous materials/WMD incidents is that person, competent at the operations level, who, at hazardous materials/WMD incidents involving biological materials, is assigned to support the hazardous materials technician and other personnel, provides strategic and tactical recommendations to the on-scene incident commander, serves as a technical advisor to provide technical oversight for operations, and acts as a liaison between the hazardous material technician, response personnel, and outside resources regarding biological issues.

Δ **B.1.1.2** The operations level responder assigned biological agent–specific tasks at hazardous materials/WMD incidents should be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all mission-specific competencies for personal protective equipment *(see Section 6.2)*, and all competencies in this annex.

B.1.1.3 The operations level responder assigned biological agent–specific tasks at hazardous materials/WMD incidents should operate under the guidance of a hazardous materials technician, an allied professional, or standard operating procedures.

B.1.1.4 The operations level responder assigned biological agent–specific tasks at hazardous materials/WMD incidents should receive the additional training necessary to meet specific needs of the jurisdiction.

B.1.2 Goal.

B.1.2.1 The goal of this section is to provide the operations level responder assigned biological agent–specific tasks at hazardous materials/WMD incidents with the knowledge and skills to perform the tasks in B.1.2.2 safely and effectively.

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B.1.2.2 When responding to hazardous materials/WMD incidents, the operations level responder assigned biological agent–specific tasks should be able to perform the following tasks:

(1) Analyze an incident involving biological agents threat to determine the credibility and magnitude of the problem by completing the following tasks:
   (a) Understand biological-threat agents, methods of production, and potential harm from biological-threat agents involved in an incident
   (b) Understand methods of threat agent dissemination, detection, laboratory testing, and surveillance systems
(2) Plan a response for an incident involving biological threat agents 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 an incident involving biological threat agents
   (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 biological threat agents

B.1.3 Mandating of Competencies. This standard does not mandate that response organizations perform biological agent–specific tasks.

B.1.3.1 Operations level responders operating within the bounds of their operations level training should be able to respond to hazardous materials/WMD incidents involving biological agent–specific tasks.

B.1.3.2 If a response organization decides to train some or all its operations level responders to perform biological agent–specific tasks at hazardous materials/WMD incidents, this annex sets out the minimum required competencies.

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B.2 Competencies — Analyzing the Incident.

B.2.1 The operations level responder assigned biological agent–specific tasks should understand biological threat agents, methods of dissemination, and potential harm from biological threat agents involved in an incident.

B.2.1.1 Given examples of biological threat agents, the operations level responder assigned biological agent–specific tasks should be able to perform the following tasks:

(1) Define the type of biological threat agent
(2) Provide examples of each group
(3) Identify potential sources of biological threat agents in industry and business
(4) Describe potential methods of biological agent production

B.2.1.2 The operations level responder assigned biological agent–specific tasks should be able to perform the following tasks:

(1) Define the following terms germane to biological agents and biological incidents:
   (a) Infectious
   (b) Contagious
   (c) Pathogen

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(d) Endemic
(e) Zoonotic
(f) Morbidity
(g) Mortality
(h) Particle size
(i) Spore
(j) Infectious dose
(k) Pandemic
(l) Incubation period
(m) Antibiotic
(n) Prophylaxis
(o) Syndromic surveillance
(p) Index case

(2) Given the following types of biological threat agents, define each category and provide examples for each group:
(a) Bacteria
(b) Viruses
(c) Fungi
(d) Toxins

(3) Identify potential sources of microorganisms in the following:
(a) Business
(b) Industry
(c) Academia
(d) Government
(e) Criminal enterprises
(f) Natural reservoirs

(4) Provide examples of components used in biological threat agent production and describe the item and its potential use in agent production
(5) Provide examples of items found in clandestine biological agent production laboratories that differ from items found in the production of illicit drugs and chemicals
(6) Given the following types of biological pathogens, identify the potential harm associated with each agent as it relates to potential criminal use:
(a) Variola virus (smallpox)
(b) *Botulinum* toxin
(c) *E. coli*
(d) Ricin toxin
(e) *B. anthracis* (anthrax)
(f) Venezuelan equine encephalitis virus
(g) Rickettsia
(h) Q fever
(i) *Yersinia pestis* (plague)
(j) *Franciscella tularensis* (tularemia, rabbit fever)
(k) Viral hermoraic fever
(l) Any other CDC Category A, B, or C organisms

B.2.2 Identify Methods of Dissemination and Identification of Biological Threat Agents.

B.2.2.1 The operations level responder assigned biological agent–specific tasks should be able to predict likely methods of dissemination of biological threat agents and methods for identification.

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B.2.2.2 The operations level responder assigned biological agent–specific tasks should be able to perform the following tasks:

(1) Given examples of the four types of exposure, identify the following potential routes of infection by biological agents:
  (a) Inhalation
  (b) Absorption
  (c) Ingestion
  (d) Injection
(2) Given examples of fixed surveillance, detection, or collection systems, define the method of operation, potential location for use, and detection technology utilized in each of the following specific systems:
  (a) Particle size detector
  (b) Automated biological agent detection system
  (c) Dry filter units
  (d) Liquid impinger
  (e) Slit-to-agar air sampler
(3) Given examples of field detection systems, identify factors to be evaluated as part of the use of these systems, including system validation, capability, limitations, detection levels, operator training, interpretation of results, purity of sample, and destruction of evidence for confirmatory analysis for the following:
  (a) Hand-held assays
  (b) Fourier transform infrared spectroscopy
  (c) Screening tests kits
  (d) Protein assays
  (e) Field microscopy
(4) Explain the United States Laboratory Response Network (LRN) system and describe each of the following components as it relates to the network (for operations level responders outside the United States, the applicable and equivalent laboratory network operating in their country is to be used wherever LRN references are made in this section):
  (a) Access to introduce samples into the laboratories in the network
  (b) Sampling procedures and required sampling equipment
  (c) Procedures for field screening items to be sent to network laboratories
  (d) Packaging requirements for items to be sent to network laboratories
(5) Given the following terms for analysis of biological threat agents, explain the methodology of agent identification:
  (a) Polymerase chain reaction
  (b) Culture tests
  (c) Gram stain
  (d) Morphology
  (e) Motility
  (f) Immunoassays (ELISA, Western blot, Southern blot, surface acoustic wave)
  (g) Time-resolved fluorescence

B.3 Competencies — Planning the Response.

B.3.1 Determining the Response Options. Given an analysis of an incident involving biological threat agents, the operations level responder assigned biological agent–specific tasks should be able to determine the response options for the incident following standardized

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protocols such as ASTM E2770, *Standard Guide for Operational Guidelines for Initial Response to a Suspected Biothreat Agent*.

B.3.2 The operations level responder assigned biological agent–specific tasks should be able to perform the following tasks:

(1) Given a release of biological agents, describe the considerations for establishing a hot zone for the following scenarios:
  (a) Biological agent release from a dissemination device or air-handling system
  (b) Biological agent release from an envelope or package
  (c) Biological agent spill or container breach of a liquid agent
(2) Describe the factors to be evaluated in selecting personal protective equipment for use at an incident involving biological threat agents
(3) Given the following scenarios, describe the considerations for selecting personal protective clothing:
  (a) Biological agent release from a dissemination device or air-handling system
  (b) Biological agent release from an envelope or a package
  (c) Biological agent spill or container breach of a liquid agent
(4) Describe the factors to be considered in selecting decontamination procedures for use at an incident involving biological threat agents
(5) Given the following scenarios, describe the considerations for selecting decontamination procedures:
  (a) Equipment exposed to the release of a dry or liquid biological agent
  (b) Hard surfaces exposed to the release of a dry or liquid biological agent following a standardized protocol, such as ASTM E2458, *Standard Practices for Bulk Sample Collection and Swab Sample Collection of Visible Powders Suspected of Being Biothreat Agents from Nonporous Surfaces*
  (c) Victim exposed to a localized release (e.g., hands or arms) of a dry or liquid biological agent
  (d) Victim exposed to a significant release of a dry or liquid biological agent
(6) Describe the factors to be considered in identification of biological threat agents, including the following:
  (a) Field screening and packaging consistent with LRN protocols
  (b) Field test limitations, accuracy, and interpretation
  (c) Preservation of forensic evidence
  (d) Preservation of material for LRN testing
  (e) Role of law enforcement agencies
  (f) Role of the LRN
  (g) Role of public health agencies
  (h) Sampling of biological agents

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B.4 Competencies — Implementing the Planned Response.

B.4.1 Given an analysis involving the release or potential release of a WMD, the operations level responder assigned biological agent–specific tasks should be able to determine the safety and effective response options.

B.4.2 The operations level responder assigned biological agent–specific tasks should be able to perform the following tasks:

(1) Given a simulated incident involving a biological release from a dissemination device or air-handling system, describe the procedures for the following:

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(a) Identification of hot zone
(b) Managing exposed victims
(c) Selection of protective clothing
(d) Decontamination
(e) Sampling, field screening, and packaging
(f) Laboratory analysis

(2) Given a simulated incident involving a biological release from an envelope or a package, describe the procedures for the following:
(a) Identification of hot zone
(b) Managing exposed victims
(c) Selection of protective clothing
(d) Decontamination
(e) Sampling, field screening, and packaging
(f) Laboratory analysis

(3) Given a simulated incident involving a biological agent spill or container breach of a liquid agent, describe the procedures for the following:
(a) Identification of hot zone
(b) Managing exposed victims
(c) Selection of protective clothing
(d) Decontamination
(e) Sampling, field screening, and packaging
(f) Laboratory analysis

B.5 Competencies — Evaluating Progress. (Reserved)

B.6 Competencies — Terminating the Incident. (Reserved)

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Competencies for Operations Level Responders Assigned Chemical Agent–Specific Tasks

ANNEX

C

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.

C.1.1.1 The operations level responder assigned chemical agent–specific tasks by the AHJ at hazardous materials/WMD incidents is that person, competent at the operations level, who, at hazardous materials/WMD incidents involving chemical materials, is assigned to support the hazardous materials technician and other personnel, provides strategic and tactical recommendations to the on-scene incident commander, serves as a technical advisor to provide technical oversight for operations, and acts as a liaison between the hazardous material technician, response personnel, and outside resources regarding chemical issues.

Δ **C.1.1.2** The operations level responder assigned chemical agent–specific tasks at hazardous materials/WMD incidents should be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all mission-specific competencies for personal protective equipment *(see Section 6.2)*, and all competencies in this annex.

C.1.1.3 The operations level responders assigned chemical agent–specific tasks at hazardous materials/WMD incidents should operate under the guidance of a hazardous materials technician, an allied professional, or standard operating procedures.

C.1.1.4 The operations level responder assigned chemical agent–specific tasks at hazardous materials/WMD incidents should receive the additional training necessary to meet specific needs of the jurisdiction.

C.1.2 Goal.

C.1.2.1 The goal of the competencies in this annex is to provide the operations level responder assigned chemical agent–specific tasks at hazardous materials/WMD incidents with the knowledge and skills to perform the tasks in C.1.2.2 safely and effectively.

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C.1.2.2 When responding to hazardous materials/WMD incidents, the operations level responder assigned chemical agent–specific tasks should be able to perform the following tasks:

(1) Analyze a hazardous materials/WMD incident involving potential release of hazardous materials/WMD agents and determine the complexity of the problem and potential outcomes by completing the following tasks:
  (a) Determine if the incident is a potential dispersal of a hazardous materials/WMD agent and identify the agent within the capabilities of the detection equipment available
  (b) Identify unique aspects of a potential dispersal of a hazardous materials/WMD agent incident
(2) Within the capabilities and competencies of available personnel, personal protective equipment, and detection and monitoring equipment, plan a response for an incident where there is potential release of hazardous materials/WMD agents by completing the following tasks:
  (a) Determine the response options necessary to conduct detection and monitoring operations
  (b) Ensure that the options are within the legal authorities, capabilities, and competencies of available personnel, personal protective equipment, and detection equipment
(3) Implement the planned response to a hazardous materials/WMD incident involving potential criminal intent

C.1.3 Mandating of Competencies. This standard does not mandate that response organizations perform chemical agent–specific tasks.

C.1.3.1 Operations level responders operating within the bounds of their operations level training should be able to respond to hazardous materials/WMD incidents involving chemical agent–specific tasks.

C.1.3.2 If a response organization decides to train some or all its operations level responders to perform chemical agent–specific tasks at hazardous materials/WMD incidents, this annex sets out the minimum required competencies.

C.2 Competencies — Analyzing the Incident.

C.2.1 The operations level responder assigned chemical agent–specific tasks should be able to determine if the incident has the potential for the release of hazardous materials/WMD and the type of detection devices to use based on the signs and symptoms of victims.

C.2.2 Given examples of hazardous materials/WMD incidents involving potential release, the operations level responder assigned chemical agent–specific tasks should be able to describe the type of detection devices to use based on the signs and symptoms of victims and chemical and physical properties observed.

C.2.3 The operations level responder assigned chemical agent-specific tasks should be able to perform the following tasks:

(1) Given examples of various types of hazardous materials/WMD chemicals, describe the products that might be encountered, chemical and physical properties of those chemicals, and the incident response considerations associated with each

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(2) Given examples of the following potential releases at hazardous materials/WMD incidents, describe products potentially encountered and the incident response considerations associated with each situation:
   (a) Hazardous materials/WMD with no release but product present in container
   (b) Hazardous materials/WMD with release of visible vapor cloud, liquid pooling, or solid dispersion
   (c) Hazardous materials/WMD with release of visible vapor cloud, liquid pooling, or solid dispersion with suspected victims (patients)
   (d) Hazardous materials/WMD with suspected victims (patients) but no apparent chemical release

C.2.4 The operations level responder assigned chemical agent–specific tasks should be capable of identifying the unique aspects associated with hazardous materials/WMD releases.

C.2.5 Given an incident involving the release or potential release of hazardous materials/WMD, the operations level responder assigned chemical agent–specific tasks should be able to identify and implement the following tasks:

(1) Secure and isolate the scene
(2) Identify the correct detection device(s)
(3) Deploy the applicable detection device and interpret readings
(4) Notify appropriate explosive ordnance disposal (EOD) personnel if an explosive device has been used to disseminate product

C.3 Competencies — Planning Response.

C.3.1 Given an analysis of an incident involving release or potential release of hazardous materials/WMD, the operations level responder assigned chemical agent–specific tasks should be able to determine possible response options.

Δ **C.3.2** The operations level responder assigned chemical agent–specific tasks should be able to perform the following tasks:

(1) Describe the hazards, safety procedures, and tactical guidelines for responding to the following:
   (a) Environmental crime involving a hazardous materials/WMD incident
   (b) Illicit drug manufacturing
   (c) Release of or attack with a hazardous materials/WMD agent
   (d) Hazardous materials/WMD clandestine laboratory
   (e) Hazardous materials/WMD suspicious package
   (f) Hazardous materials/WMD threatening communication
(2) Describe the factors to be evaluated in selecting the correct personal protective equipment, detection devices, and decontamination for the following types of incidents:
   (a) Environmental crime involving a hazardous materials/WMD incident
   (b) Illicit drug manufacturing
   (c) Release of or attack with a hazardous materials/WMD agent
   (d) Hazardous materials/WMD clandestine laboratory
   (e) Hazardous materials/WMD suspicious package
(3) Describe the detection options for gases, liquids, and solids found at the following types of incidents:
   (a) Environmental crime involving a hazardous materials/WMD incident
   (b) Illicit drug manufacturing

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   (c) Release of or attack with a hazardous materials/WMD agent
   (d) Hazardous materials/WMD clandestine laboratory
   (e) Hazardous materials/WMD suspicious package

(4) Given examples of releases or potential releases involving a hazardous material(s)/WMD, identify and describe the application and use of the types of detection devices that can be utilized, including the following:
   (a) Combustible gas indicators
   (b) Electrochemical cells
   (c) Photoionization detector
   (d) Flame ionization detector
   (e) FT infrared spectrometer
   (f) Alpha, beta, and gamma radiation detector
   (g) Colorimetric detection devices
   (h) Mass spectrometer and gas chromatograph
   (i) Raman spectrometer
   (j) Any new technology or instrumentation utilized by the AHJ

(5) Describe the potential negative impact associated with detection devices that use destructive technologies. For each detection device listed in C.3.2(4), describe the limitations of the technology

(6) For each detection device listed in C.3.2(4), describe if the detector technology is destructive to the material being detected, and the significance that destruction has for potential evidence

C.4 Competencies — Implementing Planned Response.

C.4.1 Given an analysis involving the release or potential release of hazardous materials/WMD, the operations level responder assigned chemical agent–specific tasks should determine the safety and effective response options.

C.4.2 The operations level responder assigned chemical agent–specific tasks should be able to perform the following tasks:

(1) Given a simulated hazardous materials/WMD incident involving a release or potential release, demonstrate the safe and effective methods for identifying the following:
   (a) Illicit drug manufacturing laboratory
   (b) Hazardous materials/WMD threatening communication
   (c) Hazardous materials/WMD suspicious package
   (d) Hazardous materials/WMD clandestine laboratory
   (e) Release of or attack with a hazardous materials/WMD agent
   (f) Environmental crime involving a hazardous materials/WMD incident

(2) Given a simulated hazardous materials/WMD incident involving release or potential release, demonstrate the methods for selecting the correct personal protective equipment, sampling equipment, detection devices, and decontamination for the following:
   (a) Illicit drug manufacturing laboratory
   (b) Hazardous materials/WMD threatening communication
   (c) Hazardous materials/WMD suspicious package
   (d) Hazardous materials/WMD clandestine laboratory
   (e) Release of or attack with a hazardous materials/WMD agent
   (f) Environmental crime involving a hazardous materials/WMD incident

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(3) Given a simulated hazardous materials/WMD incident involving a release or potential release, demonstrate the safe and effective methods for nondestructive detection of hazardous materials/WMD products
(4) Given a simulated hazardous materials/WMD incident involving a release or potential release, demonstrate the safe and effective methods for detection of gas, liquid, and solid samples
(5) Given an example of a hazardous materials/WMD incident involving a release or potential release, demonstrate the different detection technologies that can be used with the following:
    (a) Illicit drug manufacturing laboratory
    (b) Hazardous materials/WMD suspicious package
    (c) Hazardous materials/WMD clandestine laboratory
    (d) Release of or attack with a hazardous materials/WMD agent
    (e) Environmental crime involving a hazardous materials/WMD incident
(6) Given an example of a potential hazardous materials/WMD incident, demonstrate the safe and effective methods for decontaminating detection instrumentation

C.5 Competencies — Evaluating Progress. (Reserved)

C.6 Competencies — Terminating the Incident. (Reserved)

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Competencies for Operations Level Responders Assigned Radiological Agent–Specific Tasks

ANNEX

D

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.

D.1.1.1 The operations level responder assigned radiological agent–specific tasks by the AHJ at hazardous materials/WMD incidents is that person, competent at the operations level, who, at hazardous materials/WMD incidents involving radiological materials, is assigned to support the hazardous materials technician and other personnel, provides strategic and tactical recommendations to the on-scene incident commander, serves as a technical advisor to provide technical oversight for operations, and acts as a liaison between the hazardous material technician, response personnel, and outside resources regarding radiological issues.

Δ **D.1.1.2** The operations level responder assigned radiological agent–specific tasks at hazardous materials/WMD incidents should be trained to meet all competencies at the awareness level *(see Chapter 4)*, all competencies at the operations level *(see Chapter 5)*, all mission-specific competencies for personal protective equipment *(see Section 6.2)*, and all competencies in this annex.

D.1.1.3 The operations level responder assigned radiological agent–specific tasks at hazardous materials/WMD incidents should operate under the guidance of a hazardous materials technician, an allied professional, or standard operating procedures.

D.1.1.4 The operations level responder assigned radiological agent–specific tasks at hazardous materials/WMD incidents should receive additional training necessary to meet specific needs of the jurisdiction.

D.1.2 Goal.

D.1.2.1 The goal of the competencies in this annex is to provide the operations level responder assigned radiological agent–specific tasks at hazardous materials/WMD incidents with the knowledge and skills to perform the tasks in D.1.2.2 safely and effectively.

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D.1.2.2 When responding to hazardous materials/WMD incidents, the operations level responder assigned radiological agent–specific tasks should be able to perform the following tasks:

(1) Analyze a hazardous materials/WMD incident involving radioactive material to determine the complexity of the problem and potential outcomes by completing the following tasks:
  (a) Understand types of radiation and potential harm of each type at an incident
  (b) Predict the direct exposure pathways, including inhalation, ingestion, injection, and absorption
(2) Plan a response for an emergency involving radioactive material within the capabilities and competencies of available personnel, personal protective equipment, and control equipment by determining the response options for a hazardous materials/WMD emergency involving radioactive material
(3) Implement or oversee the implementation of the planned response to a hazardous materials/WMD incident involving radioactive material

D.1.3 Mandating of Competencies. This standard does not mandate that response organizations perform radiological agent–specific responsibilities.

D.1.3.1 Operations level responders operating within the bounds of their operations level training should be able to respond to hazardous materials/WMD incidents involving radioactive material agent–specific tasks.

D.1.3.2 If a response organization decides to train some or all its operations level responders to perform radiological agent–specific tasks at hazardous materials/WMD incidents, this annex sets out the minimum required competencies.

D.2 Competencies — Analyzing the Incident.

D.2.1 Given examples of radiation, the operations level responder assigned radiological agent–specific tasks should be able to define the types of radiation and provide examples of radiation sources, natural, manmade, and other potential sources.

Δ **D.2.2** The operations level responder assigned radiological agent–specific tasks should be able to perform the following tasks:

(1) Define the following terms associated with radiological material:
  (a) Ionizing radiation
  (b) Nonionizing radiation
  (c) Radioactivity
  (d) Half-life
  (e) Dose, dose rate
  (f) Units of measure for radiation and radioactivity
  (g) Special nuclear material
  (h) Electromagnetic radiation, pulse
  (i) Radiological dispersion device (RDD)
  (j) Improvised nuclear device (IND)
  (k) Radiation exposure device (RED)
(2) Identify the following types of radiation:
  (a) Alpha radiation
  (b) Beta radiation
  (c) Gamma radiation, X-ray
  (d) Neutron radiation

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(3) Identify the following potential sources of radiation:
  (a) Naturally occurring
  (b) Manmade
  (c) Medical facilities
  (d) Research laboratories
  (e) Nuclear power plants
  (f) Industrial/commercial facilities
  (g) Government facilities
  (h) Radioactive material/waste shipments
  (i) Industrial applications

(4) Given the following types of radiation, identify the potential harm associated with each of the following:
  (a) Alpha radiation
  (b) Beta radiation
  (c) Gamma radiation, X-ray
  (d) Neutron radiation

(5) Identify the following terms related to a nuclear detonation from an IND:
  (a) Blast and thermal effects
  (b) Prompt radiation effects
  (c) Fallout and ground shine

D.2.3 The operations level responder assigned radiological agent–specific tasks should be able to identify the potential misuses of radioactive material, including radiological dispersal device, concealed source, improvised nuclear device, and nuclear bomb, and should be able to do the following:

(1) Given examples of the four exposure pathways for radioactive material, identify potential routes of exposure from the following:
  (a) Inhalation
  (b) Absorption
  (c) Ingestion
  (d) Injection

(2) Given examples of the classes of radiation detection systems, identify factors to be evaluated as part of the use of these systems, including system validation, capability, limitations, detection levels, operator training, and interpretation of results, for the following:
  (a) Personal radiation detectors (PRDs)
  (b) Radiation exposure rate survey meters
  (c) Contamination survey meters
  (d) Radioisotope identification detectors (RIIDs)
  (e) Portal monitor systems
  (f) Dosimetry devices

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D.3 Competencies — Planning the Response.

D.3.1 Given an analysis of an incident involving radiological material, the operations level responder assigned radiological agent–specific tasks should be able to determine response options for the incident.

D.3.2 The operations level responder assigned radiological agent–specific tasks should be able to perform the following tasks:

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(1) Given the concealment of a radioactive material source in a public area, describe the considerations for the following:
   (a) Identification of the source
   (b) Determination of exposure rate and isolation distance
   (c) Estimation of personnel exposure from the source
(2) Given a release of a radiological material, describe the considerations for establishing a hot zone for the following scenarios:
   (a) Radioactive material release from a dissemination device or system
   (b) Radioactive material release from a package
   (c) Radioactive material release or spill of a liquid agent
   (d) Radiological dispersion/dispersal device (RDD), dirty bomb
   (e) Improvised nuclear device (IND)
(3) Describe the factors to be evaluated in selecting personal protective equipment for use at an incident involving radioactive material
(4) Given the following scenarios, describe the considerations for selecting personal protective clothing:
   (a) Radioactive material release from a dissemination device or system
   (b) Radioactive material release from a package
   (c) Radioactive material release or spill of a liquid agent
   (d) Radiological dispersion/dispersal device (RDD), dirty bomb
   (e) Radiation exposure device (RED)
   (f) Improvised nuclear device (IND)
(5) Describe the factors to be considered for selecting decontamination procedures for use at an incident involving radioactive material
(6) Given the following scenarios, describe the considerations for selecting decontamination procedures:
   (a) Victim with localized external contamination (e.g., hands or feet)
   (b) Victim with significant or whole-body external contamination
   (c) Victim with internal contamination
   (d) Hard surfaces (e.g., floors and tables) contaminated with radioactive material
   (e) Porous surfaces or equipment with inaccessible areas contaminated with radioactive material
(7) Describe the factors to be considered in the identification and quantification of radioactive material, including the following:
   (a) Sampling techniques for radioactive contamination
   (b) Field test limitations, accuracy, and interpretation of results
   (c) Field screening and overpacking consistent with local protocols
   (d) Methods available for isotopic identification
   (e) Preservation of material for laboratory testing
   (f) Preservation of forensic evidence
(8) Identify the local, state, and federal resources available to assist the operations level responder to identify a radioactive material and manage the incident

D.4 Competencies — Implementing the Planned Response.

D.4.1 Given an analysis of an incident involving radioactive material, the operations level responder assigned radiological agent–specific tasks should implement or oversee the implementation of the selected response options safely and effectively.

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D.4.2 The operations level responder assigned radiological agent–specific tasks should be able to complete the following tasks:

(1) Given a simulated incident involving an RED or the concealment of a radioactive material source in a public area, describe the procedures for the following:
   (a) Locating the source
   (b) Identifying initial isolation zone
   (c) Identifying the source [i.e., isotope(s) involved]
   (d) Determining source exposure rate
   (e) Dose estimation for affected personnel

(2) Given a simulated incident involving a release of radioactive material from a dissemination or dispersion device, describe the procedures for the following:
   (a) Managing exposed and/or contaminated victims
   (b) Sampling and identification of the material involved
   (c) Decontamination
   (d) Field screening and packaging the material involved
   (e) Laboratory analysis of the material involved

(3) Given a simulated incident involving a release of radioactive material from a package, describe the procedures for the following:
   (a) Managing exposed and/or contaminated victims
   (b) Decontamination
   (c) Sampling and identification of the material involved
   (d) Field screening and packaging the material involved
   (e) Laboratory analysis of the material involved

(4) Given a simulated incident involving a release of radioactive material from a spill, describe the procedures for the following:
   (a) Managing exposed and/or contaminated victims
   (b) Decontamination
   (c) Sampling and identification of the material involved
   (d) Field screening and packaging the material involved
   (e) Laboratory analysis of the material involved

(5) Given a simulated incident involving a release of radioactive material from the detonation of an IND, describe the procedures for the following:
   (a) Managing exposed and contaminated victims
   (b) Decontamination
   (c) Sampling and identification of the material involved
   (d) Field screening and packaging the material involved
   (e) Laboratory analysis of the material involved

D.5 Competencies — Evaluating Progress. (Reserved)

D.6 Competencies — Terminating the Incident. (Reserved)

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ANNEX

E

Overview of Responder Levels and Tasks at Hazardous Materials/WMD 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. Awareness level personnel are those persons who, in the course of their normal duties, can be the first on the scene of an emergency involving hazardous materials. Awareness level personnel are expected to recognize the presence of hazardous materials/WMD, protect themselves, call for trained personnel, and secure the area.

E.1.2 Operations Level. Operations level responders are those persons who respond to hazardous materials/WMD incidents 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.

Operations level responders can have additional competencies that are specific to their response mission, expected tasks, and equipment and training as determined by the AHJ.

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.

Hazardous materials technicians respond to hazardous materials/WMD incidents using a risk-based response process *(see 7.1.2.2)* with the ability to analyze a problem involving hazardous materials/WMD, select appropriate decontamination procedures, and control a release using specialized protective clothing and control equipment. Hazardous materials technicians can have additional competencies that are specific to their response mission, expected tasks, and equipment and training as determined by the AHJ.

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.

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E.2 Responder Tasks.

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

(1) *Awareness Level.* Awareness level personnel analyze an incident to determine both the hazardous materials/WMD present and the basic hazard and response information for each hazardous materials/WMD by completing the following tasks:
   (a) Detect the presence of hazardous materials/WMD
   (b) Survey a hazardous materials/WMD incident from a safe location to identify the name, UN/NA identification number, or type placard applied for any hazardous materials/WMD involved
   (c) Collect hazard and response information from the current edition of the DOT *Emergency Response Guidebook*
(2) *Operations Level.* Operations level responders must be competent at the awareness level and be able to analyze a hazardous materials/WMD incident to determine the scope of the problem and potential outcomes by completing the following tasks:
   (a) Survey the hazardous materials/WMD incident to identify the containers and materials involved, determine whether hazardous materials/WMD 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 and manufacturer contacts
   (c) Predict the likely behavior of a hazardous materials/WMD agent as well as its container
   (d) Estimate the potential harm at a hazardous materials/WMD incident
(3) *Technician Level.* Hazardous materials technicians must be competent at the awareness and operations levels and be able to analyze a hazardous materials/WMD incident to determine the complexity of the problem and potential outcomes by completing the following tasks:
   (a) Survey the hazardous materials/WMD incident to identify special containers involved, identify or classify unknown materials, and verify the presence and concentrations of hazardous materials/WMD through the use of monitoring equipment
   (b) Collect and interpret hazard and response information from printed and technical resources, computer databases, and monitoring equipment
   (c) Determine the type and extent of damage to containers
   (d) Where multiple materials are involved, predict the likely behavior of released materials and their containers
   (e) Estimate the size of an endangered area using computer modeling, monitoring equipment, or specialists in this field
(4) *Command Level.* The incident commander analyzes a hazardous materials/WMD incident to determine the complexity of the problem and potential outcomes by completing the following tasks:
   (a) Collect and interpret hazard and response information from printed and technical resources, computer databases, and monitoring equipment
   (b) Estimate the potential outcomes within the endangered area at a hazardous materials/WMD incident

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

(1) *Awareness Level.* No requirements.
(2) *Operations Level.* The operations level responder must be competent at the first responder awareness level and be able to plan an initial response within the capabilities and

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competencies of available personnel, personal protective equipment, and control equipment by completing the following tasks:

(a) Describe the response objectives for hazardous materials/WMD incidents
(b) Describe the defensive options available by response objective
(c) Determine whether the personal protective equipment provided is appropriate for implementing each action option
(d) Identify the emergency decontamination process

(3) *Technician Level.* The hazardous materials technician must be competent at both the first responder awareness and operations 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/WMD incidents
(b) Identify the potential response options available by response objective
(c) Select the personal protective equipment required for a given action option
(d) Select the applicable technical decontamination process
(e) Develop an incident action plan, including site safety and control plan, consistent with the emergency response plan and/or standard operating procedures and within the capability of the available personnel, personal protective equipment, and control equipment

(4) *Command Level.* The incident commander plans 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/WMD incidents
(b) Identify the potential response 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 an incident action plan, including site safety and control plan, consistent with the emergency response plan and/or standard operating procedures and within the capability of available personnel, personal protective equipment, and control equipment

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

(1) *Awareness Level.* The awareness level personnel must be able to implement actions consistent with the emergency response plan, standard operating procedures, and the current edition of the DOT *Emergency Response Guidebook* by completing the following tasks:

(a) Initiate protective actions
(b) Initiate the notification process

(2) *Operations Level.* The operations level responder must be competent at the awareness level and be able to implement the planned response to favorably change the outcomes consistent with the emergency response plan and/or standard operating procedures by completing the following tasks:

(a) Establish and enforce scene control procedures, including control zones, decontamination, and communications
(b) Establish a means of evidence preservation where criminal or terrorist acts are suspected
(c) Initiate an incident management system (IMS)
(d) Don, work in, and doff personal protective equipment provided by the authority having jurisdiction

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(e) Perform the defensive control actions identified in the incident action plan
(f) Perform mass decontamination as required

(3) *Technician Level.* The hazardous materials technician must be competent at both the first responder awareness and operations levels and be able to implement the planned response to favorably change the outcomes consistent with the standard operating procedures or site safety and control plan by completing the following tasks:
(a) Perform the duties of an assigned position within the local IMS
(b) Don, work in, and doff appropriate personal protective clothing, including, but not limited to, liquid splash– and vapor-protective clothing with approved respiratory protection
(c) Perform the control functions identified in the incident action plan

(4) *Command Level.* The incident commander must be competent at the operations level and be able to implement a response to favorably change the outcomes consistent with the emergency response plan and/or standard operating procedures by completing the following tasks:
(a) Implement the IMS 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 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 IMS structures

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

(1) *Awareness Level.* No requirements.
(2) *Operations Level.* The operations level responder must 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 must be competent in evaluating the progress of the planned response by completing the following tasks:
(a) Evaluate the effectiveness of the control functions
(b) Evaluate the effectiveness of the decontamination process
(4) *Command Level.* The incident commander must be competent at the operations 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 incident action plan accordingly by evaluating the effectiveness of the control functions

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

(1) *Awareness Level.* No requirements.
(2) *Operations Level.* No requirements.
(3) *Technician Level.* The hazardous materials technician must 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

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(4) *Command Level.* The incident commander must be competent to terminate an 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/WMD incident and submit the reports to the proper entity

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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.

Many definitions and descriptive names are used for the term *hazardous material*, each of which depends on the nature of the problem being addressed. Unfortunately, no one list or definition covers everything. U.S. government agencies, 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 substances* in 29 CFR 1910.120, which resulted from Title I of the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355) and covers emergency response. Unlike EPA, OSHA uses the term *hazardous substances* to 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 (40 CFR 355).

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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 toxic chemicals are listed in Title III of SARA (40 CFR 355).

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* for any chemical that would be a risk to employees if they were exposed in the workplace. The term *hazardous chemicals* covers a broader group of chemicals than the other chemical terms.

F.2.7 Dangerous Goods. In United Nations model codes and regulations, 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 Annex A of 29 CFR 1910.119.

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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 has 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 trinitrotoluene, dynamite, and trinitrotoluene (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 a minor blast hazard, 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 0.9 oz (25 g) 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.

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G.2.5 Division 1.5. Division 1.5 consists of very insensitive explosives. This division comprises 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 comprises 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 materials that are a gas at 68°F (20°C) or less and 14.7 psi (101.3 kPa) of pressure, have a boiling point of 68°F (20°C) or less at 14.7 psi (101.3 kPa), and have the following properties:

(1) Are ignitable at 14.7 psi (101.3 kPa) when in a mixture of 13 percent or less by volume with air
(2) Have a flammable range at 14.7 psi (101.3 kPa) 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, asphyxiant gas, and oxidizing gas) consists of materials (or mixtures) that exert in the packaging an absolute pressure of 41 psi (280 kPa) at 68°F (20°C). A cryogenic liquid is a refrigerated liquefied gas having a boiling point colder than –130°F (–90°C) at 14.7 psi (101.3 kPa).

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 (gas poisonous by inhalation) consists of materials that are a gas at 68°F (20°C) or less and a pressure of 14.7 psi, or 1 atm (101.3 kPa), have a boiling point of 68°F (20°C) or less at 14.7 psi (101.3 kPa), and have the following properties:

(1) Are 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, are presumed to be toxic to humans because, when tested on laboratory animals, they have 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 Liquids.

Flammable liquids are liquids having a flash point of not more than 140°F (60°C) or materials in a liquid phase with a flash point at or above 100°F (37.8°C) that are intentionally heated and offered for transportation or transported at or above their flash point in a bulk packaging.

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Examples of Class 3 liquids include acetone, amyl acetate, gasoline, methyl alcohol, and toluene.

G.4.1 Combustible Liquids. Combustible liquids are liquids that do not meet the definition of any other hazard class and that have a flash point above 140°F (60°C) and below 200°F (93°C). Flammable liquids with a flash point above 100°F (38°C) can be reclassified as combustible liquids.

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 solids) is comprised of the following three types of materials:

(1) Desensitized explosives — explosives wetted with sufficient water, alcohol, or plasticizers to suppress explosive properties
(2) Self-reactive materials — materials that are thermally unstable and that can undergo a strongly exothermic decomposition even with participation of oxygen (air)
(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) is comprised of the following materials:

(1) Pyrophoric materials — liquids or solids 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 materials — materials that, when in contact with air and without an energy supply, are 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 materials) is comprised 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 (oxidizers) is comprised 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 peroxides) is comprised of organic compounds that contain 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. Examples of Division 5.2 materials include dibenzoyl peroxide, methyl ethyl ketone peroxide, and peroxyacetic acid. Division 5.2 (organic peroxide) materials are assigned to one of the following seven types:

(1) Type A — organic peroxides that can detonate or deflagrate rapidly as packaged for transport. Transportation of Type A organic peroxides is forbidden.

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(2) Type B — organic peroxides that neither detonate nor deflagrate rapidly but that can undergo a thermal explosion.
(3) Type C — organic peroxides that neither detonate nor deflagrate rapidly and that cannot undergo a thermal explosion.
(4) Type D — organic peroxides that detonate only partially or deflagrate slowly, with medium to no effect when heated under confinement.
(5) Type E — organic peroxides that neither detonate nor deflagrate and that show low or no effect when heated under confinement.
(6) Type F — organic peroxides that will not detonate, do not deflagrate, show only a low or no effect if heated when confined, and have low or no explosive power.
(7) Type G — organic peroxides that will not detonate, do not deflagrate, show no effect if heated when confined, have no explosive power, are thermally stable, and are desensitized.

G.7 Class 6 — Poisonous Materials.

G.7.1 Division 6.1. Division 6.1 (poisonous materials) is comprised 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 substances) is comprised of materials known to contain or suspected of containing a pathogen. A pathogen is a micro-organism (including viruses, plasmids, and other genetic elements) or a proteinaceous infectious particle (prion) that has the potential to cause disease in humans or animals. The terms *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 containing radionuclides where both the activity concentration and the total activity in the consignment exceed specified values. Examples of Class 7 materials include cobalt, uranium hexafluoride, and "yellow cake."

G.9 Class 8 — Corrosive Materials.

Corrosive materials are liquids or solids that cause full-thickness destruction of skin at the site of contact within a specified period of time. A liquid that has a severe corrosion rate on steel or aluminum is also a corrosive material. Examples of Class 8 materials include nitric acid, phosphorus trichloride, sodium hydroxide, and sulfuric acid.

G.10 Class 9 — Miscellaneous Hazardous Materials.

Miscellaneous hazardous materials are materials that present a hazard during transport but that do not meet the definition of any other hazard class. Miscellaneous hazardous materials include the following:

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(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 that is subject to DOT requirements (e.g., elevated-temperature material, hazardous substance, hazardous waste, marine pollutant). Examples of Class 9 materials include adipic acid, hazardous substances (e.g., PCBs), and molten sulfur.

G.11 ORM-D Material.

ORM-D materials are materials that present a limited hazard during transportation due to their 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 into devices.

G.13 Marine Pollutant.

A marine pollutant is a material that has an adverse effect on aquatic life.

G.14 Elevated-Temperature Material.

Elevated temperature materials are materials that, when offered for transportation in a bulk packaging, meet one of the following conditions:

(1) Are liquid at or above 212°F (100°C)
(2) Are liquid with a flash point at or above 100°F (37.8°C) and are intentionally heated and transported at or above their flash point
(3) Are solid at or above 464°F (240°C)

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ANNEX

H

Informational References

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H.1 Referenced Publications.

The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

H.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2016 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2018 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.

NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2018 edition.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, 2017 edition.

NFPA 1005, *Standard for Professional Qualifications for Marine Fire Fighting for Land-Based Fire Fighters*, 2014 edition.

NFPA 1405, *Guide for Land-Based Fire Departments That Respond to Marine Vessel Fires*, 2016 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2018 edition.

NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies*, 2016 edition.

NFPA 1992, *Standard on Liquid Splash–Protective Ensembles and Clothing for Hazardous Materials Emergencies*, 2018 edition.

NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*, 2018 edition.

Hazardous Materials/Weapons of Mass Destruction Response Handbook, 2013.

Wright, Charles J., "Managing the Response to Hazardous Materials Incidents," Section 13, Chapter 8, *Fire Protection Handbook*, 20th edition, 2008.

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H.1.2 Other Publications.

H.1.2.1 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA, 19428-2959.

ASTM E2601, *Standard Practice for Radiological Emergency Response*, 2015.

H.1.2.2 API Publications. American Petroleum Institute, 1220 L Street, N.W., Washington, DC 20005-4070.

API 2021, *Guide for Fighting Fires in and Around Flammable and Combustible Liquid Atmospheric Petroleum Storage Tanks*, 2015.

API 2510-A, *Fire Protection Considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities*, 2015.

H.1.2.3 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM E2770, *Standard Guide for Operational Guidelines for Initial Response to a Suspected Biothreat Agent*, 2010.

ASTM E2458, *Standard Practices for Bulk Sample Collection and Swab Sample Collection of Visible Powders Suspected of Being Biothreat Agents from Nonporous Surfaces*, 2015.

Δ **H.1.2.4 IMO Publications.** International Maritime Organization, 4 Albert Embankment, London, SEI 7SR, UK.

Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code).

International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code).

International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code).

International Maritime Dangerous Goods Code (IMDG Code).

International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78.

International Convention for the Safety of Life at Sea (SOLAS).

H.1.2.5 NRT Publications. U.S. National Response Team, Washington, DC 20593, www.nrt.org.

NRT-1, *Hazardous Materials Emergency Planning Guide*, 2001.

Δ **H.1.2.6 U.S. Government Publications.** U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Bulk Chemical Data Guide, 1990.

Department of Homeland Security (DHS), Responder Knowledge Base, www.rkb.mipt.org.

Environmental Protection Agency, *Standard Operating Safety Guides*, June 1992.

National Incident Management System (NIMS), *Site Safety and Control Plan* (formerly ICS 208 HM).

National Incident Management System (NIMS), March 2004, www.fema.gov/nims/nims_compliance.shtm#nimsdocument.

NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, October 1985.

NIOSH *Pocket Guide to Chemical Hazards*, DHHS (NIOSH) Publication No. 2007-149, September 2007, www.cdc.gov/niosh.npg.

OSHA 1910.120(8), *Hazardous Waste Operations and Emergency Response.*

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Title 18, U.S. Code, Section 2332a, "Use of Weapons of Mass Destruction."

Title 29, Code of Federal Regulations, Parts 1910.119–1910.120.

Title 29, Code of Federal Regulations, Part 1910.134.

Title 33, Code of Federal Regulations, "Navigation and Navigable Waters."

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 46, Code of Federal Regulations, "Shipping."

Title 49, Code of Federal Regulations, Parts 170–180.

Title 49, Code of Federal Regulations, Part 173.431.

U.S. Army Research, Development, and Engineering Command (RDECOM), Edgewood Chemical Biological Center, Emergency Response, Command, and Planning Guidelines (various documents) for terrorist incidents involving chemical and biological agents. http://www.ecbc.army.mil/hld.

U.S. Department of Transportation, *Emergency Response Guidebook*, 2004 edition.

Δ **H.1.2.7 Additional Publications.** *International Safety Guide for Oil Tankers and Terminals*, Witherby Seamanship International, 5th edition, 2006.

International Chamber of Shipping Tanker Safety Guide(chemicals), 4th edition, Witherby and Co., London, 2014.

International Chamber of Shipping Tanker Safety Guide (liquefied gases), 2nd edition, Witherby and Co., London, 1996.

Provisional Categorization of Liquid Substances, MEPC.2/Circ.10 2004, International Maritime Organization, London.

SIGTTO *Liquefied Gas Handling Principles on Ships and in Terminals*, 3rd edition, McGuire and White (Authors) London, 2000, Witherby Seamanship International.

SIGTTO *Ship to Ship Transfer Guide for Petroleum, Chemicals, and Liquefied Gases*, 2013.

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H.2 Informational References.

The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

H.2.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2017 edition.

NFPA 306, *Standard for the Control of Gas Hazards on Vessels*, 2014 edition.

NFPA 424, *Guide for Airport/Community Emergency Planning*, 2018 edition.

NFPA 600, *Standard on Facility Fire Brigades*, 2015 edition.

NFPA 1404, *Standard for Fire Service Respiratory Protection Training*, 2013 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 2018 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety*, 2014 edition.

NFPA 1581, *Standard on Fire Department Infection Control Program*, 2015 edition.

NFPA 1951, *Standard on Protective Ensembles for Technical Rescue Incidents*, 2018 edition.

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N **H.2.2 American Chemistry Council (formerly Chemical Manufacturers Association) Publications.** American Chemistry Council, 1300 Wilson Blvd., Arlington, VA 22209.

Recommended Terms for Personal Protective Equipment, 1985.

N **H.2.3 Government Publications.** U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), P.L. 107-377, December 31, 2002.

Emergency Response Guidebook, U.S. Department of Transportation, 2016.

Hazardous Materials Incident Analysis, National Fire Academy, U.S. Fire Administration, 2014.

National Preparedness Goal, March 2005, https://llis.dhs.gov.

National Preparedness Guidance, April 2005, https://www.llis.dhs.gov.

National Response Plan, December 2004, www.dhs.gov/Xprepresp/committees/editorial_0566.shtm.

National Toxicology Program, U.S. Department of Health and Human Services, *12th Report on Carcinogens*, Washington, DC, 2011.

Target Capabilities List, May 2005, https://www.llis.dhs.gov.

Title 49, Code of Federal Regulations, "Transportation."

Universal Task List, May 2005, https://www.llis.dhs.gov.

H.2.4 Other Publications. Association of American Railroads, *Field Guide to Tank Cars*, Bureau of Explosions, Pueblo, CO 2010.

Grey, G. L., et al., *Hazardous Materials/Waste Handling for the Emergency Responder*, Fire Engineering Publications, New York, 1989.

Maslansky, C. J., and Stephen P. Maslansky, *Air Monitoring Instrumentation*, New York, Van Nostrand Reinhold, 1993.

Noll, G., and M. Hildebrand, *Hazardous Materials: Managing the Incident*, 4th edition, Fire Protection Publications, Stillwater, OK, 2012.

H.3 References for Extracts in Informational Sections. (Reserved)

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PART II

NFPA® 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents,* 2018 Edition, with Commentary

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Part II of this handbook presents the full text of NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents*, with explanatory commentary to guide the reader through the standard. As in Part I, the text, figures, and tables of NFPA 473 appear in black. The commentary and its exhibits and tables are overprinted by a color tint panel.

The goal of the 2018 edition of NFPA 473 is to provide emergency medical services personnel with guidance on how to deliver basic life support (BLS) and advanced life support (ALS) at hazardous materials/weapons of mass destruction incidents. Essentially, the objective is to define BLS and ALS competencies for EMS responders, both mission-specific and agent-specific, for incidents involving chemical, biological, nuclear, radiological, and explosive events, when human injury or illness is suspected or confirmed.

A diverse task group of EMS industry experts (both within and outside of the technical committee structure) was assembled to compile and refine comments, achieve consensus, and prepare a draft for technical committee review. The task group worked under the following basic assumptions:

1. Responders would be protected first, and then the patients would be managed.
2. No ALS would be performed in the hot zone.
3. Hazardous materials response training would be left to NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, to address, with NFPA 473 concentrating on the EMS element.
4. EMS responders at hazardous materials incidents would be the "first receivers of the first receivers." NFPA 473 would function as the missing link in hazardous materials/EMS response, taking patient care from the scene to definitive hospital care.

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REVISION SYMBOLS IDENTIFYING CHANGES FROM THE PREVIOUS EDITION

Text revisions are shaded. A Δ before a section number indicates that words within that section were deleted and a Δ to the left of a table or figure number indicates a revision to an existing table or figure. When a chapter was heavily revised, the entire chapter is marked throughout with the Δ symbol. Where one or more sections were deleted, a • is placed between the remaining sections. Chapters, annexes, sections, figures, and tables that are new are indicated with an ***N***.

Note that these indicators are a guide. Rearrangement of sections may not be captured in the markup, but users can view complete revision details in the First and Second Draft Reports located in the archived revision information section of each code at www.nfpa.org/docinfo. Any subsequent changes from the NFPA Technical Meeting, Tentative Interim Amendments, and Errata are also located there.

Shaded text = Revisions   Δ = Text deletions and figure/table revisions   • = Section deletions   ***N*** = New material

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Administration

1

The goal of the 2018 edition of NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents*, is to provide emergency medical services (EMS) personnel with guidance on how to deliver basic life support (BLS) and advanced life support (ALS) at hazardous materials/weapons of mass destruction (WMD) incidents.

Essentially, the objective is to define BLS and ALS competencies for EMS responders, both mission specific and agent specific, for incidents involving chemical, biological, nuclear, radiological, and explosive events when human injury and illness is suspected or confirmed.

A diverse task group of EMS industry experts (both within and outside of the technical committee structure) was assembled to compile and refine comments, achieve consensus, and prepare a draft for the technical committee to review.

The task group worked under the following basic assumptions:

1. Protect the responders first, and then manage the patient.
2. No ALS would be performed in the hot zone.
3. Hazardous materials response training would be left to NFPA 472 to address, with NFPA 473 concentrating on the EMS element.
4. EMS responders at hazardous materials incidents are essentially the "first receivers of the first receivers." NFPA 473 would function as the missing link in hazardous materials/EMS response, taking patient care from the scene to definitive hospital care.

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1.1 Scope.

This standard identifies the levels of competence required of emergency medical services (EMS) personnel who respond to incidents involving hazardous materials or weapons of mass destruction (WMD).

Δ **1.1.1** This document covers the requirements for basic life support and advanced life support personnel in the prehospital setting.

Δ **1.1.2** This standard is based on the premise that all EMS responders are trained to meet at least the core competencies of the operations level responders as defined in Chapter 5 of NFPA 472.

1.2 Purpose.

The purpose of this standard is to specify minimum requirements of competence and to enhance the safety and protection of response personnel and all components of the emergency medical services system.

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NFPA 473 recognizes the inherent differences in pre-hospital care systems nationwide and the variety of ways EMS responders can be called on to render care to victims of hazardous materials/WMD incidents. To that end, the document is not protocol driven. It is intended to provide a set of broad competencies that an AHJ can use to better train BLS and ALS responders to render care at a hazardous materials/WMD incident. The goal of NFPA 473 is to create a template for informed and effective decision making when identifying and treating exposed patients.

This standard might require additional training for some EMS providers, but it is believed that this additional training is prudent and essential for the safety of EMS personnel responding to a hazardous materials/WMD incident. Although NFPA 473 is designed to promote thoughtful and informed medical care, it is unrealistic to expect that any standard can address all possible situations.

NFPA 472, which is covered in Part I of this handbook, is designed to provide guidance for a variety of first responder disciplines such as fire, law enforcement, EMS, public works, and others. NFPA 473 is designed to build on that training with EMS-specific competencies.

1.2.1 It is not the intent of this standard to restrict any jurisdiction from exceeding these minimum requirements.

1.3* CDC Categories A, B, and C.

This standard uses the U.S. Centers for Disease Control and Prevention (CDC) categories of diseases and agents.

A.1.3 The CDC categories of bioterrorism diseases and agents are as follows (for more information, see the CDC website www.bt.cdc.gov):

(1) Category A
   (a) Anthrax (*Bacillus anthracis*)
   (b) Botulism (*Clostridium botulinum* toxin)
   (c) Plague (*Yersinia pestis*)
   (d) Smallpox (variola major)
   (e) *Francisella tularensis* (tularemia)
   (f) Viral hemorrhagic fevers [filoviruses (e.g., Ebola, Marburg) and arenaviruses (e.g., Lassa, Machupo)]

(2) Category B
   (a) Brucellosis (*Brucella* species)
   (b) Epsilon toxin of *Clostridium perfringens*
   (c) Food safety threats (e.g., *Salmonella* species, *Escherichia coli* O157:H7, *Shigella*)
   (d) Glanders (*Burkholderia mallei*)
   (e) Melioidosis (*Burkholderia pseudomallei*)
   (f) Psittacosis (*Chlamydia psittaci*)
   (g) Q fever (*Coxiella burnetii*)
   (h) Ricin toxin from Ricinus communis (castor beans)
   (i) Staphylococcal enterotoxin B
   (j) Typhus fever (*Rickettsia prowazekii*)
   (k) Viral encephalitis [alphaviruses (e.g., Venezuelan equine encephalitis, eastern equine encephalitis, western equine encephalitis)]
   (l) Water safety threats (e.g., *Vibrio cholerae*, *Cryptosporidium parvum*)

(3) Category C — emerging infectious diseases, such as Nipah virus and hantavirus

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Category A Diseases/Agents. The U.S. public health system and primary health care providers must be prepared to address various biological agents, including pathogens that are rarely seen in the United States. These high-priority agents include organisms that pose a risk to national security because of the following:

(1) They can be easily disseminated or transmitted from person to person.
(2) They result in high mortality rates and have the potential for major public health impact.
(3) They might cause public panic and social disruption.
(4) They require special action for public health preparedness.

Category B Diseases/Agents. These second-highest priority agents have the following characteristics:

(1) They are moderately easy to disseminate.
(2) They result in moderate morbidity rates and low mortality rates.
(3) They require specific enhancements of CDC's diagnostic capacity and enhanced disease surveillance.

Category C Diseases/Agents. These third-highest priority agents include emerging pathogens that could be engineered for mass dissemination in the future because of the following characteristics:

(1) Availability
(2) Ease of production and dissemination
(3) Potential for high morbidity and mortality rates and major health impact

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Referenced Publications

2

This chapter lists the publications that are referenced within the mandatory chapters of NFPA 473. These mandatory referenced publications are needed for effective use of and compliance with NFPA 473. The requirements in these references constitute part of the requirements of NFPA 473. Annex B lists nonmandatory publications that are referenced within the nonmandatory annexes of NFPA 473.

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, Quincy, MA 02169-7471.

NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2018 edition.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, 2017 edition.

NFPA 1584, *Standard on the Rehabilitation Process for Members During Emergency Operations and Training Exercises*, 2015 edition.

2.3 Other Publications.

2.3.1 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Emergency Response Guidebook, Pipeline and Hazardous Materials Administration, U.S. Department of Transportation, 2016.

ICS Forms, www.fema.gov/emergency/nims/JobAids.shtm, ICS Form 206.pdf.

Title 18, U.S. Code, Section 2332a, "Use of Weapons of Mass Destruction."

Title 29, Code of Federal Regulations, Part 1910.120, "Hazardous Waste Operations and Emergency Response."

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2.3.2 Other Publications. *Merriam-Webster's Collegiate Dictionary*, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections. (Reserved)

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3 Definitions

The definitions contained in this chapter have been updated from the previous edition of NFPA 473 to more closely align with current emergency medical services (EMS) terminology. See Part V of this handbook for a glossary of all the definitions from Chapter 3 of each of the following codes: NFPA 472, NFPA 473, NFPA 475, and NFPA 1072.

3.1 General.

The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary,* 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

The authority having jurisdiction (AHJ) can also seek the expertise of other allied professionals, including a certified safety professional (CSP), certified health physicist (CHP), certified industrial hygienist (CIH), certified hazardous materials (CHM), or similar credentialed or competent individuals. These individuals might also be referred to as a subject matter expert (SME) in a mission-specific area.

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.

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3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

In a document dealing with the very broad concept of hazardous materials response, AHJs include officials at all levels of government, from federal to local authorities.

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.

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.

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.

3.2.4 Shall. Indicates a mandatory requirement.

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

The term *should* is not used in the main body of an NFPA standard, but it can be found in the annexes, which contain explanatory or recommended information.

3.2.6 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Advanced Life Support (ALS). Emergency medical treatment beyond basic life support level as defined by the medical authority having jurisdiction in conjunction with the American Heart Association guidelines.

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Because advanced life support (ALS) can be broadly defined, the intent of this definition is to give the AHJ the latitude to determine which category most closely reflects the EMS responders within their system.

3.3.1.1 Emergency Medical Technician — Intermediate (EMT-I). An individual who has completed a course of instruction that includes selected modules of the U.S. Department of Transportation National Standard EMT — Paramedic curriculum and who holds an intermediate level EMT-I or EMT-C certification from the authority having jurisdiction.

The Emergency Medical Technician — Intermediate (EMT-I) is an individual who has successfully completed a course of instruction based on the U.S. Department of Transportation (DOT) EMT-Intermediate: National Standard Curriculum and who holds a license to practice at the EMT-I level from the AHJ.

According to the *National EMS Scope of Practice Model,* the definition of an advanced emergency medical technician (AEMT) is as follows:

> Individual who has successfully completed a course based on the U.S. DOT AEMT Education Standards and provides basic and limited advanced emergency medical care and transportation for critical and emergent patients. Performs interventions with the basic and advanced equipment typically found on an ambulance. Licensed to practice by their State and credentialed by the authority having jurisdiction (AHJ). [1]

3.3.1.2 Emergency Medical Technician — Paramedic (EMT-P). An individual who has successfully completed a course of instruction that meets or exceeds the requirements of the U.S. Department of Transportation National Standard EMT — Paramedic curriculum and who holds an EMT-P certification from the authority having jurisdiction.

The Emergency Medical Technician — Paramedic (EMT-P) is an individual who has successfully completed a course of instruction based on the DOT EMT-Paramedic: National Standard Curriculum and who holds a license to practice at the EMT-P level from the AHJ.

According to the *National EMS Scope of Practice Model,* the definition of a paramedic is as follows:

> Individual who has successfully completed a course based on the U.S. DOT Paramedic Education Standards and provides advanced emergency medical care for critical and emergent patients. Performs interventions with the basic and advanced equipment typically found on an ambulance. Licensed to practice by their State and credentialed by the authority having jurisdiction (AHJ). [1]

3.3.1.3 Medical Director. An individual who plans and directs all aspects of an organization's or system's medical policies and programs, including operations and offline (protocol) and online medical direction (direct communication consultation); is responsible for strategic clinical relationships with other physicians; oversees the development of the clinical content in materials; ensures all clinical programs are in compliance; writes and reviews research publications appropriate to support clinical service offerings; requires an active degree in medicine with specialty experience or training in emergency and disaster medical mitigation, administration, and management; relies on experience and judgment to plan and accomplish goals; and typically coordinates with the incident command.

Δ ***3.3.1.4* Medical Team Specialist.*** Any health care provider or medically trained specialist acting under the authority of the medical director, and within the context of the National Incident Management System, authorized to act as the medical point of contact for an incident.

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N *A.3.3.1.4 Medical Team Specialist.* This can include, but is not exclusive to, nurses, nurse practitioners, EMTs, physician assistants, and in some cases a health and safety officer.

Δ **3.3.2* Allied Professional.** That person who possesses the knowledge, skills, and technical competence to provide assistance in the selection, implementation, and evaluation of tasks at a hazardous materials/weapons of mass destruction (WMD) incident.

Allied professionals might also be referred to as SMEs in a mission-specific area.

N **A.3.3.2 Allied Professional.** Examples of an allied professional could include certified safety professional (CSP), certified health physicist (CHP), certified industrial hygienist (CIH), radiation safety officer (RSO), or similar credentialed or competent individuals as determined by the AHJ. An allied professional can also be referred to as a technical specialist or subject matter expert (SME) in a mission-specific area.

3.3.3 Basic Life Support (BLS). Emergency medical treatment at a level as defined by the medical authority having jurisdiction in conjunction with American Heart Association guidelines.

Because basic life support (BLS) can be broadly defined, the intent of this definition is to give the AHJ the latitude to determine which category most closely reflects the EMS responders within their system.

3.3.3.1* Emergency Care First Responder (ECFR). An individual who has successfully completed the specified emergency care first responder course developed by the U.S. Department of Transportation and who holds an ECFR certification from the authority having jurisdiction.

The Emergency Care First Responder (ECFR) is an individual who has successfully completed a course based on the DOT First Responder: National Standard Curriculum and who holds a license to practice at the first responder (FR) level from the AHJ.

According to the *National EMS Scope of Practice Model*, the definition of an emergency medical responder (EMR) is as follows:

> Individual who has successfully completed a course based on the U.S. DOT EMR Education Standards and performs basic interventions with minimal equipment while awaiting additional EMS response. Licensed to practice as an EMR by their State and credentialed by the authority having jurisdiction (AHJ). [1]

A.3.3.3.1 Emergency Care First Responder (ECFR). In Canada, the terminology used is Emergency Medical Assistant-1 (EMA-1), Emergency Medical Assistant-2 (EMA-2), and Emergency Medical Assistant-3 (EMA-3).

3.3.3.2 Emergency Medical Technician — Ambulance/Basic (EMT-A/B). An individual who has successfully completed an EMT-A or EMT-B curriculum developed by the U.S. Department of Transportation or equivalent and who holds an EMT-A/B certification from the authority having jurisdiction.

The Emergency Medical Technician — Ambulance/Basic (EMTA/B) is an individual who has successfully completed a course of instruction based on the DOT EMT-A or EMT-B - Basic: National Standard Curriculum and who holds a license to practice at the EMT-A/B level from the AHJ.

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According to the *National EMS Scope of Practice Model*, the definition of an Emergency Medical Technician (EMT) is as follows:

> Individual who has successfully completed a course based on the U.S. DOT EMT Education Standards and performs interventions with the basic equipment typically found on an ambulance on the scene and during transport. Licensed to practice as an EMT by their State and credentialed by the authority having jurisdiction (AHJ). [1]

Δ **3.3.4 Competence.** Possessing the knowledge, skills, and judgment needed to perform indicated objectives.

Knowledge and skills can be measured, but judgment is not as easily evaluated, and judgment and decision-making skills can vary substantially with circumstances. Nonetheless, training and experience improve a responder's ability to make decisions in emergencies. Various competencies outlined in this performance-based standard focus on the skills necessary rather than the hours of training needed to achieve those skills. Necessary training hours can vary from individual to individual and jurisdiction to jurisdiction, depending on prior individual training and experience and on the requirements of the AHJ. In addition to training, experience and practice through drills, tabletop exercises, and other hands-on practice and training exercises is invaluable.

3.3.5* Components of Emergency Medical Service (EMS) System. The parts of a comprehensive plan to treat an individual in need of emergency medical care following an illness or injury.

A.3.3.5 Components of Emergency Medical Service (EMS) System. These components include the following:

(1) First responders
(2) Emergency dispatching
(3) EMS agency response
(4) Hospital emergency departments
(5) Specialized care facilities

3.3.6 Contaminant. A hazardous material, or the hazardous component of a weapon of mass destruction (WMD), 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.

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Inherent in the definition of *contaminant* are the factors that the offending material is present where it does not belong and that it is somehow toxic or harmful to persons, animals, or the environment. Contaminants could be present in solid, gas, liquid, or vapor form. Dealing with each hazard type requires a different set of skills and operations.

3.3.7* Demonstrate. To show by actual performance.

A.3.3.7 Demonstrate. This performance can be supplemented by simulation, explanation, illustration, or a combination of these.

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

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3.3.9 Emergency Medical Services (EMS). The provision of treatment, such as first aid, cardiopulmonary resuscitation, basic life support, advanced life support, and other prehospital procedures, including transportation, of patients.

N **3.3.10 Emergency Response Guidebook (ERG).** The reference book, written in plain language, to guide emergency responders in their initial actions at the incident scene, specifically the *Emergency Response Guidebook* from the U.S. Department of Transportation, Transport Canada, and the Secretariat of Transportation and Communications, Mexico.

3.3.11 EMS Hazardous Materials (EMS/Hazardous Materials/WMD) Responder.

Δ ***3.3.11.1 Emergency Medical Services Responders to Hazardous Materials/Weapon of Mass Destruction at the ALS Level (ALS Responder).*** Operations-level responders who are ALS certified, assigned EMS mission-specific responsibilities at hazardous materials/WMD incidents, and are trained to meet all competencies of NFPA 472, Chapters 4 and 5, and all competencies for the assigned responsibilities in NFPA 473, Chapters 4 and 5.

Δ ***3.3.11.2 Emergency Medical Services Responders to Hazardous Materials/Weapon of Mass Destruction at the BLS Level (BLS Responder).*** Operations-level responders who are BLS certified, assigned EMS mission-specific responsibilities at hazardous materials/WMD incidents, and are trained to meet all competencies of NFPA 472, Chapters 4 and 5, and all competencies for the assigned responsibilities in NFPA 473, Chapter 4.

N ***3.3.12 Evaluate.*** The process of assessing or judging the effectiveness of a response operation or course of action within the training and capabilities of the emergency responder.

N **3.3.13* Exposure.** The process by which people, animals, the environment, property, and equipment are subjected to or come in contact with a hazardous material/weapon of mass destruction (WMD).

An exposure is quickly assumed to be an external one, but attention must be paid to the special hazards of internal exposures. For example, an internal radiation exposure from ingesting radioactive material can be more damaging to the body than an external exposure.

N **A.3.3.13 Exposure.** The magnitude of exposure is dependent primarily on the duration of exposure and the concentration of the hazardous material. This term is also used to describe a person, an animal, the environment, or a piece of equipment. The exposure can be external, internal, or both.

N **3.3.14 Exposures.** The people, animals, environment, property, and equipment that might potentially become exposed at a hazardous materials/weapons of mass destruction (WMD) incident.

N **3.3.15* Fissile Material.** Material whose atoms are capable of nuclear fission (capable of being split).

N **A.3.3.15 Fissile Material.** Department of Transportation (DOT) regulations define fissile material as plutonium-239, plutonium-242, uranium-233, uranium-235, or any combination of these radionuclides. This material is usually transported with additional shipping controls that limit the quantity of material in any one shipment. Packaging used for fissile material is designed and tested to prevent a fission reaction from occurring during normal transport conditions as well as hypothetical accident conditions. [**472**:A.3.3.27]

N **3.3.16 Hazard.** Capable of causing harm or posing an unreasonable risk to life, health, property, or the environment.

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Δ **3.3.17* Hazardous Material.** Matter (solid, liquid, or gas) or energy that when released is capable of creating harm to people, the environment, and property, including weapons of mass destruction (WMD) as defined in 18 U.S. Code, Section 2332a, as well as any other criminal use of hazardous materials, such as illicit labs, environmental crimes, or industrial sabotage.

Δ **A.3.3.17 Hazardous Material.** In the United Nations model codes and regulations, hazardous materials are dangerous goods. See also 3.3.32 and A.3.3.32, Weapon of Mass Destruction (WMD).

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

3.3.19 Incident. An emergency involving the release or potential release of hazardous materials/weapons of mass destruction (WMD).

3.3.20* Incident Commander (IC). The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and the release of resources.

A.3.3.20 Incident Commander (IC). This position is equivalent to the on-scene incident commander. The IC has overall authority and responsibility for conducting incident operations and is responsible for the management of all incident operations at the incident site.

3.3.21 Incident Command System (ICS). A specific component of an incident management system (IMS) designed to enable effective and efficient on-scene incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure.

3.3.22* Incident Management System (IMS). A process 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 to include the incident command system (ICS), unified command, multiagency coordination system, training, and management of resources.

A.3.3.22 Incident Management System (IMS). The IMS provides a consistent approach for all levels of government, private sector, and volunteer organizations to work together effectively and efficiently to prepare for, respond to, and recover from domestic incidents, regardless of cause, size, or complexity. An IMS provides for interoperability and compatibility among all levels of government, private sector, and volunteer organization capabilities. The IMS includes a core set of concepts, principles, terminology, and technologies covering the ICS, multiagency coordination systems, training, and identification and management of resources.

3.3.23 Medical Control. The physician or designee providing direction for patient care activities in the prehospital setting.

3.3.24 Medical Surveillance. The ongoing process of medical evaluation of hazardous materials response team members and public safety personnel who respond to a hazardous materials incident.

Δ **3.3.25 Mission-Specific Competencies.** The knowledge, skills, and judgment needed by operations-level responders who have completed the operations-level competencies and who are designated by the authority having jurisdiction (AHJ) to perform mission-specific tasks, such as decontamination, victim/hostage rescue and recovery, and evidence preservation and sampling.

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In the 2013 edition of NFPA 472, Chapter 5 specifies the competencies required of emergency responders at the operations level. In Chapter 4 of the 2002 edition, operations level responders were also required to have product control competencies, which included personal protective equipment (PPE).

The competencies specified in Chapter 6 of the 2013 edition of NFPA 472 are optional and are provided so that the AHJ can match the expected tasks and duties of its personnel with the required competencies to perform those tasks.

Mission-specific competencies are available in NFPA 472 for operations level responders who are assigned the following tasks:

- Use PPE, as provided by the AHJ
- Perform technical decontamination
- Perform mass decontamination
- Perform product control
- Perform air monitoring and sampling
- Perform victim rescue and recovery operations
- Provide evidence preservation and sampling
- Respond to illicit laboratory incidents

Operations-level, mission-specific tasks must be performed under the guidance of a hazardous materials technician, allied professional, or standard operating procedure.

3.3.26 Patient. Any person or persons requiring or requesting a BLS/ALS evaluation or intervention at the scene of a hazardous materials/WMD incident.

N **3.3.27* Personal Protective Equipment (PPE).** The protective clothing and respiratory protective equipment provided to shield or isolate a person from the hazards encountered at hazardous materials/weapon of mass destruction (WMD) incident operations.

PPE is designed to protect the individual responder against anticipated or expected hazards. Responders must be trained to use, care for, and select appropriate PPE.

N **A.3.3.27 Personal Protective Equipment (PPE).** 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. [472:A.3.3.47]

3.3.28 Protocol. A guideline for a series of sequential steps directing patient treatment.

3.3.29 Region. A geographic area that includes the local and neighboring jurisdiction for an EMS agency.

N **3.3.30* Safety Data Sheet (SDS).** Formatted information provided by chemical manufacturers and distributors of hazardous products, which contains information about chemical composition, physical and chemical properties, health and safety hazards, emergency response, and waste disposal of the material.

N **A.3.3.30 Safety Data Sheet (SDS).** SDS is a component of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) and replaces the term material safety data sheet (MSDS). GHS is an internationally agreed-upon system, created by the United Nations beginning in 1992. It was designed to replace the various classification and labeling standards used in different countries by using consistent criteria on a global level.

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It supersedes the relevant European Union (EU) system, which has implemented the GHS into EU law as the Classification, Labelling and Packaging (CLP) Regulation, and United States Occupational Safety and Health Administration (OSHA) standards. The SDS requires more information than MSDS regulations and provides a standardized structure for presenting the required information.

N **3.3.31 Victim Prioritization and Patient Triage.** Victim prioritization utilizes risk-based factors to establish an action plan for victim removal and eventual treatment. Patient triage is a clinical prioritization employed to maximize survival and to prioritize application of therapeutic modalities.

3.3.32* Weapon of Mass Destruction (WMD). (1) Any destructive device, such as any explosive, incendiary, or poison gas bomb, grenade, rocket having a propellant charge of more than four ounces, missile having an explosive or incendiary charge of more than one quarter ounce (7 grams), mine, or device similar to the preceding description; (2) any weapon involving toxic or poisonous chemicals; (3) any weapon involving a disease organism; or (4) any weapon that is designed to release radiation or radioactivity at a level dangerous to human life.

A.3.3.32 Weapon of Mass Destruction (WMD). The source of this definition is 18 USC 2332a. Weapons of mass destruction (WMD) are known by many different abbreviations and acronyms, the most common of which is CBRNE, which is the acronym for chemical, biological, radiological, nuclear, and explosive problems that could be released as the result of a terrorist attack.

3.3.32.1* Radiological Weapons of Mass Destruction.

N ***A.3.3.32.1 Radiological Weapons of Mass Destruction.*** The intent of the annex material is to provide information on the different types of radiological/nuclear devices that can be used as a weapon by those with malicious intent.

3.3.32.1.1* Improvised Nuclear Device (IND). An illicit nuclear weapon that is bought, stolen, or otherwise obtained from a nuclear state (that is, a national government with nuclear weapons), or a weapon fabricated from fissile material that is capable of producing a nuclear explosion.

A.3.3.32.1.1 Improvised Nuclear Device (IND). The nuclear explosion from an IND produces extreme heat, powerful shockwaves, and prompt radiation that would be acutely lethal for a significant distance. It also produces potentially lethal radioactive fallout, which may spread and deposit over very large areas. A nuclear detonation in an urban area could result in over 100,000 fatalities (and many more injured), massive infrastructure damage, and thousands of square kilometers of contaminated land. If the IND fails to work correctly and does not create a nuclear explosion, then the detonation of the conventional explosives would likely disperse radioactive material like an explosive radiation dispersal device (RDD).

3.3.32.1.2* Radiation Dispersal Device (RDD). A device designed to spread radioactive material through a detonation of conventional explosives or other means.

A.3.3.32.1.2 Radiation Dispersal Device (RDD). Any device that intentionally spreads radioactive material across an area with the intent to cause harm, without a nuclear explosion occurring. An RDD that uses explosives for spreading or dispersing radioactive material is commonly referred to as a "dirty bomb" or "explosive RDD." Nonexplosive RDDs could spread radioactive material using common items such as pressurized containers, fans, building air-handling systems, sprayers, crop dusters, or even spreading by hand.

3.3.32.1.3* Radiation Exposure Device (RED). A device intended to cause harm by exposing people to radiation without spreading radioactive material.

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A.3.3.32.1.3 Radiation Exposure Device (RED). A device, used interchangeably with the term "radiological exposure device" or "radiation emitting device," consisting of radioactive material, either as a sealed source or as material within some type of container, or a radiation-generating device, to cause harm by exposure to ionizing radiation.

Reference Cited in Commentary

1. *The National EMS Scope of Practice Model,* U.S. Department of Transportation/National Highway Traffic Safety Administration, Washington, DC, 2010, www.nhtsa.gov.

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Competencies for Hazardous Materials/WMD Basic Life Support (BLS) Responder

4

Hazardous materials/WMD incidents differ from other situations in which EMS personnel provide patient care. These incidents may require greater coordination with other response personnel, and usually it is not the basic life support (BLS) responder that makes initial patient contact. These incidents can be unique and can involve infrequently used skills such as victim decontamination and protection of the emergency medical services (EMS) crew from cross contamination.

Many EMS systems have a system of triage that manages the sorting of critical to noncritical patients. When dealing with hazardous materials/WMD, the lines of triage are blurred. Many chemicals act on different systems within the body that present symptoms immediately; other chemicals take time before the injury manifests. The responder should fall back on the chemical and physical properties of a material to identify triage modalities. Triage is based on a set of signs and symptoms that the patient will display. With chemicals, this constellation of signs and symptoms are in many cases delayed or even masked. Additionally, underlying medical conditions can be exacerbated when exposed to certain classifications of chemicals. Understanding the chemical and physical properties and how they effect a person will lead to appropriate patient care.

4.1 General.

Δ **4.1.1 Introduction.** All emergency medical services (EMS) personnel at the hazardous materials/WMD basic life support (BLS) responder level, in addition to their BLS certification, shall be trained to meet at least the competencies of the operations level responders as defined in Chapter 5 of NFPA 472 and all competencies of this chapter.

Δ **4.1.2 Goal.** The goal of the competencies at the BLS responder level shall be to provide the individual with the knowledge and skills necessary to safely deliver BLS at hazardous materials/WMD incidents, function within the established IMS/ICS, and perform the following duties:

(1) Analyze a hazardous materials/WMD incident to determine the potential health hazards encountered by the BLS responder, other responders, and anticipated and actual patients by completing the following tasks:

It is imperative that BLS responders maintain strong situational awareness when responding to hazardous materials/WMD incidents. In some circumstances, the local third-party EMS might arrive at the incident first. In those cases, the BLS responders should take time to size up the scene and understand the hazards present. When the BLS providers arrive after an organized hazmat response has begun, it is equally important to again size up the incident to understand the potential threats to the health and safety of the responders and civilian population.

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(a) Survey an incident where hazardous materials/WMD have been released and evaluate suspected and identified patients for signs and symptoms of exposure

BLS responders must be aware of the subtle signs and symptoms that can accompany a chemical exposure. Not all patients show an overt or clear-cut collection of signs and symptoms. When there are multiple patients, BLS responders should look for consistencies and inconsistencies in the patients' symptoms, and their observations should center around respiratory, cardiovascular, and neurological assessments. It may be possible to determine the presence of a nerve agent, for example, by the signs and symptoms exhibited by exposed patients.

(b) Collect hazard and response information from available technical resources to determine the nature of the problem and potential health effects of the substances involved

BLS responders must take steps to correlate the physical and chemical properties of a released substance to the potential health effects and treatment(s) provided to exposed patients.

If BLS responders are called to the scene to stand by during a working hazmat incident, they should seek information about the chemical and physical properties of the released substance. In some cases, alerting the anticipated receiving hospital would be prudent if specific antidotes or other therapies are indicated or required. It is wise to plan to render care aggressively — it will be too late to formulate a good plan after the exposure happens.

(2) Plan to deliver BLS to any exposed patient within the scope of practice by completing the following tasks:

(a) Identify preplans of high-risk areas and occupancies to identify potential locations where significant human exposures can occur

It is important for BLS care providers to identify fixed facilities and other locations where hazardous substances are used routinely. The idea is to prepare for low-frequency, high-impact situations before they occur. For example, it would be good to know that a facility within a response area uses hydrofluoric (HF) acid and also keeps available (or identifies readily available sources of) topical calcium gluconate gel to treat skin exposures. It also would be beneficial to contact the appropriate receiving hospital to discuss procedures for handling a patient exposed to HF.

(b) Identify the capabilities of the hospital network to accept exposed patients and perform emergency decontamination if required

As with other specialty requirements such as trauma, pediatrics, and burns, hospitals vary in their ability to handle contaminated patients. Prehospital care providers should be familiar with local hospitals and their ability to perform emergency decontamination. Ideally, all patients are fully decontaminated before transport, however that may occur. An example of this is walk-in patients who may be affected by the event.

(c) Identify the medical components of the communication plan

All BLS responders should be familiar with the radio communications procedures for their jurisdictions.

(d) Describe the role of the BLS responder as it relates to the local emergency response plan and established IMS/ICS

All BLS responders should understand their roles in the incident command system (ICS). The ICS is a reliable and effective method of organizing and managing a hazardous materials/WMD incident. Responders of any discipline who act outside their accepted roles at an incident run the risk of undermining the goals

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and objectives set by the incident commander (IC) and put themselves and fellow responders at greater risk. It may be tempting to arrive at a large incident, for example, and start working without direction. Unfortunately, this is counterproductive to the overall goal and objectives of the incident.

(3) Implement a prehospital treatment plan within the scope of practice by completing the following tasks:

(a) Determine the nature of the hazardous materials/WMD incident as it relates to anticipated or actual patient exposures and subsequent medical treatment

BLS responders should learn as much as possible about the physical and chemical properties of the released substance to develop an informed treatment plan for exposed individuals. Understanding how vapor pressure, solubility, and pH can affect patient care should be part of the development of the patient care planning.

(b) Identify the need for and the effectiveness of decontamination efforts

Before transport, it is incumbent on the medical personnel accepting responsibility for a patient(s) to ensure that the patient has been fully decontaminated. It is unacceptable to spread contamination from the scene to the hospital.

(c) Determine if the available medical resources will meet or exceed patient care needs

All BLS response personnel should be able to estimate the medical resources necessary to deliver optimal care to victims of a hazardous materials/WMD event. The BLS responder should be able to advise the IC about quality and quantity of necessary resources, the availability of those resources, and special conditions affecting access to the scene and delivery of patient care. In general, the BLS responder should be able to understand the needs of the incident as a whole. It is easy to get tunnel vision and focus on the needs of a single patient while neglecting the needs within the patient care system.

(d) Describe evidence preservation issues associated with patient care

Evidence preservation is not solely the responsibility of law enforcement personnel. Each responder involved with the incident is responsible for identifying potential evidence and taking steps to preserve it. This includes contaminated clothing, personal articles belonging to the exposed individuals, and bodies of victims.

(e) Develop and implement a medical monitoring plan for responders

Pre-entry medical monitoring, as it relates to evaluating the medical status of a responder or rendering treatment for an accidentally exposed responder, is an important facet of providing EMS at hazardous materials/WMD incidents.

Medical support personnel should also address the medical history and baseline physical status of responders immediately before and immediately after an operational rotation. Medical history should include any present illness or condition, past medical history, allergies, and medications. Physical evaluation should include routine measures such as pulse, blood pressure, body temperature, and respiratory rate.

Other measures that may be evaluated include pre- and post-entry body weight. These statistics will provide invaluable information in discerning between dehydration and free water toxicity or overhydration. It has been established that prolonged excessive ingestion of water can lead to electrolyte derangement and hyponatremia, and the physical signs and symptoms are often similar to the

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manifestations of dehydration. It is additionally important that comparison weights be recorded so that any potential incorrect treatment course can be avoided.

(f) Report and document the actions taken by the BLS responder at the incident scene

BLS providers infrequently encounter patients suffering significant illness as a result of an exposure. When those situations occur, however, it is critical that the BLS provider understand the nature of the exposure and treat it accordingly. Documenting and reporting those findings is a valuable tool for the continuum of care. A good report at the transfer of care is important.

(4) Coordinate the following tasks with the hazardous materials safety officer:
   (a) Analyze potential health concerns, which could be inclusive of environmental concerns
   (b) Plan for treatment and services delivery for patients and responders

4.2 Competencies — Analyzing the Incident.

Medical support personnel should be aware of the signs and symptoms of the more common human and animal exposures. This capacity is necessary so that the information can be communicated to the IC and to the next level of prehospital care providers (if present) to provide valuable intelligence for strategic determinations.

4.2.1 Surveying Hazardous Materials/WMD Incidents. Given scenarios of hazardous materials/WMD incidents, the BLS responder shall assess the nature and severity of the incident as it relates to anticipated or actual EMS responsibilities at the scene.

4.2.1.1 Given examples of the following types of containers, the BLS responder shall identify the potential mechanisms of injury/harm and possible treatment modalities:

(1) Pressure
(2) Nonpressure
(3) Cryogenic
(4) Radioactive

Good situational awareness enables the BLS responder to see and interpret the overall picture at a hazardous materials/WMD incident. Without knowing anything about the nature of the product inside a container, the BLS responder should, simply by identifying the type of container, distinguish basic physical characteristics of the contained substance that could have an impact on an exposed patient. The same applies for other types of containers. Again, the BLS responder should develop the ability to pick out the important visual clues and link them to the delivery of patient care.

4.2.1.2 Given examples of the nine U.S. Department of Transportation (DOT) hazard classes, the NFPA 704 markings, and the Globally Harmonized System (GHS) classifications, the BLS responder shall identify possible types of injuries or illnesses and possible prehospital treatment modalities associated with each hazard class.

Even when the exact chemical name is unknown, it is still possible to formulate a treatment plan based on the broad hazards of a particular classification of a chemical. When no other information is known about the hazardous material/WMD, routine medical care could be the most appropriate care provided.

4.2.1.3 Given examples of various hazardous materials/WMD incidents at fixed facilities, the BLS responder shall identify the following available health-related resource personnel:

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(1) Occupational/environmental health and safety representatives

Typically, corporate environmental health and safety representatives are well informed about chemical inventories, processes, and other important health- and safety-related issues at the site. These employees are typically trained in safety and industrial hygiene and are familiar with their workplaces and the hazards that could be present, whether stored chemicals or materials used in manufacturing processes.

(2) Radiation safety officers (RSO)

The requirements for a fixed facility to have a radiation safety officer (RSO) vary with the type of license and/or the radioactive substances used. If BLS providers respond to a radiation exposure at a fixed facility, attempts should be made to contact the RSO. That person could provide useful guidance on the potential health effects of an exposure to radiation.

(3) Occupational physicians and nurses

These individuals may provide medical information pertaining to the victims (plant or site workers) to the medical support personnel.

(4) Site emergency response teams

Site-specific emergency response teams (ERTs) can be a useful asset to BLS responders called to the scene of a hazardous materials/WMD incident. In many cases, formalized fire brigades and/or ERTs are able to provide site-specific information from an emergency response perspective to the arriving responders.

(5) Product or container specialists

• **4.2.1.4** Given the following biological agents, the BLS responder shall describe the signs and symptoms of exposure and/or illness for the following:

(1) Variola major virus (smallpox)
(2) *Clostridium botulinum*
(3) Coliforms (e.g., *E. coli* O157:H7)
(4) Ricin toxin
(5) *Bacillus anthracis* (anthrax)
(6) Venezuelan equine encephalitis virus
(7) *Rickettsia*
(8) *Yersinia pestis* (plague)
(9) *Francisella tularensis* (tularemia)
(10) Viral hemorrhagic fever
(11) Ebola
(12) Other CDC Category A, B, or C–listed organism

The U.S. Centers for Disease Control and Prevention (CDC)'s web site for bioterrorism agents and diseases states the following:

Category A Agents/Diseases

The U.S. public health system and primary healthcare providers must be prepared to address various biological agents, including pathogens that are rarely seen in the United States. High-priority agents that pose a risk to national security because they

- Can be easily disseminated or transmitted from person to person;
- Result in high mortality rates and have the potential for major public health impact;

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- Might cause public panic and social disruption; and
- Require special action for public health preparedness.

Category B Agents/Diseases

Second highest priority agents include those that

- Are moderately easy to disseminate;
- Result in moderate morbidity rates and low mortality rates; and
- Require specific enhancements of CDC's diagnostic capacity and enhanced disease surveillance.

Category C Agents/Diseases

Third highest priority agents include emerging pathogens that could be engineered for mass dissemination in the future because of

- Availability;
- Ease of production and dissemination; and
- Potential for high morbidity and mortality rates and major health impact.

Source: U.S. Centers for Disease Control and Prevention, https://emergency.cdc.gov/agent/agentlist-category.asp

4.2.1.5 Given a scenario involving a hazardous materials/WMD, the BLS responder shall determine the general health risks to patients exposed to those substances in the case of any release with the following:

(1) Visible cloud

Countless substances can harm civilians and responders alike. It is not the intention of 4.2.1.5 to require BLS responders to be familiar with every potential substance. The BLS responder should, however, be familiar with the substances that are present in their jurisdiction, as well as the most common WMDs, toxic industrial chemicals (TICs), and toxic industrial materials (TIMs).

The U.S. Occupational Safety and Health Administration (OSHA) states that TICs are industrial chemicals that are manufactured, stored, transported, and used throughout the world. The physical state of TICs can be gas, liquid, or solid. They can be chemical hazards (e.g., carcinogens, reproductive hazards, corrosives, or agents that affect the lungs or blood) or physical hazards (e.g., flammable, combustible, explosive, or reactive). See www.osha.gov for a table of TICs, and see www.osha.gov/SLTC/emergencypreparedness/guides/chemical.html for more information on chemicals.

The National Institute of Justice (NIJ) states that TIMs are similar to TICs but are chemicals other than chemical warfare agents that have harmful effects on humans [1]. They are used in a variety of settings such as manufacturing facilities, maintenance areas, and general storage areas.

Training programs for BLS responders should include a section on the basic physical and chemical properties of the broad classifications of hazardous materials/WMD and how they might encounter them. Typically, the scope of practice for BLS responders is limited when it comes to handling exposures resulting from hazardous materials/WMD incidents (see Exhibit II.4.1). Therefore, training in this area should focus on recognizing the signs and symptoms of typical hazardous materials/WMD substances, basic treatment modalities, and the best practices to avoid becoming exposed.

(2) Liquid pooling
(3) Solid dispersion

4.2.1.6 Given examples of hazardous materials/WMD incidents involving illicit laboratory operations, BLS responders assigned to respond to illicit laboratory incidents shall identify the potential drugs/WMD being manufactured and shall describe the operational considerations,

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perform a comprehensive scene survey, and complete a hazard and risk analysis to meet the following related requirements:

A risk assessment must be done before entry to identify potential hazards to the responders, civilian population, and the community. In all cases, the appropriate level of personal protective equipment (PPE) must be worn. Common examples of general hazards include the following:

(a) Confined spaces
(b) Electrical hazards
(c) Pathogen hazards
(d) Damaged or unstable containers
(e) Flammable, corrosive, oxygen deficient or enriched atmospheres

(1)* Given examples of illicit drug manufacturing methods, identify the health hazards associated with the products and processes involved in the illicit laboratory

As with any emergency event, realizing potential hazards and health effects are a part of the risk assessment. In any incident, especially where an illicit lab might be present, a complete hazard-risk assessment must be accomplished. Concerns to consider when responding to an illicit lab include the following:

1. Large amounts of waste product(s) can be generated from the synthesis process.
2. A variety of acids, bases, and solvents are among the common types of chemicals used.
3. Some chemical processes cause reduced oxygen levels within enclosed environments, which are sometimes associated with flammable gases and with asphyxiating gases with ignition sources.
4. Potential health hazards can fall into one or more of the following categories:
   (a) Flammable
   (b) Corrosive
   (c) Oxygen deficient/enriched
   (d) Asphyxiant
   (e) Results from energetic materials

A.4.2.1.6(1) Examples of products involved in illicit drug manufacturing include the following:

(1) Ammonia
(2) Ephedrine and pseudoephedrine
(3) Flammable solvents such as ether compounds and methanol
(4) Fluorinated/chlorinated hydrocarbons (Freon)
(5) Hydrogen chloride
(6) Aluminum chloride
(7) Iodine
(8) Lithium or sodium metal
(9) Phosphine gas
(10) Red phosphorus
(11) Sodium hydroxide or other caustic substances

(2) Given examples of illicit chemical WMD methods, identify the hazards of the potential products and processes involved in the illicit laboratory

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EXHIBIT II.4.1

The BLS responder must determine the health risks to individuals exposed to toxic materials. (Courtesy of Rob Schnepp)

The production of chemicals used for illegal purposes presents a myriad of challenges for the BLS responder. Management of these labs can, in certain circumstances, involve the handling of chemicals, including acids, bases, solvents, reagents, and intermediates.

These chemicals with their associated reagents sometimes produce intermediates. This reaction process can further require heating or cooling reactants and products. Cooling a substance that requires heat or heating a substance that requires cooling could cause further release of product. An understanding of the process is necessary before interacting with the lab.

Chemicals that might be used in an illicit chemical lab include the following:

- Acetylene
- Acetone
- Ammonium fluoride
- Arsenic
- Arsenic trichloride
- Benzyl chloride
- Bromine
- Carbon dioxide
- Carbon tetrachloride
- Chlorine gas
- Cyclohexanol
- Dimethylamine
- Ethylene
- Ethylene dichloride
- Hydrofluoric acid
- Malononitrile
- Methyl chloride
- Nitromethane
- Phosphorus trichloride
- Potassium cyanide
- Sodium cyanide
- Sodium fluoride
- Sulfuric acid
- Toluene
- Vinyl chloride

Potential health hazards fall into one or more of the following categories:

1. Neurotoxins (nerve agents)
2. Chemical asphyxiants (blood agents)
3. Irritating (lachrymators)
4. Strong bases (mustards)
5. Psychomotor (disabling) toxins (psychogenic)

(3) Given examples of illicit biological WMD methods, identify the health hazards of the potential products and processes involved in the illicit laboratory

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The biological laboratory can have both chemical hazards and the biological agent that is being produced. As with the drug, chemical, and explosives labs, the biological lab has chemicals in the precursor form as reagents before the desired product is formed.

The goal of a biological process is to grow or extract biological materials. These can include bacteria, viruses, or toxins extracted from the microorganism.

A growth medium called agar is used in the growing stage of the process. Agar can be protein, blood, or chemical based. These samples are then incubated for potential growth production in which the culture is produced. Some biological agents can be concentrated and dried for easy dissemination.

Biological weapons can be placed into three general categories based on potential outcome: lethal, potentially lethal, or incapacitating. Commentary Table II.4.1 provides examples of these categories. As with any illicit lab, waste production has components of the desired end product along with process waste. These components can be just as hazardous as the initial production products.

COMMENTARY TABLE II.4.1 *Three General Categories of Biological Weapons*

Lethal	*Potentially Lethal*	*Incapacitating*
Anthrax	Diphtheria	West Nile encephalitis
Glanders	Brucellosis	Q-Fever
Plague	Monkey pox infection	Influenza
Smallpox	Tularemia	Dengue fever
Ebola	Psittacosis	Venezuelan equine encephalitis (VEE), Eastern equine encephalitis (EEE)

(4) Given examples of illicit laboratory operations, describe the potential booby traps that have been encountered by response personnel

As with any illegal activity, the perpetrator does not want to be found or recognized. These labs are producing product for financial return. The end manufactured goods have a street value several times the cost of production. In many cases, these operations are guarded by booby traps, which can be one or more of the following:

- Trip wires
- Improvised explosive devices
- Light bulbs filled with gasoline
- Containers of acids/bases/cyanides over door openings or behind doors
- Hidden guard dogs

(5) Given examples of illicit laboratory operations, describe the agencies that have investigative authority and operational responsibility to support the response

The resources within any community must be planned before the event. Examples of resources, agencies, and disciplines that might be required include the following:

- Field hospitals
- Emergency department loads, support staff, physicians
- Medical antidote and/or prophylaxis

Community resources include the following:

- EMS
- Law enforcement

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- Fire department
- Local health department
- Mutual aid/automatic response from surrounding communities
- Local interhospital agreements
- Medical reserve corps

State resources include the following:

- Statewide mutual aid for catastrophic events (multidisciplinary)
- Pharmaceutical stockpiles
- Time-phased resources for long-term events (state planning or federal resources)
- Civil support teams
- State health department
- State law enforcement
- National Guard

Federal resources include the following:

- U.S. Disaster Medical Assistance Teams (DMAT)
- Pharmaceutical stockpiles
- Federal Bureau of Investigation (FBI)
- Centers for Disease Control and Prevention (CDC)
- Military assets (National Guard)
- National Medical Response Team (NMRT)
- Metropolitan Medical Response System (MMRS)

4.2.1.7 Given a scenario involving radioactive materials, including an accidental release, a radiological dispersion device (RDD), and a radiological exposure device (RED), the BLS responder shall determine the prehospital care based upon the probable health risks and potential patient outcomes by completing the following:

(1) Determine the most likely exposure pathways for a given radiation exposure, including inhalation, ingestion, injection, and direct skin exposure
(2) Identify the difference between radiation exposure and radioactive contamination and the health concerns associated with each

Radiation exposure occurs when a person is near a source of radiation. The person might receive a radiation exposure but might not become radioactive. For example, a person having an x-ray receives a radiation exposure but does not become radioactive. Persons suffering a radiation exposure do not require decontamination before medical treatment.

Radioactive contamination occurs when loose particles, contaminated with a radioactive material, settle on clothing, PPE, or skin. A person with radioactive contamination is radioactive. Radiation illness can result from inhaled or ingested particles. Persons with radioactive contamination must be decontaminated before transportation to a medical facility to avoid the spread of radiation.

4.2.1.8 Given three examples of pesticide labels and labeling, the BLS responder shall use the following information to determine the associated health risks and prehospital care for an exposure:

(1) Hazard statement
(2) Precautionary statement

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Precautionary statements guide the applicator in taking proper precautions to protect humans or animals that could be exposed.

(3) Signal word

Each pesticide label must contain a signal word. The three signal words, in order of increasing toxicity, are *caution*, *warning*, and *danger*.

The following are the toxicity categories for pesticides established by the U.S. Environmental Protection Agency (EPA) (40 CFR 156) according to their acute (short-term) toxicity [7]:

- **Toxicity Category I:** All pesticide products meeting the criteria of Toxicity Category I must bear on the front panel the signal word "Danger." In addition, if the product was assigned to Toxicity Category I on the basis of its oral, inhalation, or dermal toxicity (as distinct from skin and eye local effects), the word "Poison" must appear in red on a background of distinctly contrasting color and the skull and crossbones must appear in immediate proximity to the word "poison."
- **Toxicity Category II:** All pesticide products meeting the criteria of Toxicity Category II must bear on the front panel the signal word "Warning."
- **Toxicity Category III:** All pesticide products meeting the criteria of Toxicity Category III must bear on the front panel the signal word "Caution."
- **Toxicity Category IV:** All pesticide products meeting the criteria of Toxicity Category IV must bear on the front panel the signal word "Caution."
- **Child Hazard Warning Statement:** The Child Hazard Warning Statement "Keep Out of Reach of Children" is required on all product labels, unless the requirement is waived. The warning statement requirement may be waived when the registrant (the individual or entity registering the pesticide with EPA) adequately demonstrates that the likelihood of contact with children during distribution, storage, or use is extremely remote or if the pesticide is approved for use on infants or small children.

The EPA uses the criteria shown in Commentary Table II.4.2 to determine the toxicity category of pesticides. These criteria are based on the results of animal tests done in support of registration of the pesticide.

COMMENTARY TABLE II.4.2 *Pesticide Toxicity Category Criteria*

Hazard Indicators	*I*	*II*	*III*	*IV*
Oral LD_{50}	Up to and including 50 mg/kg	50 thru 500 mg/kg	500 thru 5,000 mg/kg	5,000 mg/kg
Dermal LD_{50}	Up to and including 200 mg/kg	200 thru 2000 mg/kg	2000 thru 20,000 mg/kg	20,000 mg/kg
Inhalation LC_{50}	Up to and including 0.2 mg/liter	0.2 thru 2 mg/liter	2 thru 20 mg/liter	20 mg/liter
Eye irritation	Corrosive; corneal opacity not reversible within 7 days	Corneal opacity reversible within 7 days; irritation persisting for 7 days	No corneal opacity; irritation reversible within 7 days Moderate irritation at 72 hours	No irritation
Skin irritation	Corrosive	Severe irritation at 72 hours		Mild or slight irritation at 72 hours

Source: Title 40 CFR Part 156.62, Toxicity Category.

(4) Pesticide name

A specific name, usually registered as a trademark, will identify a pesticide as having been produced by a manufacturer.

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4.2.2 Collecting and Interpreting Hazard and Response Information. The BLS responder shall obtain information from the following sources to determine the nature of the medical problem and potential health effects:

(1) Hazardous materials databases
(2) Clinical monitoring
(3) Reference materials (e.g., SDS and ERG)
(4)* Technical information centers (e.g., CHEMTREC, CANUTEC, and SETIQ) and local, state, provincial, and federal authorities

A.4.2.2(4) CHEMTREC, the Chemical Transportation Emergency Center, is a round-the-clock resource for obtaining immediate emergency response information for accidental chemical releases. CANUTEC, the Canadian Transport Emergency Centre, is operated by Transport Canada to assist emergency response personnel in handling dangerous goods emergencies. SETIQ is the Mexican Emergency Transportation System for the Chemical Industry.

(5) Allied professionals
(6) Regional poison control centers

4.2.3 Establishing and Enforcing Scene Control Procedures. Given two scenarios involving hazardous materials/WMD incidents, the BLS responder shall identify how to establish and enforce scene control, including control zones and emergency decontamination, and communications between responders and to the public 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/WMD incidents
(3) Identify the basic techniques for the following protective actions at hazardous materials/WMD incidents:
    (a) Evacuation
    (b) Shelter-in-place protection
    (c) Isolation of the hazard area and denial of entry
(4) Demonstrate the ability to perform emergency decontamination
(5) Identify the items to be considered in a safety briefing prior to allowing personnel to work at the following:
    (a) Hazardous materials incidents
    (b) Hazardous materials/WMD incidents involving criminal activities
(6) Identify the procedures for ensuring coordinated communication between responders and to the public

Even though it might not be a primary responsibility for EMS personnel to establish control zones, it is still an important concept to understand. There could be times when BLS care providers, especially those assigned to transport ambulances, arrive first at the scene of a hazardous materials/WMD incident. In those instances, it might be necessary to control the scene instead of stopping to treat the first victim encountered.

If control zones are not in place before the arrival of BLS personnel, control zones should be quickly established. BLS care providers should draw on their hazmat training to understand the nature of the release and set zones accordingly. In some cases, it is more beneficial to begin to manage the incident instead of finding and treating the first patient encountered.

All BLS responders should be familiar with the tools, equipment, and standard operating procedures of the authority having jurisdiction (AHJ) when it comes to emergency decontamination. It might be necessary to improvise on the scene — be flexible. If the concept of emergency decontamination is understood, the procedures can be worked out on the scene.

It is vital to provide the public with adequate information when it comes to illness and injuries as a result of a hazardous materials/WMD incident. The emergency response community as a whole

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should be aware of the need to provide good public information. This may involve incorporation in a joint information center (JIC).

4.3 Competencies — Planning the Response.

Planning the response might involve the medical response/support personnel as subject matter contributors to the IC, safety officer, or other responders as appropriate. The strategic considerations directly addressed by medical specialists include hospital capability; hospital considerations; caregiver-to-victim ratios; special resources; medical logistics; and emergent, immediate, mid- and long-range clinical considerations.

4.3.1 Identifying High Risk Areas for Potential Exposures.

4.3.1.1 The BLS responder, given an events calendar and pre-incident plans, which can include the local emergency planning committee plan, as well as the agency's emergency response plan and standard operating procedures (SOPs), shall identify the venues for mass gatherings, industrial facilities, potential targets for terrorism, and any other location where an accidental or intentional release of a harmful substance can pose a health risk to any person in the local geographical area as determined by the AHJ and shall identify the following:

The goal of 4.3.1.1 is to remind BLS responders that planning is essential. Almost every jurisdiction has an area of concern when it comes to hazardous materials/WMD events. It is unwise not to plan at these locations. A sound plan could be the difference between handling an event effectively and being completely overwhelmed.

(1) Locations where hazardous materials/WMD are used, stored, or transported
(2) Areas and locations that present a potential for a high loss of life or rate of injury in the event of an accidental or intentional release of hazardous materials/WMD
(3)* External factors that might complicate a hazardous materials/WMD incident, including routes of travel and traffic issues, receiving hospital availability, communications interoperability, and inter-agency cooperation

A.4.3.1.1(3) External factors can include geographic, environmental, mechanical, and transportation factors such as prevailing winds, water supply, vehicle and pedestrian traffic flow, ventilation systems, and other natural or man-made influences, including air and rail corridors.

4.3.2 Determining the Capabilities of the Local Hospital Network.

4.3.2.1 The BLS responder shall identify the following methods and vehicles available to transport hazardous materials patients and shall determine the location and potential routes of travel to the medically appropriate local and regional hospitals, based on the patients' needs:

BLS responders, especially those charged with patient transport, should be familiar with the local and regional health care systems when it comes to the location, type, and capabilities of local hospitals. During the planning process, it is necessary to identify the facilities that are capable of providing care to exposed patients (see Exhibit II.4.2). BLS responders should be aware of the level of preparedness of local hospitals.

(1) Adult trauma centers
(2) Pediatric trauma centers
(3) Adult burn centers

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EXHIBIT II.4.2

The photograph shows exposed patients at a hazardous materials incident. (Courtesy of Fairfax County Fire and Rescue Department)

(4) Pediatric burn centers
(5) Hyperbaric chambers
(6) Field hospitals
(7) Dialysis centers
(8) Supportive care facilities
(9) Forward deployable assets
(10) Other specialty hospitals or medical centers

4.3.2.2 Given a list of receiving hospitals in the region, the BLS responder shall describe the location, availability, and capability of hospital-based decontamination facilities.

Methods used for decontamination vary from hospital to hospital. Responders need to be familiar with the capabilities of local and regional primary care facilities as they relate to guarding against cross contamination and treatment of hazardous materials exposures. This will aid in ensuring that the most appropriate receiving facility is chosen to ensure the best care for the patient and the safety of attending personnel.

4.3.2.3 The BLS responder shall describe the BLS protocols for prehospital care and SOPs for a mass casualty incident (MCI), including priority condition, treatment, and transport at a hazardous materials/WMD incident where exposures have occurred as developed by the AHJ and the prescribed role of medical control and poison control centers.

The local emergency response plan, protocols, and procedures must define the actions that the BLS responder should follow when confronted with a hazardous material–related mass casualty incident. The action plan should provide direction for times when normal communications are disrupted. An alternative means of contacting medical control or poison control centers is required.

4.3.2.4 The BLS responder shall identify the formal and informal mutual aid resources (hospital- and non-hospital-based) for the field management of multicasualty incidents, as follows:

(1) Mass-casualty trailers with medical supplies
(2) Mass-decedent capabilities
(3) Regional decontamination units
(4) Replenishment of medical supplies during long-term incidents
(5) Rehabilitation units for the EMS responders
(6) Replacement transport units for vehicles lost to mechanical trouble, collision, theft, and contamination

4.3.2.5 The BLS responder shall identify the special hazards associated with inbound and outbound air transportation of patients exposed to hazardous materials/WMD.

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The threat of a contaminant spread by inbound aircraft and the potential contamination of the aircraft by the release can pose a significant risk to responders, the public, and the aircraft itself. The threat to the outbound aircraft is the risk that exposed patients might emit a hazardous substance that would affect the flight crew while the aircraft is in flight. Additionally, the threat of contaminating the aircraft itself is another risk. The proper management of air operations at hazardous materials events is extremely important to both the aircraft flight crews and those on the ground.

4.3.3 Identifying Incident Communications.

4.3.3.1 Given an incident communications plan, the BLS responder shall identify the following:

(1) Medical components of the communications plan
(2) Ability to communicate with other responders, transport units, and receiving facilities

4.3.3.2 Given examples of various patient exposure scenarios, the BLS responder shall describe the following information to be transmitted to the medical or poison control center or the receiving hospital prior to arrival:

(1) Name of the substance(s) involved
(2) Physical and chemical properties of the substance(s) involved
(3) Number of victims being transported
(4) Age and sex of transported patient
(5) Patient condition and chief complaint
(6) Medical history
(7) Circumstances and history of the exposure, such as duration of exposure and primary route of exposure
(8) Vital signs, initial and current
(9) Symptoms described by the patient, initial and current
(10) Presence of associated injuries, such as burns and trauma
(11) Decontamination status
(12) Treatment rendered or in progress
(13) Patient response to treatment(s)
(14) Estimated time of arrival

BLS responders should understand that an accurate and complete report to the receiving hospital is crucial. It provides the necessary lead time for hospital staff to prepare for accepting the exposed patient.

4.3.4 Identifying the Role of the BLS Responder.

The agency's hazardous materials emergency response plan should outline the role of the BLS responder. Primarily, that role includes responding to an emergency, assessing the nature of the incident, implementing protective measures, notifying other agencies, asking for additional assistance, establishing or working within an incident management system, and performing BLS medical treatment, triage, and transport in accordance with local protocols and procedures.

Δ **4.3.4.1** Given scenarios involving hazardous materials/WMD, the BLS responder shall identify his or her role during hazardous materials/WMD incidents as specified in the emergency response plan and SOPs developed by the AHJ, as follows:

(1) Describe the purpose, benefits, and elements of the IMS/ICS as it relates to the BLS responder

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The ICS is an organized structure of roles, responsibilities, and procedures for the command and control of emergency operations. ICS is modular and can expand or contract based on the need, the size, and nature of an incident. It enables multiple disciplines and multiple jurisdictions to work together safely and effectively.

The ICS uses the following three management concepts: unity of command, span of control, and functional positions.

Unity of command stipulates that only one incident command or unified command is ultimately responsible for the entire incident. The command structure encompasses clearly defined lines of authority in which everyone is responsible to, and directed by, one person.

Span of control is established so that only three to seven individuals report to one position so that no one position becomes overloaded, with optimum span of control at five.

The functional positions concept means that all resources assigned to one functional position [e.g., fire fighter, BLS responder, hazardous materials officer, hazardous materials technician (HMT)] are to remain in that position until reassigned or released from the incident.

(2) Describe the typical incident command structure for the emergency medical component of a hazardous materials/WMD incident as specified in the emergency response plan and SOPs, as developed by the AHJ

The medical component of the command structure will normally be a functional group directly under either the IC or the operations sections, if established. The function can be expanded to a medical branch, with a medical group performing treatment and triage, and a patient transportation group. Further expansion of the medical branch might include dividing the medical group into the triage group and treatment group, depending on the scope of the incident and available resources. Additional functions of the medical group could be extrication and air operations. BLS responders could be assigned to the medical unit under the logistics section, if established. The medical unit is responsible for responder medical treatment, while the medical group/branch under the operations section would be responsible for public medical treatment. The size and complexity of the medical function will expand and collapse, depending on the needs of the incident.

(3) Demonstrate the ability of the BLS responder to function within the IMS/ICS

The BLS responder must be able to function within the ICS. The BLS responder first reports to the incident command post or staging area to check in. On receiving an assignment, the BLS responder reports to the assignment (i.e., incident, response area) and reports to the branch director/group supervisor at the incident or response area and performs the task assigned. On completion of the task, the BLS responder reports to the supervisor for release or reassignment.

(4) Demonstrate the ability to initiate an ICS for a hazardous materials/WMD incident where an IMS/ICS does not currently exist

The BLS responder might be the first on the scene of an emergency. When this happens, it is imperative that the BLS responder initiate the ICS and assume command until relieved by a senior authority. The importance of this action is to ensure responder safety and coordination of resources to best effect the desired outcome of the incident.

(5) Identify the procedures for requesting additional resources at a hazardous materials/WMD incident

Responders at every level are required to know what types of resources are available and how to request them. The employer's emergency response plan and procedures should identify the pro-

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cesses by which the BLS responder will request additional resources both within and from outside the organization.

4.3.4.2 The hazardous materials/WMD BLS responder shall describe his or her role within the hazardous materials response plan developed by the AHJ or identified in the local emergency response plan, as follows:

(1) Determine the toxic effect of hazardous materials/WMD

As early as possible in the incident, the identity or classification of the product should be obtained so that the BLS responder can take appropriate actions to minimize the impact of toxic effect on the patient(s). Once the material is identified or classified, the BLS responder can call medical control for orders on treatment if no standing protocols exist. Information can also be obtained from a poison control center. Consideration must also be given to personal protection and decontamination of victims before patient treatment.

(2) Estimate the number of patients

As with any multicasualty incident, the estimate of the number of potential patients needs to be ascertained to determine the number and types of resources necessary to triage, treat, and transport the injured.

(3) Recognize and assess the presence and severity of symptoms

The BLS responder should be able to associate symptoms consistent with the product exposure as confirming the determination of the toxic effects of exposure to a material. Severity of symptoms might not be immediately known, depending on the material, because symptoms are the result of a dose and the material's effect on the body and our ability to intervene.

(4) Take and record vital signs

Properly taking and recording vital signs such as respiration, pulse, and blood pressure on regular intervals will assist in evaluating the severity of the exposure and monitoring the body's vital functions in response to the toxic effects.

(5) Determine resource maximization and assessment

A vital part of initial triage is the identification of additional resource needs as early as possible and to use them to maximum efficiency and effectiveness within the established ICS.

(6) Assess the impact on the health care system

Once the number of patients and the identity or classification of the materials have been determined, the local health care system should be alerted and medical control notified. The number of decontaminated patients being transported and the number of self-transporting victims en route to a facility should be communicated to medical control as early as possible. Every effort should be given to minimize the impact to any facility, both in numbers of transported injured and potential for cross contamination of transport vehicles and emergency facilities.

(7) Perform appropriate patient monitoring

While treating and transporting patients, it is imperative that the patient be monitored closely to identify changes in condition, extent of symptoms, or impacts of underlying medical problems.

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(8) Communicate pertinent information

Information related to the incident as well as the patients' numbers, types, and severity of exposure or injuries should be communicated and updated regularly throughout the event to receiving facilities and medical control as well as the ICS.

4.4 Competencies — Implementing the Planned Response.

Because the BLS responder will play a key role in the EMS part of the response plan, on which the outcome for both patients and responders depends, the BLS responder is required by Section 4.4 to know enough about the hazardous materials to analyze the incident and effectively determine the risks and medical care necessary for his or her part of the response.

4.4.1 Determining the Nature of the Incident/Providing Medical Care. The BLS responder shall demonstrate the ability to identify the mechanisms of injury or harm and the clinical implications and provide emergency medical care to those patients exposed to hazardous materials/WMD agent by completing the following tasks:

The BLS responder is required by 4.4.1 to be able to determine from clues presented during dispatch, response, and approach whether a hazardous material is present at the scene and whether the released material poses a risk to the patient and, in turn, to the responders at the scene. Typical indicators of the presence of a released hazardous material include the following: operators or witnesses, placards, the normal occupancy of buildings at the scene (such as chemical storage buildings), the type of containers involved, and the presence of fires or explosions.

It is critical for BLS responders to have a good working understanding of the many physical states of potentially released substances that could be present at a hazardous materials/WMD incident as they perform their emergency medical care duties. Understanding these states and the associated mechanisms of injury and health implications associated with the released substance in these various states is critical to their care of patients as well as their personal safety while performing their medical care duties. It is also important for BLS responders to be aware that the released substances could be in more than one state at the incident, and that there could be more than one type of released substance.

(1) Determine the physical state of the released substance, in addition to the environmental influences surrounding the release, as follows:

(a) Solid

A solid is a material in the state of matter characterized by resistance to deformation and changes of volume. At the microscopic scale, a solid has the properties of the atoms or molecules packed closely together, its constituent elements have fixed positions in space relative to each other, and because any solid has some thermal energy, its atoms vibrate. However, this movement is very small and very rapid and cannot be observed under ordinary conditions. It is important to recognize that solid materials can change state rapidly under certain environmental conditions (of particular concern are those solids that rapidly volatilize under certain environmental conditions).

(b) Liquid

A liquid is a state of matter whose shape is usually determined by the container it fills. Liquid particles (normally molecules or clusters of molecules) are free to move within the liquid volume, but their

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mutual attraction limits ability of particles to leave the volume. The volume of a quantity of liquid is fixed by its temperature and pressure. It is also important to recognize that liquids can change state rapidly under certain environmental conditions (of particular concern are those liquids that rapidly volatilize under certain environmental conditions).

(c) Gas

A gas is a state of matter that has atoms or molecules moving independently, with no forces keeping them together or pushing them apart. Hazardous substances in the gaseous state are of particular concern for the inhalation exposure route.

(d) Vapor

A vapor refers to a gas-phase material that normally exists as a liquid or solid under a given set of environmental conditions. Vapors are composed of single gas-phase molecules. Many, but not all, vapors are colorless and therefore invisible. Vapors do not wet objects with which they come in contact.

(e) Dust

A dust is fine (small) particles of dry matter. Handling, crushing, grinding, rapid impact, detonation, and breakdown of certain organic or inorganic materials, such as rocks, ore, metal, coal, wood, grains, or other such material, can generate dusts. Particles ranging in size from 0.1 μm in diameter to about 30 μm in diameter and are referred to as total suspended particulate (TSP) matter. Particles in the size range between 0.1 μm and 10 μm are of particular concern for inhalation exposures.

(f) Mist

A mist or fog is a microscopic suspension of liquid droplets in a gas. Do not confuse a mist with a vapor. Mists can generally be seen and reduce visibility. Mists generally wet objects with which they come in contact.

(g) Aerosol

The BLS responder should also be aware of the environmental conditions at the incident and how these environmental conditions can alter the health effects and physical states of the released substances. For example, on very hot days or in situations where the event results in elevated temperature at the scene, a substance normally not very volatile can become quite volatile with increased gaseous releases.

Windy conditions can create lower concentrations of the released substance in the working area. If aware of these conditions, BLS responders can position themselves upwind of the source and away from higher exposures. By knowing about situations like this, BLS responders are better able to perform their medical care duties safely and more efficiently.

(2) Identify potential routes of exposure and correlate those routes of exposure to the physical state of the released substance, to determine the origin of the illness or injury, as follows:

The BLS responders need to be aware of how the associated released substances can enter the patient — and themselves if they are not careful. Also, BLS responders should continually evaluate all routes of exposure as they render medical care to patient(s). For example, care must be taken not to introduce the released substance into a patient through ingestion or injection as they administer medications to

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the patient. Likewise, they should be aware that while caring for patients who have received inhalation doses of the released substance, they could be subjecting themselves as well as other patients to the substance from the exhalation of that patient. Again, it is important to consider all routes of exposure while proceeding to administer to patients at a hazardous materials/WMD incident.

(a) Inhalation

Inhalation is how contaminants enter the body through the normal respiratory process (i.e., uptake through normal breathing process, with contaminants deposited along the respiratory tract into the lungs).

(b) Absorption

Absorption is the process by which contaminants are absorbed into the body through the skin and other exposed tissue (often referred to as *dermal absorption* or *dermal uptake*).

(c) Ingestion

Ingestion is the process of consuming contaminants through the normal ingestion process (i.e., usually through the process of consuming food and water).

(d) Injection

Injection is the process by which contaminants are introduced directly into the bloodstream by means of a needle, cannula, or other mechanical process. Contaminants entering the bloodstream through an open wound are considered introduced by injection.

(3)* Describe the potential routes of entry into the body, the common signs and symptoms of exposure, and the BLS treatment options approved by the AHJ for exposure(s) to the following classification of substances:

A.4.4.1(3) Examples of hazard classifications include the following:

(1) Acids, alkalis, and corrosives
(2) Fumigants and pesticides: organophosphates, carbamates, zinc or aluminum phosphide, strychnine, sulfuryl fluoride
(3) Chemical asphyxiants: cyanide, carbon monoxide, hydrogen sulfide
(4) Simple asphyxiants: nitrogen, helium
(5) Organic solvents: xylene, benzene, methylene chloride
(6) Nerve agents: Tabun, Sarin, Soman, V agent
(7) Vesicants and blister agents: mustard, Lewisite
(8) Blood agents: cyanide, cyanogen chloride, arsine
(9) Choking agents: ammonia, chlorine, diphosgene, phosgene
(10) Pepper spray, irritants, and riot-control agents: CS (orthochlorobenzalmalononitrile), CN (chloroacetophenone), CR (dibenzoxazepine), MACE (phenylchloromethylketone), OC (oleoresin capsicum)
(11) Biological agents and toxins: anthrax, mycotoxin, plague, viral hemorraghic fevers, smallpox, ricin
(12) Incapacitating agents: BZ, LSD
(13) Radioactive materials: cobalt-60, cesium-137, iridium-192
(14) Nitrogen-containing compounds: aniline, nitrates
(15) Hydrocarbons/hydrocarbon derivatives

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(16) Fluorine compounds: hydrogen fluoride, hydrofluoric acid
(17) Phenolic compounds: carbolic acid, cresylic acid

The BLS responder should maintain a strong working knowledge of the signs and symptoms of exposure from each class of substances. These signs and symptoms will provide the BLS responder with key insights to add to their awareness of the material(s) release, associated routes of exposure, and associated health effects and implications and are important checkpoints for a BLS responder to use in providing medical care and to protect themselves at the scene.

Patients exposed to hazardous materials could pose a risk of contamination to others who encounter them, including the BLS responder. A BLS responder's knowledge of toxic exposure, patient assessment, and decontamination procedures is essential to determine the actions necessary for preparing patients to be treated and transported safely. In some cases, treatment might need to wait until the HMTs at the scene decontaminate and transfer a patient to the cold zone.

(a) Corrosives

Corrosives are chemicals that cause visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. A chemical is considered corrosive if, when tested on the intact skin of albino rabbits by the method described in Appendix A of Title 49 CFR Part 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of 4 hours [2]. For purposes of this standard, the term does not refer to action on inanimate surfaces.

(b) Pesticides

A pesticide is a substance or mixture of substances intended for preventing, destroying, repelling, or mitigating a pest. A pesticide might be a chemical substance or biological agent (such as a virus or bacteria) used against pests, including insects, plant pathogens, weeds, mollusks, birds, mammals, fish, nematodes (roundworms), and microbes that compete with humans for food, destroy property, spread disease, or are a nuisance. Many pesticides are poisonous to humans.

(c) Chemical asphyxiants

Chemical asphyxiants reduce the body's ability to absorb, transport, or use inhaled oxygen. They are often active at very low concentrations — a few parts per million (ppm).

(d) Simple asphyxiants

An asphyxiant is a substance that can cause unconsciousness or death by suffocation (asphyxiation). Asphyxiants, which have no other health effects, are referred to as simple asphyxiants. Asphyxiation is an extreme hazard when working in enclosed spaces. Responders must be trained in confined space entry before working in sewers, storage tanks, and so on, where gases such as methane can displace oxygen from the atmosphere.

(e) Organic solvents

Organic solvents are a chemical class of compounds that are used routinely in commercial industries. They share a common structure (at least 1 carbon atom and 1 hydrogen atom), low molecular weight, lipophilicity, and volatility, and they exist in liquid form at room temperature. They may be grouped further into aliphatic-chain compounds, such as *n*-hexane, and as aromatic compounds with a 6-carbon ring, such as benzene or xylene. Aliphatics and aromatics can contain a substituted halogen

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element and might be referred to as halogenated hydrocarbons, such as perchloroethylene (PCE or PER), trichloroethylene (TCE), and carbon tetrachloride. Alcohols, ketones, glycols, esters, ethers, aldehydes, and pyridines are substitutions for a hydrogen group. Organic solvents can dissolve oils, fats, resins, rubber, and plastics.

(f) Nerve agents

The following information on nerve agents is extracted from the Federation of American Scientists' web site:

> Nerve agents are a group of particularly toxic chemical warfare agents. They were developed just before and during World War II and are related chemically to the organophosphorus insecticides. The principle agents in this group are:
>
> - GA - tabun
> - GB - sarin
> - GD - soman
> - GF - cyclosarin
> - VX - methylphosphonothioic acid
>
> The "G" agents tend to be non-persistent whereas the "V" agents are persistent. Some "G" agents may be thickened with various substances in order to increase their persistence, and therefore the total amount penetrating intact skin. At room temperature GB is a comparatively volatile liquid and therefore non-persistent. GD is also significantly volatile, as is GA though to a lesser extent. VX is a relatively non-volatile liquid and therefore persistent. It is regarded as presenting little vapor hazard to people exposed to it. In the pure state nerve agents are colorless and mobile liquids. In an impure state nerve agents may be encountered as yellowish to brown liquids. Some nerve agents have a faint fruity odor.
>
> - GB and VX doses which are potentially life threatening may be only slightly larger than those producing least effects. Death usually occurs within 15 minutes after absorption of a fatal VX dosage.
> - Although only about half as toxic as GB by inhalation, GA in low concentrations is more irritating to the eyes than GB. Symptoms appear much more slowly from a skin dosage than from a respiratory dosage. Although skin absorption great enough to cause death may occur in 1 to 2 minutes, death may be delayed for 1 to 2 hours. Respiratory lethal dosages kill in 1 to 10 minutes, and liquid in the eye kills almost as rapidly.

Toxicological Data

Route	*Form*	*Effect*	*Type*	*GA*	*GB*	*GD*	*VX*	*Dosage*
Ocular	Vapor	Miosis	ECt_{50}	—	<2	<2	<0.09	mg · min/m^3
Inhalation at RMV = 15 1/min	Vapor	Runny Nose	ECt_{50}	—	<2	<2	<0.09	mg · min/m^3
Inhalation at RMV = 15 liters/min	Vapor	Incapacitation	ICt_{50}	—	35	35	25	mg · min/m^3
Inhalation at RMV = 15 liters/min	Vapor	Death	LCt_{50}	135	70	70	30	mg · min/m^3
Percutaneous	Liquid	Death	LD_{50}	4,000	1,700	350	10	Mg

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Ct (Concentration time; mg • min/m^3) - A measure of exposure to a gas, the effective vapor exposure, determined by the concentration of the gas (mg/m^3) and the length of exposure (min).

ECt_{50} (Effective Concentration Time; mg • min/m^3) - The Ct at which a gas debilitates 50% of the exposed population in a specific way.

ICt_{50} (Incapacitating Concentration Time; mg • min/m^3) - The Ct at which a gas incapacitates 50% of the exposed population.

LCt_{50} (Lethal concentration time; mg • min/m^3) - The Ct at which a gas kills 50% of the exposed population.

LD_{50} (Lethal dose; mg) - The dose or amount at which a substance kills 50% of the exposed population.

RMV (Respiratory minute volume; liters/min) - Volume of air inhaled per minute.

The values are estimates of the doses, which have lethal effects on a 70 kg man. Effective dosages of vapor are estimated for exposure durations of 2–10 minutes. The effects of the nerve agents are mainly due to their ability to inhibit acetylcholinesterase throughout the body. Since the normal function of this enzyme is to hydrolyse acetylcholine wherever it is released, such inhibition results in the accumulation of excessive concentrations of acetylcholine at its various sites of action. These sites include the endings of the parasympathetic nerves to the smooth muscle of the iris, ciliary body, bronchial tree, gastrointestinal tract, bladder and blood vessels; to the salivary glands and secretory glands of the gastrointestinal tract and respiratory tract; and to the cardiac muscle and endings of sympathetic nerves to the sweat glands.

The sequence of symptoms varies with the route of exposure. While respiratory symptoms are generally the first to appear after inhalation of nerve agent vapor, gastrointestinal symptoms are usually the first after ingestion. Tightness in the chest is an early local symptom of respiratory exposure. This symptom progressively increases, as the nerve agent is absorbed into the systemic circulation, whatever the route of exposure. Following comparable degrees of exposure, respiratory manifestations are most severe after inhalation, and gastrointestinal symptoms may be most severe after ingestion.

The lungs and the eyes absorb nerve agents rapidly. In high vapor concentrations, the nerve agent is carried from the lungs throughout the circulatory system; widespread systemic effects may appear in less than 1 minute.

- The earliest ocular effect, which follows minimal symptomatic exposure to vapor, is miosis. The pupillary constriction may be different in each eye. Within a few minutes after the onset of exposure, there also occurs redness of the eyes. Following minimal exposure, the earliest effects on the respiratory tract are a watery nasal discharge, nasal hyperaemia, sensation of tightness in the chest and occasionally prolonged wheezing.
- Exposure to a level of a nerve agent vapor slightly above the minimal symptomatic dose results in miosis, pain in and behind the eyes and frontal headache. Some twitching of the eyelids may occur. Occasionally there is nausea and vomiting.
- In mild exposures, the systemic manifestations of nerve agent poisoning usually include tension, anxiety, jitteriness, restlessness, emotional lability, and giddiness. There may be insomnia or excessive dreaming, occasionally with nightmares.
- If the exposure is more marked, the following symptoms may be evident: headache, tremor, drowsiness, difficulty in concentration, impairment of memory with slow recall of recent events, and slowing of reactions. In some casualties there is apathy, withdrawal and depression.
- With the appearance of moderate systemic effects, the casualty begins to have increased fatigability and mild generalized weakness, which is increased by exertion. This is followed by involuntary muscular twitching, scattered muscular fasciculation's and occasional muscle cramps. The skin may be pale due to vasoconstriction and blood pressure moderately elevated.
- If the exposure has been severe, the cardiovascular symptoms will dominate and twitching (which usually appear first in the eyelids and in the facial and calf muscles) becomes generalized. Many rippling movements are seen under the skin and twitching movements appear in all parts

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of the body. This is followed by severe generalized muscular weakness, including the muscles of respiration. The respiratory movements become more labored, shallow and rapid; then they become slow and finally intermittent.

- After moderate or severe exposure, excessive bronchial and upper airway secretions occur and may become very profuse, causing coughing, airway obstruction and respiratory distress. Bronchial secretion and salivation may be so profuse that watery secretions run out of the sides of the mouth. The secretions may be thick and tenacious. If the exposure is not so overwhelming as to cause death within a few minutes, other effects appear. These include sweating, anorexia, nausea and heartburn. If absorption of nerve agent has been great enough, there may follow abdominal cramps, vomiting, diarrhea, and urinary frequency. The casualty perspires profusely, may have involuntary defecation and urination and may go into cardio respiratory arrest followed by death.
- If absorption of nerve agent has been great enough, the casualty becomes confused and ataxic. The casualty may have changes in speech, consisting of slurring, difficulty in forming words, and multiple repetition of the last syllable. The casualty may then become comatose, reflexes may disappear and generalized convulsions may ensue. With the appearance of severe central nervous system symptoms, central respiratory depression will occur and may progress to respiratory arrest.
- After severe exposure the casualty may lose consciousness and convulse within a minute without other obvious symptoms. Death is usually due to respiratory arrest requires prompt initiation of assisted ventilation to prevent death. If assisted ventilation is initiated, the individual may survive several lethal doses of a nerve agent.
- If the exposure has been overwhelming, amounting to many times the lethal dose, death may occur despite treatment as a result of respiratory arrest and cardiac arrhythmia. When overwhelming doses of the agent are absorbed quickly, death occurs rapidly without orderly progression of symptoms.

Nerve agent poisoning may be identified from the characteristic signs and symptoms. If exposure to vapor has occurred, the pupils will be very small, usually pin-pointed. If exposure has been cutaneous or has followed ingestion of a nerve agent in contaminated food or water, the pupils may be normal or, in the presence of severe systemic symptoms, slightly to moderately reduced in size. In this event, the other manifestations of nerve agent poisoning must be relied on to establish the diagnosis. No other known chemical agent produces muscular twitching and fasciculation's, rapidly developing pinpoint pupils, or the characteristic train of muscarinic, nicotinic and central nervous system manifestations.

The rapid action of nerve agents call for immediate self-treatment. Unexplained nasal secretion, salivation, tightness of the chest, shortness of breath, constriction of pupils, muscular twitching, or nausea and abdominal cramps call for the immediate intramuscular injection of 2 mg of atropine, combined if possible with oxime.

Source: Federation of American Scientists, www.fas.org/cw/cwagents.htm.

(g) Vesicants and blister agents

The following information on vesicant agents is extracted from the Federation of American Scientists' web site:

Blister or vesicant agents are likely to be used both to produce casualties and to force opposing troops to wear full protective equipment thus degrading fighting efficiency, rather than to kill, although exposure to such agents can be fatal. Blister agents can be thickened in order to contaminate terrain, ships, aircraft, vehicles or equipment with a persistent hazard.

Vesicants burn and blister the skin or any other part of the body they contact. They act on the eyes, mucous membranes, lungs, skin and blood-forming organs. They damage the respiratory tract when inhaled and cause vomiting and diarrhea when ingested. The vesicant agents include:

- HD - sulfur mustard
- HN - nitrogen mustard

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- L - lewisite (arsenical vesicants may be used in a mixture with HD)
- CX - phosgene (properties and effects are very different from other vesicants)

HD and HN are the most feared vesicants historically, because of their chemical stability, their persistency in the field, the insidious character of their effects by attacking skin as well as eyes and respiratory tract, and because no effective therapy is yet available for countering their effects. Since 1917, mustard has continued to worry military personnel with the many problems it poses in the fields of protection, decontamination and treatment. It should be noted that the ease with which mustard can be manufactured and its great possibilities for acting as a vapor would suggest that in a possible future chemical war HD would be preferred to HN.

Due to their physical properties, mustards are very persistent in cold and temperate climates. It is possible to increase the persistency by dissolving them in non-volatile solvents. In this way thickened mustards are obtained that are very difficult to remove by decontaminating processes.

Exposure to mustard is not always noticed immediately because of the latent and sign-free period that may occur after skin exposure. This may result in delayed decontamination or failure to decontaminate at all. Whatever means is used has to be efficient and quick acting. Within 2 minutes contact time, a drop of mustard on the skin can cause serious damage. Chemical inactivation using chlorination is effective against mustard and lewisite, less so against HN, and is ineffective against phosgene oxime.

- In a single exposure the eyes are more susceptible to mustard than either the respiratory tract or the skin. The effects of mustard on the eyes are very painful. Conjunctivitis follows exposure of about 1 hour to concentrations barely perceptible by odor. This exposure does not affect the respiratory tract significantly. A latent period of 4 to 12 hours follows mild exposure, after which there is lachrymation and a sensation of grit in the eyes. The conjunctival and the lids become red. Heavy exposure irritates the eyes after 1 to 3 hours and produces severe lesions.
- The hallmark of sulfur mustard exposure is the occurrence of a latent symptom and sign free period of some hours post exposure. The duration of this period and the severity of the lesions are dependent on the mode of exposure, environmental temperature and probably on the individual himself. High temperature and wet skin are associated with more severe lesions and shorter latent periods.
- If only a small dose is applied to the skin, the skin turns red and itches intensely. At higher doses blister formation starts, generally between 4 and 24 hours after contact, and this blistering can go on for several days before reaching its maximum. The blisters are fragile and usually rupture spontaneously giving way to a suppurating and necrotic wound. The necrosis of the epidermal cells is extended to the underlying tissues, especially to the dermis. The damaged tissues are covered with slough and are extremely susceptible to infection. The regeneration of these tissues is very slow, taking from several weeks to several months.
- Mustard attacks all the mucous membranes of the respiratory tract. After a latent period of 4 to 6 hours, it irritates and congests the mucous membranes of the nasal cavity and the throat, as well as the trachea and large bronchi. Symptoms start with burning pain in the throat and hoarseness of the voice. A dry cough gives way to copious expectoration. Airway secretions and fragments of necrotic epitheliums may obstruct the lungs. The damaged lower airways become infected easily, predisposing to pneumonia after approximately 48 hours. If the inhaled dose has been sufficiently high the victim dies in a few days, either from pulmonary edema or mechanical asphyxia due to fragments of necrotic tissue obstructing the trachea or bronchi, or from superimposed bacterial infection, facilitated by an impaired immune response.

The great majority of mustard gas casualties survive. There is no practical drug treatment available for preventing the effects of mustard. Infection is the most important complicating factor in the healing of mustard burns. There is no consensus on the optimum form of treatment.

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A full protective ensemble can only achieve protection against these agents. The respirator alone protects against eye and lung damage and gives some protection against systemic effects. No drug is available for the prevention of the effects of mustard on the skin and the mucous membranes caused by mustards. It is possible to protect the skin against very low doses of mustard by covering it with a paste containing a chlorinating agent, e.g., chloramine. The only practical prophylactic method is physical protection such as is given by the protective respirator and special clothing.

In a pure form lewisite is a colorless and odorless liquid, but usually contains small amounts of impurities that give it a brownish color and an odor resembling geranium oil. It is heavier than mustard, poorly soluble in water but soluble in organic solvents. L is a vesicant (blister agent); also, it acts as a systemic poison, causing pulmonary edema, diarrhea, restlessness, weakness, subnormal temperature, and low blood pressure. In order of severity and appearance of symptoms, it is: a blister agent, a toxic lung irritant, absorbed in tissues, and a systemic poison. When inhaled in high concentrations, may be fatal in as short a time as 10 minutes.

- Liquid arsenical vesicants cause severe damage to the eye. On contact, pain and blepharospasm occur instantly. Edema of the conjunctival and lids follow rapidly and close the eye within an hour. Inflammation of the iris usually is evident by this time. After a few hours, the edema of the lids begins to subside, while haziness of the cornea develops.
- Liquid arsenical vesicants produce more severe lesions of the skin than liquid mustard. Stinging pain is felt usually in 10 to 20 seconds after contact with liquid arsenical vesicants. The pain increases in severity with penetration and in a few minutes becomes a deep, aching pain. Contamination of the skin is followed shortly by erythema, then by vesication, which tends to cover the entire area of erythema. There is deeper injury to the connective tissue and muscle, greater vascular damage, and more severe inflammatory reaction than are exhibited in mustard burns. In large, deep, arsenical vesicant burns, there may be considerable necrosis of tissue, gangrene and slough.
- The vapors of arsenical vesicants are so irritating to the respiratory tract that conscious casualties will immediately put on a mask to avoid the vapor. No severe respiratory injuries are likely to occur except among the wounded that cannot put on masks or the careless, caught without masks. Lewisite is irritating to nasal passages and produces a burning sensation followed by profuse nasal secretion and violent sneezing. Prolonged exposure causes coughing and production of large quantities of froth mucus. Injury to respiratory tracts, due to vapor exposure is similar to mustard's; however, edema of the lung is more marked and frequently accompanied by pleural fluid.

An antidote for lewisite is dimercaprol (British anti-lewisite [BAL]). This ointment may be applied to skin exposed to lewisite before actual vesication has begun. Some blistering is inevitable in most arsenical vesicant cases. The treatment of the erythema, blisters and denuded areas is identical with that for similar mustard lesions. Burns severe enough to cause shock and systemic poisoning are life threatening. Even if the patient survives the acute effects, the prognosis must be guarded for several weeks.

Phosgene oxime (CX) is a white crystalline powder. It melts between 39–40°C, and boils at 129°C. By the addition of certain compounds it is possible to liquefy phosgene oxime at room temperature. It is fairly soluble in water and in organic solvents. In aqueous solution phosgene oxime is hydrolyses fairly rapidly, especially in the presence of alkali. It has a high vapor pressure and its odor is very unpleasant and irritating. Even as a dry solid, phosgene oxime decomposes spontaneously and has to be stored at low temperatures.

In low concentrations, phosgene oxime severely irritates the eyes and respiratory organs. In high concentrations, it also attacks the skin. A few milligrams applied to the skin cause severe irritation, intense pain, and subsequently a necrotizing wound. Very few compounds are as painful and destructive to the tissues.

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Phosgene oxime also affects the eyes, causing corneal lesions and blindness and may affect the respiratory tract causing pulmonary edema. The action on the skin is immediate: phosgene oxime provokes irritation resembling that caused by a stinging nettle. A few milligrams cause intense pain, which radiates from the point of application, within a minute the affected area turns white and is surrounded by a zone of erythema (skin reddening), which resembles a wagon wheel in appearance. In 1 hour the area becomes swollen, and within 24 hours, the lesion turns yellow and blisters appear. Recovery takes 1 to 3 months.

Source: Federation of American Scientists, www.fas.org/cw/cwagents.htm.

(h) Blood agents

A blood agent or cyanogen agent is a chemical compound that contains the cyanide group, which prevents the body from using oxygen. The term *blood agent* is a misnomer, however, because these agents do not actually affect the blood in any way. Rather, they exert their toxic effect at the cellular level by interrupting the electron transport chain in the inner membranes of mitochondria.

(i) Choking agents

The following information on choking agents is extracted from the Federation of American Scientists' web site:

Choking agents are chemical agents which attack lung tissue, primarily causing pulmonary edema, are classed as lung damaging agents. To this group belong:

- CG - phosgene
- DP - diphosgene
- Cl - chlorine
- PS - chloropicrin

The toxic action of phosgene is typical of a certain group of lung damaging agents. Phosgene is the most dangerous member of this group and the only one considered likely to be used in the future. Phosgene was used for the first time in 1915, and it accounted for 80% of all chemical fatalities during World War I.

Phosgene is a colorless gas under ordinary conditions of temperature and pressure. Its boiling point is 8.2°C, making it an extremely volatile and non-persistent agent. Its vapor density is 3.4 times that of air. It may therefore remain for long periods of time in trenches and other low-lying areas. In low concentrations it has a smell resembling new mown hay.

The outstanding feature of phosgene poisoning is massive pulmonary edema. With exposure to very high concentrations death may occur within several hours; in most fatal cases pulmonary edema reaches a maximum in 12 hours followed by death in 24–48 hours. If the casualty survives, resolution commences within 48 hours and, in the absence of complicating infection, there may be little or no residual damage.

During and immediately after exposure, there is likely to be coughing, choking, a feeling of tightness in the chest, nausea, and occasionally vomiting, headache and lachrymation. The presence or absence of these symptoms is of little value in immediate prognosis. Some patients with severe coughs fail to develop serious lung injury, while others with little sign of early respiratory tract irritation develop fatal pulmonary edema. A period follows during which abnormal chest signs are absent and the patient may be symptom-free. This interval commonly lasts 2 to 24 hours but may be shorter. The signs and symptoms of pulmonary edema terminate it.

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These begin with cough (occasionally substernally painful), dyspnea, rapid shallow breathing and cyanosis. Nausea and vomiting may appear. As the edema progresses, discomfort, apprehension and dyspnea increase and frothy sputum develops. The patient may develop shock-like symptoms, with pale, clammy skin, low blood pressure and feeble, rapid heartbeat. During the acute phase, casualties may have minimal signs and symptoms and the prognosis should be guarded. Casualties may very rapidly develop severe pulmonary edema. If casualties survive more than 48 hours they usually recover.

Source: Federation of American Scientists, www.fas.org/cw/cwagents.htm.

(j) Irritants

An irritant is a chemical that is not corrosive, but that causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. A chemical is a skin irritant if, when tested on the intact skin of albino rabbits by the methods of Title 16 CFR Part 1500.41 for 4 hours exposure or by other appropriate techniques, it results in an empirical score of five or more [3]. A chemical is an eye irritant if so determined under the procedure listed in Title 16 CFR Part 1500.42 or other appropriate techniques [4].

(k) Biological agents and toxins

Biological warfare (BW), also known as germ warfare, is the use of any pathogen (e.g., bacterium, virus, or other disease-causing organism) or toxin found in nature as a weapon of war. BW agents can be intended to kill, incapacitate, or seriously impede an adversary. Ideal characteristics of biological agents and toxins are high infectivity, high potency, availability of vaccines, and delivery as an aerosol. Diseases most likely to be considered for use as biological weapons are contenders because of their lethality (if delivered efficiently) and robustness (making aerosol delivery feasible).

The biological agents used in biological weapons can often be manufactured quickly and easily. The primary difficulty is not the production of the biological agent but delivery in an infective form to a vulnerable target. For example, anthrax is considered an effective agent for several reasons. First, it forms hardy spores, perfect for dispersal aerosols. Second, pneumonic (lung) infections of anthrax usually do not cause secondary infections in other people. Thus, the effect of the agent is usually confined to the target. A pneumonic anthrax infection starts with ordinary cold-like symptoms and quickly becomes lethal, with a fatality rate that is 80 percent or higher. Finally, friendly personnel can be protected with suitable antibiotics.

A mass attack using anthrax would require the creation of aerosol particles of 1.5 μm to 5 μm. Too large and the aerosol would be filtered out by the respiratory system. Too small and the aerosol would be inhaled and exhaled. Also, at this size, nonconductive powders tend to clump and cling because of electrostatic charges, which hinders dispersion. So, the material must be treated with silica to insulate and discharge the charges. The aerosol must be delivered so that rain and sun do not rot it, and yet the human lung can be infected. There are other technological difficulties as well. Diseases considered for weaponization or known to be weaponized include anthrax, Ebola, bubonic plague, cholera, tularemia, brucellosis, Q fever, Machupo virus, coccidioides mycosis, glanders, melioidosis, shigella, Rocky Mountain spotted fever, typhus, psittacosis, yellow fever, Japanese B encephalitis, Rift Valley fever, and smallpox. Naturally occurring toxins that can be used as weapons include ricin, SEB, botulism toxin, saxitoxin, and many mycotoxins. The organisms causing these diseases are known as select agents. Their possession, use, and transfer are regulated by the CDC's Select Agent Program.

(l) Incapacitating agents

The term *incapacitating agent* is defined by the U.S. Department of Defense as follows:

> An agent that produces temporary physiological or mental effects, or both, which will render individuals incapable of concerted effort in the performance of their assigned duties. [5]

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Incapacitating agents are not primarily intended to kill, but supposedly nonlethal incapacitating agents can kill many of those exposed to them. The term *incapacitation*, when used in a general sense, is roughly equivalent to the term *disability* as used in occupational medicine and denotes the inability to perform a task because of a quantifiable physical or mental impairment. In this sense, any of the chemical warfare agents can incapacitate a victim; however, again by the military definition of this type of agent, incapacitation refers to impairments that are temporary and nonlethal. Thus, riot-control agents are incapacitating because they cause temporary loss of vision due to blepharospasm, but they are not considered military incapacitants because the loss of vision does not last long. Although incapacitation can result from physiological changes such as mucous membrane irritation, diarrhea, or hyperthermia, the term *incapacitating agent* as militarily defined refers to a compound that produces temporary and nonlethal impairment of military performance by virtue of its psychobehavioral or central nervous system (CNS) effect.

(m) Radioactive materials

The following information is extracted from the EPA's web site:

> Three basic concepts apply to all types of ionizing radiation. When developing regulations or standards that limit how much radiation a person can receive in a particular situation, one considers how these concepts affect a person's exposure.
>
> **BASIC CONCEPTS OF RADIATION PROTECTION**
>
> **Time.** The amount of radiation exposure increases and decreases with the time people spend near the source of radiation.
>
> In general, think of the exposure time as how long a person is near radioactive material. It's easy to understand how to minimize the time for external (direct) exposure. Gamma and X-rays are the primary concern for external exposure.
>
> However, if radioactive material gets inside the body, one can't move away from it. The only options once internal uptake occurs are to wait until it decays or until the body can eliminate it. When this happens, the biological half-life of the radionuclide controls the time of exposure. Biological half-life is the amount of time it takes the body to eliminate one half of the radionuclide initially present. Alpha and beta particles are the main concern for internal exposure.
>
> When establishing a radiation standard that assumes an exposure over a certain period, the concept of time is applied. For example, exposures are often expressed in terms of a committed dose. A committed dose is one that accounts for continuing exposures over long periods of time (such as 30, 50, or 70 years). It refers to the exposure received from radioactive material that enters and remains in the body for many years.
>
> When assessing the potential for exposure in a situation, consider the amount of time a person is likely to spend in the area of contamination. For example, in assessing the potential exposure from radon in a home, estimate how much time people are likely to spend in the basement.
>
> **Distance.** The farther away a person is from a radiation source, the less their exposure. How close to a source of radiation one can get without getting a high exposure depends on the energy of the radiation and the size (or activity) of the source. Distance is a prime concern when dealing with gamma rays, because they can travel long distances. Alpha and beta particles don't have enough energy to travel very far.
>
> As a rule, if you double the distance, you reduce the exposure by a factor of four (i.e., halving the distance increases the exposure by a factor of four). The area of the circle depends on the distance from the center to the edge of the circle (radius). It is proportional to the square of the radius. As a result, if the radius doubles, the area increases four times. Using the light bulb analogy, think of the radiation source as a bare light bulb. The bulb gives off light equally in every direction, in a circle. The energy from the light is distributed evenly over the whole area of the circle. When the radius doubles, the radiation is spread out over four times as much area,

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so the dose is only one fourth as much. (In addition, as the distance from the source increases so does the likelihood that some gamma rays will lose their energy.

The exposure of an individual sitting 4 feet from a radiation source will be ¼ the exposure of an individual sitting 2 feet from the same source.

Shielding. The greater the shielding around a radiation source, the smaller the exposure. Shielding simply means having something that will absorb radiation between you and the source of the radiation. The amount of shielding required to protect against different kinds of radiation depends on how much energy they have.

α (Alpha)	A thin piece of light material, such as paper, or even the dead cells in the outer layer of human skin provides adequate shielding because alpha particles can't penetrate it. However, living tissue inside body, offers no protection against inhaled or ingested alpha emitters.
β (Beta)	Additional covering, for example heavy clothing, is necessary to protect against beta-emitters. Some beta particles can penetrate and burn the skin.
γ (Gamma)	Thick, dense shielding, such as lead, is necessary to protect against gamma rays. The higher the energy of the gamma ray, the thicker the lead must be. X-rays pose a similar challenge, so X-ray technicians often give patients receiving medical or dental X-rays a lead apron to cover other parts of their body.

DIRTY BOMBS/RADIOACTIVE DISPERSAL DEVICES (RDDS)

Although "dirty bombs," or radioactive dispersal devices (RDDs), are not weapons of mass destruction, in the past few years terrorists have indicated their interest in acquiring such weapons. RDDs disperse radioactive material by using conventional explosives or other means. There are only a few radioactive sources that can be used effectively in an RDD. The greatest security risk is posed by Cobalt-60, Cesium-137, Iridium-192, Strontium-90, Americium-241, Californium-252, and Plutonium-238.

Source: U.S. Environmental Protection Agency, www.epa.gov/radiation.

(n) Nitrogen compounds

Nitrogen oxides are produced during most combustion processes. About 80 percent of the immediately released nitrogen oxide is in the form nitric oxide (NO). Small amounts of nitrous oxide (N_2O) are also produced. Nitric oxide reacts with oxygen in the air to produce nitrogen dioxide (NO_2). Further oxidation during the day causes the nitrogen dioxide to form nitric acid and nitrate particles. In the dark, nitrogen dioxide can react with ozone and form a very reactive free radical. The free radical then can react with organic compounds in the air to form nitrogenated organic compounds, some of which have been shown to be mutagenic and carcinogenic.

Nitrogen dioxide is the most important nitrogen oxide compound with respect to acute adverse health effects. Under most chemical conditions, it is an oxidant. However, it takes about 10 times more nitrogen dioxide than ozone to cause significant lung irritation and inflammation.

Nitrates and nitrites are known to cause several health effects. In general, the following are the most common effects:

- Reactions with hemoglobin in blood, causing the oxygen-carrying capacity of the blood to decrease (nitrite)
- Decreased functioning of the thyroid gland (nitrate)
- Vitamin A shortages (nitrate)
- Formation of nitro amines, which are known as one of the most common causes of cancer (nitrates and nitrites)

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(o) Hydrocarbon/hydrocarbon derivatives

A hydrocarbon compound is made up of carbon and hydrogen atoms bound together. Hydrocarbon derivatives contain different elements attached to the carbon instead of or in addition to hydrogen atoms. For example, hydrocarbon derivatives include alcohol compounds (methyl and ethyl alcohol), ketones (methyl ethyl ketone), and aldehydes (formaldehyde and glutaraldehyde).

(p) Fluorine compounds

Pure fluorine (F_2) is a corrosive pale yellow or brown gas that is a powerful oxidizing agent. It is the most reactive of all the elements and readily forms compounds with most other elements. Fluorine even combines with the noble gases krypton, xenon, and radon. Even in dark, cool conditions, fluorine reacts explosively with hydrogen. It is so reactive that glass, metals, and even water, as well as other substances, burn with a bright flame in a jet of fluorine gas. It is far too reactive to be found in elemental form and has such an affinity for most elements, including silicon, that it can neither be prepared nor be kept in ordinary glass vessels. Instead, fluorine must be kept in specialized quartz tubes lined with a very thin layer of fluorocarbons. In moist air it reacts with water to form (also dangerous) hydrofluoric acid.

Fluorides are compounds that combine fluorine with some positively charged counterpart. They often consist of crystalline ionic salts. Fluorine compounds with metals are among the most stable of the salts. Both elemental fluorine and fluoride ions are highly toxic and must be handled with great care. Contact with skin and eyes should be strictly avoided. In its free element state, fluorine has a characteristic pungent odor that is detectable in concentrations as low as 20 nL/L.

Hydrofluoric acid (HF) contact with exposed skin poses one of the most extreme and dangerous hazards. These effects are intensified by the fact that HF damages nerves in such a way as to make such burns initially painless. The HF molecule is capable of rapidly migrating through lipid layers of cells that would ordinarily stop an ionized acid, and the burns are typically deep. HF can react with calcium, permanently damaging the bone. More seriously, reaction with the body's calcium can cause cardiac arrhythmias, followed by cardiac arrest brought on by sudden chemical changes within the body. These reactions cannot always be prevented by local or intravenous injection of calcium salts. HF spills covering just 2.5 percent of the body's surface area (an area of about 9 $in.^2$ or 23 cm^2), despite copious immediate washing, have been fatal. If the patient survives, HF burns typically produce open wounds of an especially slow-healing nature.

(q) Phenolic compounds

Phenols, sometimes called phenolics, are a class of chemical compounds consisting of a hydroxyl group (OH) attached to an aromatic hydrocarbon group. The simplest of the class is phenol (C_6H_5OH). Although similar to alcohols, phenols have unique properties and are not classified as alcohols (because the hydroxyl group is not bonded to a *saturated* carbon atom). They have relatively higher acidities due to the aromatic ring tightly coupling with the oxygen and a relatively loose bond between the oxygen and hydrogen.

A number of health effects from breathing phenol in air have been reported. Short-term effects include respiratory irritation, headaches, and burning eyes. Chronic effects of high exposures include weakness, muscle pain, anorexia, weight loss, and fatigue. Effects of long-term, low-level exposures included increases in respiratory cancer and heart disease and effects on the immune system. In animal laboratory studies, exposure to high concentrations of phenol in air for a few minutes irritates the lungs, and repeated exposure for several days produces muscle tremors and loss of coordination. Exposure to high concentrations of phenol in the air for several weeks results in paralysis and severe injury to the heart, kidneys, liver, and lungs, followed by death in some cases. When exposures involve the skin (dermal uptake), the size of the total surface area of exposed skin can influence the severity of the toxic effects. Ingestion of very high concentrations of phenol has resulted in death.

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Effects reported in humans following dermal exposure to phenol include liver damage, diarrhea, dark urine, and red blood cell destruction. Skin exposure in humans to a relatively small amount of concentrated phenol has resulted in death. Small amounts of phenol applied to the skin of laboratory animals for brief periods can produce blisters and burns on the exposed surface, and spilling dilute phenol solutions on large portions of the body (greater than 25 percent of the body surface) can result in death.

(4) Describe the basic toxicological principles relative to assessment and treatment of persons exposed to hazardous materials, including the following:

An understanding of the toxicological principles of the various classes of compounds, coupled with the clinical signs and symptoms associated with exposure to these compounds, is critical for the BLS responder to provide medical care to their patients and to protect themselves at an incident. While managing acute effects is often crucial to the survival of the patient, the BLS responder should also be aware of delayed (chronic) effects. An understanding of both acute and chronic effects of the released materials will help the BLS responder give the most prudent care to patients. It is the dose–response relationship of the release material that can provide the BLS responder with the best insights on the health effects associated with the different internal concentration levels of an exposed patient.

(a) Acute and chronic effects

Acute toxicity refers to the sudden, severe onset of symptoms due to an exposure to the contaminant(s) of concern. Delayed toxicity might not develop for hours, days, or even years following an exposure to the contaminant(s) of concern. In some cases, such as exposure to biological agents, symptoms might not appear until three or more days following an exposure.

(b) Local and systemic effects

Local effects are those in which a toxic substance comes in direct contact with the skin or other sensitive tissue. Systemic effects are the effects of a toxic substance on either the entire body or a specific organ or organ system.

(c) Dose–response relationship

The chemical, biological, or radiological dose–response relationship refers to the response a specific dose produces in the human body. The magnitude of the body's response depends on the on-scene concentration (as can be measured by monitoring systems) of the hazardous substance, the patient exposure concentration and duration, and the actual dose (considering uptake rate for each applicable exposure route) received by the patient. The maximum ambient concentration at the scene determines the maximum concentration available for exposure. The exposure concentration is the concentration available to the pertinent routes of exposure, and the duration is the amount of time the patient is exposed to this available concentration. The actual dose is that amount taken up by the patient through the applicable uptake mechanisms. The dose will be the total amount of a patient's uptake during the exposure time considering all routes of uptake.

(5) Given examples of various hazardous materials/WMD, define the basic toxicological terms as applied to patient care:

(a) Threshold limit value — time-weighted average (TLV-TWA)

The threshold limit value–time-weighted average (TLV–TWA) is the time-weighted average concentration for a conventional 8-hour workday and 40-hour workweek, to which it is believed that nearly all workers might be repeatedly exposed, day after day, without adverse health effects.

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(b) Permissible exposure limit (PEL)

Permissible exposure limit (PEL) is a term OSHA uses in its health standards covering exposures to hazardous chemicals. It is similar to the TLV–TWA established by the American Conference of Governmental Industrial Hygienists (ACGIH). The PEL, which generally relates to the legally enforceable TLV limits, is the maximum concentration, averaged over 8 hours, to which 95 percent of healthy adults can be repeatedly exposed for 8 hours per day, 40 hours per week.

(c) Threshold limit value — short-term exposure limit (TLV-STEL)

Threshold limit value–short-term exposure limit (TLV–STEL) is the maximum average concentration, averaged over a 15-minute period, to which healthy adults can be exposed safely for up to 15 minutes continuously. Exposure should not occur more than four times a day with at least 1 hour between exposures.

(d) Immediately dangerous to life and health (IDLH)

Immediate danger to life and health (IDLH) is the maximum level to which a healthy worker can be exposed for 30 minutes and escape without suffering irreversible health effects or impairment. If at all possible, exposure to this level should be avoided. If that is not possible, responders must wear positive pressure self-contained breathing apparatus (SCBA) or a positive pressure supplied-air respirator (SAR) with an auxiliary escape system. OSHA and NIOSH establish this limit.

(e) Threshold limit value — ceiling (TLV-C)

Threshold limit value–ceiling (TLV–C) is the maximum concentration to which a healthy adult can be exposed without risk of injury. TLV–C is comparable to IDLH, and exposures to higher concentrations should not occur.

(f) Parts per million/parts per billion/parts per trillion (ppm/ppb/ppt)

The values used to establish the exposure limits are quantified in parts per million, parts per billion, or parts per trillion. A good reference to remember is that 1 percent equals 10,000 ppm, 1 ppm equals 1,000 ppb, and 1 ppb equals 1,000 ppt. Thus, a reading from a sampling instrument of 0.5 percent is equivalent to 5,000 ppm, 5,000,000 ppb, or 5,000,000,000 ppt. If the TLV is determined to be 7,500 ppm, the reading from the instrument can be related to determine the degree of hazard that exposure concentration represents.

(6) Given examples of hazardous materials/WMD incidents with exposed patients, evaluate the progress and effectiveness of the medical care provided at a hazardous materials/WMD incident to ensure that the overall incident response objectives, along with patient care goals, are being met by completing the following tasks:
  (a) Locate and track all exposed patients at a hazardous materials/WMD incident, from priority conditions and treatment to transport to a medically appropriate facility
  (b) Review the incident objectives at periodic intervals to ensure that patient care is being carried out within the overall incident action plan
  (c) Ensure that the required incident command system forms are completed, along with the patient care forms, during the course of the incident
  (d) Evaluate the need for trained and qualified EMS personnel, medical equipment, transport units, and other supplies based on the scope and duration of the incident

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Understanding the critical factors in 4.4.1 for a particular hazardous material released at an incident is essential for a responder to determine the nature of the hazards to both the patients and the responders themselves. The *Emergency Response Guidebook* is an excellent reference to use in finding the needed information [6].

It is essential for responders to know which references and on-line databases provide the information necessary to determine the health effects of the hazardous materials involved in an incident to establish the medical treatment to combat them, in consultation with medical control. They must also understand which properties affect a patient's reactions and the medical care the patient must receive. These references become critical resources to perform these tasks. Sources of this information include EMS reference books, the poison control center, EMS/HM data systems, and the Agency for Toxic Substances and Disease Registry (ATSDR), which is part of the CDC. Contact information for voice and data communications for these resources should be part of the EMS response teams' resources.

The BLS responder must be able to understand and apply the information from these reference sources to the patient presentation. For example, if a patient states that he or she was completely covered by a particular hazardous material and reference sources indicate that the material is very difficult to remove once it has contaminated the skin, the chance of secondary exposure is slight because the material does not dislodge easily. However, if the responder must touch the patient to provide medical care, the contaminant could be transferred in their physical contact.

4.4.2 Decontamination. Given the emergency response plan and SOPs developed by the AHJ, the BLS responder shall do the following:

(1) Determine if patient decontamination activities were performed prior to accepting responsibility and transferring care of exposed patients

To anticipate and understand patient decontamination requirements, the BLS responder must make every effort to learn about the released substance. This information will help the BLS responder make an informed decision on performing decontamination or more fully evaluate the effectiveness of the decontamination attempted. These are important decisions, especially for transporting agencies. It is unwise to accept a contaminated patient into a transport unit or to be unsure of the level of decontamination performed. A poor decision in the field can have significant ramifications at the door of the hospital. If hospital staff are unconvinced that proper decontamination was performed in the field, they may require further decontamination before accepting the patient. This could delay care and have an adverse effect on the patient.

There can also be a need to balance decontamination with providing emergency medical care. In some cases, it might be wise to provide airway management, bleeding control, basic trauma care, or CPR before or concurrent with decontamination. There are no clear-cut guidelines for these situations. The BLS responder must weigh the benefits and risks of the need to provide BLS with the need to decontaminate.

As with all other sections in this handbook, the NFPA 473 section is designed to promote thoughtful and informed medical care. It is impossible to expect a standard to address all situations. To that end, the BLS responder, at the moment he or she must make a decision regarding patient care, should be well trained and confident to make that decision.

BLS responders must weigh all options and make reasonable decisions in the field. Again, it is important to understand the nature and level of contamination to make the best decision regarding decontamination and patient care (see Exhibit II.4.3).

(2) Determine the need and location for patient decontamination, including mass casualty decontamination, in the event none has been performed prior to arrival of EMS personnel and complete the following tasks:

   (a) Given the emergency response plan and SOPs developed by the AHJ, identify sources of information for determining the appropriate decontamination procedure and identify how to access those resources in a hazardous materials/WMD incident

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EXHIBIT II.4.3

This is an example of patient decontamination. (Courtesy of Rob Schnepp)

(b) Given the emergency response plan and SOPs developed by the AHJ, identify (within the plan) the supplies and equipment required to set up and implement the following:

The BLS responder should access and apply information from reliable reference sources to determine appropriate decontamination procedures. These reference sources include safety data sheets (SDSs), CHEMTREC/CANUTEC/SETIQ, regional poison control centers, the U.S. Department of Transportation (DOT)'s *Emergency Response Guidebook*, the Hazardous Materials Information System (HMIS), shipper/manufacturer contacts, Agency for Toxic Substances and Disease Registry (ATSDR) medical management guidelines, medical toxicologists, and electronic databases.

i. Emergency decontamination operations for ambulatory and nonambulatory patients with open wounds
ii. Mass decontamination operations for ambulatory and nonambulatory patients with open wounds

Decontamination efforts are influenced by the number of ambulatory and nonambulatory patients and must be addressed accordingly. It is more difficult and requires more personnel to decontaminate nonambulatory patients. The BLS responder should be familiar enough with the concepts and procedures for decontamination to adapt to the situation. Flexibility is the key to handling decontamination issues when it comes to life safety. Patient decontamination should be rapid, complete, and geared at getting the patient clean enough to treat and transport.

(c) Identify procedures, equipment, and safety precautions for the treatment and handling of emergency service animals brought to the decontamination corridor at hazardous materials/WMD incidents
(d) Identify procedures, equipment, and safety precautions for communicating with critical, urgent, and potentially exposed patients, and identify population prioritization as it relates to decontamination purposes

Responders are reminded of the importance of communicating with large groups of people who might be ill or injured. Panic can be contagious, and a lack of crowd control can create significant problems for the responders. BLS responders should expect panic and unexpected behaviors from groups of people exposed to a hazardous materials/WMD.

(e) Identify procedures, equipment, and safety precautions for preventing cross contamination

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4.4.3 Determining the Ongoing Need for Medical Supplies.

4.4.3.1 Given examples of single-patient and multicasualty hazardous materials/WMD incidents, the BLS responder shall determine the following:

(1) If the available medical equipment will meet or exceed patient care needs throughout the duration of the incident
(2) If the available transport units will meet or exceed patient care needs throughout the duration of the incident

Multicasualty incidents present different challenges than a single patient medical response (see Exhibit II.4.4). Multicasualty incidents require more personnel and equipment and are usually more chaotic. In these cases, the BLS responder should look at the entire incident and determine the need for medical equipment, qualified EMS personnel, and transport units. These and other resources should be called to the scene as soon as possible. Additionally, the ICS should be implemented as soon as possible to ensure responder accountability and the most efficient use of on-scene resources.

EXHIBIT II.4.4

This shows an example of single-patient medical response. Multicasualty hazardous materials/WMD incidents will pose significantly more challenges to the BLS responder. (Courtesy of Rob Schnepp)

4.4.4 Preserving Evidence. Given examples of hazardous materials/WMD incidents where criminal acts are suspected, the BLS responder shall make every attempt to preserve evidence during the course of delivering patient care by completing the following tasks:

(1) Evaluate the incident for potential criminal activity, and cooperate with the law enforcement agency having investigative jurisdiction
(2) Identify the unique aspects of criminal hazardous materials/WMD incidents, including crime scene preservation and evidence preservation, to avoid the destruction of potential evidence on medical patients during the decontamination process
(3) Identify, within the emergency response plan and SOPs developed by the AHJ, procedures, equipment, and safety precautions for preserving evidence during decontamination operations at hazardous materials/WMD incidents
(4) Ensure that any information regarding suspects, sequence of events during a potentially criminal act, and observations made based on patient presentation or during patient assessment are documented and communicated to the law enforcement agency having investigative jurisdiction

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The rationale behind 4.4.4 is to remind BLS responders that they have a role in identifying and preserving evidence at a crime scene. If there is a suspicion that the event might be criminal in nature, it is incumbent on the BLS responder to be vigilant, pay attention to what is touched or moved, understand patient presentations relative to the suspected hazardous materials/WMD, see and note the locations of patients, and observe other precautions. Furthermore, complete and thorough documentation is important and can be used in the prosecution of suspects. These and other actions taken by BLS responders assist law enforcement with the criminal investigation.

4.4.5 Medical Support at Hazardous Materials/WMD Incidents. Given examples of hazardous materials/WMD incident, the BLS responder shall describe the procedures of the AHJ for performing medical monitoring and support of hazardous materials incident response personnel and shall complete the following tasks:

The use of a systematic approach to medical monitoring is required of the hazmat responder, especially when entry into a hazardous environment is prolonged, affected by environmental factors, or difficult to mitigate. When the primary objective is potential rescue, on-scene medical personnel might default back to the annual “fit to work” physical. In either case, at an absolute minimum, the responder should be evaluated for heat stress, which includes hydration, and potential exposure.

(1) Given examples of various hazardous materials/WMD incidents requiring the use of PPE, the BLS responder shall complete the following tasks:

(a) Demonstrate the ability to set up and operate a medical monitoring station

The medical monitoring station can serve many purposes at the scene of a hazardous materials event. The first and primary role of the medical monitoring station is to evaluate the core vitals of the entry team. Evaluation can include the backup team and the decontamination line personnel. Each individual assigned to work at the medical monitoring station should observe all responders for any physiological response that becomes detrimental toward the responder and the task of that responder.

The basic setup of the monitoring station could facilitate taking vital signs along with pulse oximetry, the responder’s weight, skin status, body temperature, and hydration, as determined by the AHJ. Medical monitoring stations should be positioned to protect responders from adverse weather conditions.

In large incidents, a medical manager within the incident command structure will have to organize his or her resources to compile basic physiological information from each responder, but also must anticipate future medical needs of the hazmat technician. This may include, but is not limited to, specialized transport capability, on-scene advanced life support, and analysis of the capacity of the health care system.

(b) Demonstrate the ability to recognize the signs and symptoms of heat stress, cold stress, heat exhaustion, and heat stroke

BLS responders should be trained to recognize and treat various types of heat/cold stress. Heat stroke is the most dangerous of all the heat-related illnesses. BLS care providers should understand the need for prompt recognition of the early signs of heat stroke.

(c) Determine the BLS needs for responders exhibiting the effects of heat stress, cold stress, and heat exhaustion

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Aggressive monitoring of individuals will become the priority for the BLS care providers. Once heat or cold stress has been identified, the treatment might only include monitoring of the individual and oral hydration. All medical providers that are active at a hazardous materials/WMD incident must always look for the signs and symptoms of heat stress especially when environmental factors present challenges when encapsulating protective equipment is in use.

(d) Describe the medical significance of heat stroke and the importance of rapid transport to an appropriate medical receiving facility
(e) Given a simulated hazardous materials incident, demonstrate the appropriate documentation of medical monitoring activities

(2) The BLS responder responsible for pre-entry medical monitoring shall obtain hazard and toxicity information on the hazardous materials/WMD from the designated hazardous materials technical reference resource or other sources of information at the scene.
(3) The following information shall be conveyed to the entry team, incident safety officer, hazardous materials officer, other EMS personnel at the scene, and any other responders responsible for the health and well-being of those personnel operating at the scene:

(a) Substance name

Looking up synonyms and trade names can give the responder additional information when databases are referenced.

Databases such as ToxNet from the U.S. National Library of Medicine Hazardous Substance Data Bank can assist the responder on the potential medical modalities required.

(b) Hazard class

Although direct information about medical application is limited, it may give clues about the type of injury observed. For example, Class 2 gases (pressurized or liquefied), give the highest potential for a respiratory hazard if PPE is not worn, not worn properly, or if a breach has occurred.

(c) Multiple hazards and toxicity information

Because many chemicals have multiple hazards, it is up to medical personnel to fully reference the suspected/confirmed substance. Understanding how these factors affect individuals allows the medical staff to have a proactive treatment plan.

(d) Applicable decontamination methods and procedures

BLS responders should be familiar with the local procedures used for victim decontamination. In some jurisdictions, decontamination is considered to be a form of medical treatment. The BLS responder should look at the overall scene and balance decontamination efforts with the need to provide patient care.

(e) Potential for cross contamination

Liquids and particulate solids provide the highest level of cross contamination; gases rarely have any cross-contamination issues. The organophosphates as a chemical family have the highest level of cross contamination due to the mechanism of injury. Again, one must understand the state of matter, hazards associated with the substance at different concentrations, and the multiple hazards that a substance might have.

(f) Procedure for transfer of patients from the constraints of the incident to the EMS
(g) Prehospital management of medical emergencies and exposures

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As with any medical emergency that occurs outside of a hospital, rapid evaluation, BLS measures, and transportation with information transfer are the keys toward a positive outcome. This includes, but is not limited to, the type of substance involved, the action(s) at the time of the incident, referenced information of the substance, and the potential degree of exposure.

(4) The BLS responder shall evaluate the pre-entry health status of responders to hazardous materials/WMD incidents as per the AHJ policies and procedures prior to their donning personal protective equipment (PPE) by performing the following tasks (consideration shall be given to excluding responders if they do not meet criteria specified by the AHJ prior to working in chemical protective clothing):

The medical AHJ must decide before an event the situations or criteria that will exclude a responder from donning PPE and working in a contaminated area. These considerations must be in accordance with prevailing federal, state, and local criteria.

(a) Record vital signs

Vital signs should include, but are not limited to, body temperature, pulse, respiration (rate and character), and blood pressure.

(b) Body weight measurements to address hydration considerations

Fluid loss is best measured in the field by measuring the responder's pre- and post-entry body weight. By achieving a percent loss of body weight, the BLS care provider can estimate the level of hydration. Hydration procedures should have input from the medical control officer (medical director). Fluid loss will become the most important factor to monitor and observe for working effectively within protective ensembles.

(c) General health observations

An idea of the responder's general health status can be obtained by observing his or her physical appearance and asking specific questions about their well-being. Anyone who has had signs and symptoms of general common illness such as a cold or the flu, or has just been released to work after having a general illness should be further evaluated and should consult with the medical director.

(d) Body temperature: hypothermia/hyperthermia

Extreme heat or cold will make it difficult for personnel to function in protective ensembles. Response personnel must be evaluated in either extreme for signs and symptoms that may indicate hypothermia/hyperthermia. The wearing of protective ensembles can exacerbate these conditions especially when working in high-level PPE.

(e) Blood pressure: hypotension/hypertension

It is important to monitor the diastolic blood pressure pre- and post-entry. Pre-entry exam diastolic in relation to the systolic should be evaluated and exclusion criteria planned for by the medical director. Look for a 3- to 5-minute recovery back to baseline after exiting PPE during post-entry exam.

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(f) Pulse rate: bradycardia/tachycardia as defined

Each jurisdiction must adhere to its own definitions of bradycardia and tachycardia. The intent here is not to set hard limits, but to include these vital signs as part of a pre-entry examination. As with any vital sign, bradycardia and tachycardia must be viewed in the context of an overall patient presentation. As an example, a pulse rate over 100 beats per minute might not be out of line for a responder preparing to don PPE on a hot and humid day. The NFPA 473 committee encourages a reasonable and well-thought-out approach to medical monitoring.

(g) Respiratory rate: bradypnea/tachypnea

Both the rate and character of respiration should be evaluated with these conditions, which should have a planned response from the medical control officer and this vital sign related to the blood pressure, historical conditions, and annual physical findings.

(5) The BLS responder shall determine how the following factors influence cold and heat stress on hazardous materials/WMD response personnel:

(a) Baseline level of hydration
(b) Underlying physical fitness
(c) Environmental factors
(d) Activity levels during the entry
(e) Level of PPE worn
(f) Duration of entry
(g) Cold stress

(6) The BLS responder shall medically evaluate all team members after decontamination and PPE removal, using the following criteria:

Each organization should develop and have preplanned medical monitoring protocols that identify conditions that are the basic evaluative concerns for the first responder. Within 3 to 5 minutes of exit from the protective ensemble, all vitals should be close to the pre-entry physical. Temperature should be monitored longer and evaluated. This is especially important when performing entry functions within the two extreme conditions of heat and cold.

(a) Pulse rate determined within the first minute
(b) Pulse rate determined 3 minutes after initial evaluation
(c) Temperature
(d) Body weight
(e) Blood pressure
(f) Respiratory rate

(7) The BLS responder shall recommend that any hazardous materials team member be prohibited from redonning chemical protective clothing if any of the following criteria is exhibited:

The use of exclusion criteria is important to establish guidelines for the post exam and for team members re-entering a hazardous environment. Again, the NFPA 473 committee encourages a reasonable approach to medical monitoring. The standard is designed to provide a framework for monitoring, but the limits and exclusion points should be determined on a case-by-case basis, adhering to the standard of care of the AHJ.

(a) Signs or symptoms of heat stress or heat exhaustion

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Heat stress can affect the performance of any responder. It is up to the BLS care provider to recognize, evaluate, and treat the responder who may be suffering from a heat stress event. This type of event should have input from the local medical control officer for guidance within the systems response manual. This guidance is a blueprint for the medical authority to provide the necessary evaluation and treatment for a responder that may be subject to heat stress.

(b) Abnormal vital signs
(c) Abnormal core body temperature
(d) Abnormal heart rate and/or rhythm
(e) Abnormal blood pressure
(f)* Significant acute body weight loss

A.4.4.5(7)(f) Regarding the issue of weighing individuals, recent medical research has focused on the concerns relating to water consumption and the difficulty in managing oral fluid intake. Often the distinction of water intoxication and resulting hyponatremia versus dehydration from insufficient water consumption, especially during sustained and prolonged operations, cannot be determined by vital sign measurements alone in the prehospital setting. One invaluable measure in making this distinction is a comparison weight of the individual prior to and following entry and re-entry to the operational theater. It is for this reason that comparison weighing is an included recommendation for evaluation of fitness.

(8) Any team member exhibiting the signs or symptoms of extreme heat exhaustion or heat stroke shall be transported to the medical facility.
(9) The BLS responder responsible for medical monitoring and support shall immediately notify the persons designated by the incident action plan that a team member required significant medical treatment or transport. Transportation shall be arranged through the designee identified in the emergency response plan.

4.5 Reporting and Documenting the Incident.

Given a scenario involving a hazardous materials/WMD incident, the responder assigned to use PPE shall complete the reporting and documentation requirements consistent with the emergency response plan or SOPs and identify the reports and supporting documentation required by the emergency response plan or SOPs.

4.6 Compiling Incident Reports.

The BLS responder shall describe his or her role in compiling incident reports that meet federal, state, local, and organizational requirements, as follows:

(1) List the information to be gathered regarding the exposure of all patient(s) and describe the reporting procedures, including the following:
   (a) Detailed information on the substances released
   (b) Pertinent information on each patient treated and transported
   (c) Routes, extent, and duration of exposures
   (d) Actions taken to limit exposure
   (e) Decontamination activities
(2) At the conclusion of the hazardous materials/WMD incident, identify the methods used by the AHJ to evaluate transport units that might have been contaminated and the process and locations available to decontaminate those units

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The intent of Section 4.6 is to offer basic guidance in the area of documentation. Each jurisdiction has unique characteristics and requirements for patient care reports and incident documentation. The BLS responder should, in all cases, write timely documentation that is accurate and reflective of his or her actions on the scene. When it comes to hazardous materials/WMD incidents, patient care reports may be used during a criminal prosecution. To that end, the report should be written in a professional manner.

References Cited in Commentary

1. "Guide 100-00: Guide for the Selection of Chemical Agent and Toxic Industrial Material Detection Equipment for Emergency First Responders," U.S. Department of Justice, National Institute of Justice, Office of Science and Technology, Washington, DC, June 2000. Available online at www.ncjrs.gov/pdffiles1/nij/184449.pdf.
2. Title 49, Code of Federal Regulations, Part 173, "Shippers — General Requirements for Shipments and Packagings," U.S. Government Publishing Office, Washington, DC.
3. Title 16, Code of Federal Regulations, Part 1500.41, Hazardous Substances and Articles; Administration and Enforcement Regulations, "Method of testing primary irritant substances," U.S. Government Publishing Office, Washington, DC.
4. Title 16, Code of Federal Regulations, Part 1500.42, Hazardous Substances and Articles; Administration and Enforcement Regulations, "Test for eye irritants," U.S. Government Publishing Office, Washington, DC.
5. Publication 1-02, *Dictionary of Military and Associated Terms*, U.S. Department of Defense, Washington, DC, 2007. Available online at www.dtic.mil/doctrine/new_pubs/dictionary.pdf
6. *Emergency Response Guidebook* (ERG). Office of Hazardous Materials Initiatives and Training, PHH-50, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, 1200 New Jersey Avenue, SE East Building, 2nd Floor, Washington, DC 20590, http://phmsa.dot.gov/hazmat/library/erg, 2016.
7. Title 40, Code of Federal Regulations, Part 156, "Labeling Requirements for Pesticides and Devices," U.S. Government Publishing Office, Washington, DC.

Additional Reference

Agency for Toxic Substances and Disease Registry (ATSDR), U.S. Centers for Disease Control and Prevention. See www.atsdr.cdc.gov.

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5 Competencies for Hazardous Materials/WMD Advanced Life Support (ALS) Responder

There are many similarities between advanced life support (ALS) and basic life support (BLS) competencies. NFPA 473 was written and structured on the premise that BLS precedes advanced care. All EMS responders, regardless of their scope of practice, should share a basic set of hazmat response skills to deliver patient care on the scene safely and effectively. ALS competencies are not protocol-driven and not tied to antidotal therapies. The rationale behind the approach is that there are relatively few antidotes that can be administered in the field and the patient presentations requiring those antidotes are rare. Therefore, the intent of the standard is to raise the skill level of the EMS responder by making clear the links between EMS and hazardous materials response, the need to observe a scene with a critical eye to pick up the clues that might assist with understanding the nature of the exposure, and the need to look at the EMS system when it comes to treating exposed victims.

5.1 General.

Δ **5.1.1 Introduction.** All emergency medical services (EMS) personnel at the hazardous materials/WMD advanced life support (ALS) responder level, in addition to their ALS certification, shall be trained to meet at least the competencies of the operations level responders as defined in Section 6.2 (mission-specific PPE) of NFPA 472 and all competencies of this chapter.

Δ **5.1.2 Goal.** The goal of the competencies at the ALS responder level shall be to provide the individual with the knowledge and skills necessary to safely deliver ALS at hazardous materials/WMD incidents and to function within the established IMS/ICS, as follows:

(1) Analyze a hazardous materials/WMD incident to determine the potential health risks to the ALS provider, other responders, and anticipated/actual patients by completing the following tasks:

It is imperative that ALS responders maintain rigorous situational awareness when responding to hazardous materials/WMD incidents. In some circumstances, it might be a local ambulance company that arrives at an incident first. In those cases, the ALS responders should take time to size up the scene and understand the hazards present. When the ALS providers arrive after an organized hazmat response has begun, it is equally important to again size up the incident to understand the potential threats to the health and safety of the responders and civilian population.

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(a) Survey a hazardous materials/WMD incident to determine whether harmful substances have been released and to evaluate suspected and identified patients for telltale signs of exposure

ALS responders must be aware of the subtle signs and symptoms that can accompany a chemical exposure. Not all patients show an obvious or clear-cut collection of signs and symptoms. When there are multiple patients, the ALS responders should look for consistencies and inconsistencies in the patients' symptoms. It might be possible to determine the presence of a nerve agent, for example, by the signs and symptoms exhibited by an exposed population of civilians. The use of advanced technologies (capnography, rainbow) and the ability to interpret is vital for the ALS patient providers.

(b) Collect hazard and response information from reference sources and allied professionals on the scene to determine the nature of the problem and potential health effects of the substances involved *(See Annex C for a list of informational references.)*

ALS responders must take steps to correlate the physical and chemical properties of a released substance to the potential health effects and treatment(s) provided to exposed patients.

If EMS personnel are called to the scene to stand by during a working hazmat incident, they should seek information about the chemical and physical properties of the released substance. It would prudent, in some cases, to alert the anticipated receiving hospital if specific antidotes or other therapies are needed. It is wise to plan aggressively to render care — it will be too late to formulate a good plan after the exposure happens.

(c) Survey the hazardous materials/WMD scene for the presence of secondary devices and other potential hazards

The intent of discussing secondary devices is to raise responder awareness to the need for acknowledging such hazards. Not all scenes are tied to terrorism or other criminal act intended to harm responders. It is prudent, however, to maintain vigilant situational awareness and stay alert on all scenes.

(d) Inspect the operation for strategies or tactics that might cause undue environmental stress (harm) on the responder

ALS responders should pay attention to what the responders are doing at the scene of a hazardous materials incident. This will provide context to the care provider in the event a responder requires medical attention; for example, the level of protection worn, environmental stresses, length of time the incident is in progress all cause stress to a responder in one way or another.

(2) Plan to deliver ALS to exposed patients, within the scope of practice and training competencies established by the AHJ, by completing the following tasks:

(a) Evaluate high-risk areas/occupancies within the AHJ to identify potential locations where significant human exposures can occur

It is important for ALS care providers to identify fixed facilities and other locations where hazardous substances are used routinely. The idea is to prepare for low-frequency, high-impact situations before they occur. For example, it would be good to know that a facility within a response area uses hydrofluoric (HF) acid and has a topical calcium gluconate gel available to treat skin exposures. Additionally, it would be beneficial to contact the receiving hospital to discuss procedures for handling a patient exposed to HF. Generally speaking, it is possible to plan for a potential exposure before an event.

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(b) Identify the capabilities of the hospital network within the AHJ to accept exposed patients and to perform emergency decontamination if required

As with other specialty requirements such as trauma, pediatrics, and burns, hospitals vary in their ability to handle contaminated patients. Prehospital care providers should be familiar with local hospitals and their ability to perform emergency decontamination. Ideally, all patients will be fully decontaminated before transport.

(c) Evaluate the components of the incident communication plan within the AHJ

All ALS responders should be familiar with the radio and other types of communications procedures for their jurisdictions. Good communications are vital to an organized response, and problems with communications are common to responders of all disciplines.

(d) Describe the role of the ALS responder as it relates to the local emergency response plan and established IMS/ICS

All ALS responders should understand their roles in the incident command system (ICS). The ICS is a reliable and effective method of organizing and managing a hazardous materials/WMD incident. Responders of any discipline who act outside their accepted roles at an incident run the risk of undermining the goals and objectives set by the incident commander (IC). It might be tempting to arrive at a large incident, for example, and start working without direction. Unfortunately, this is counterproductive to the overall goal and objectives of the incident.

ALS responders can be assigned to many possible positions in the ICS structure. If the incident is medical in nature or has a strong medical impact, the ALS responder may be part of the command function, most likely as part of a unified command with other agencies (fire, hazmat, health, law enforcement, etc.). The ALS responder may be assigned to the medical unit in the logistics section to provide medical care to responders, or to a medical group or branch in the operations section to provide medical care to the public. ALS providers must be aware of their roles in the authority having jurisdiction's (AHJ's) incident plan.

(e) Identify supplemental regional and national medical resources, including but not limited to assets of the strategic national stockpile (SNS) or other government programs

(3) Implement a prehospital treatment plan for exposed patients, within the scope of practice and training competencies established by the AHJ, by completing the following tasks:

(a) Determine the nature of the hazardous materials/WMD incident as it relates to anticipated or actual patient exposures and subsequent medical treatment

ALS responders should learn as much as possible about the physical and chemical properties of the released substance to develop an informed treatment plan for exposed individuals. The foundation of effective patient care is the ability to understand the nature of the exposure and correlate it to a treatment plan. A defined approach to this reinforces the understanding of the chemical and physical properties and the signs and symptoms presented with situational awareness.

(b) Determine the need or effectiveness of decontamination prior to accepting an exposed patient

Before providing ALS and/or transport, it is incumbent on the medical personnel accepting responsibility for a patient(s) to ensure that the patient has been fully decontaminated. It is unacceptable to spread contamination from the scene to the hospital.

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(c) Determine if the available medical equipment, transport units, and other supplies, including antidotes and therapeutic modalities, will meet patient care needs

All ALS response personnel should be able to estimate the amounts of medical resources necessary to deliver optimal care to victims of a hazardous materials/WMD event (see Exhibit II.5.1). The ALS responder should be able to advise the IC about quality and quantity of necessary resources, availability, and special conditions affecting access to the scene and delivery of patient care. In general, the ALS responder should be able to look at the incident with perspective and to understand the needs of the incident as a whole. It is easy to get tunnel vision and focus on the needs of a single patient while neglecting the needs of the patient care system.

EXHIBIT II.5.1

Available medical resources must meet or exceed patient care needs. (Courtesy of Rob Schnepp)

(d) Describe the process of evidence preservation where criminal or terrorist acts are suspected or confirmed

Evidence preservation is not solely the responsibility of law enforcement personnel. Each responder involved with the incident is responsible for identifying and preserving potential evidence. This includes contaminated clothing, personal articles belonging to the exposed individuals, and bodies of victims. Additionally, any photos, videos, notes, radio traffic, logs, or other items related to the management of the incident have the potential to become part of any future investigative or legal proceedings.

(e) Develop and implement a medical monitoring plan for those responders operating in chemical protective clothing at a hazardous materials/WMD incident

Pre-entry medical monitoring, as it relates to the potential for rendering treatment for an exposed responder, is an important facet of providing care at hazardous materials/WMD incidents. ALS responders, however, must think beyond the basics of vital signs when doing pre-entry medical monitoring and plan to render care aggressively (for an unplanned exposure) based on the nature of the substance involved.

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Medical support personnel should address the medical history and baseline physical status of responders before and immediately following an operational rotation. Medical history should include any present illness or condition, past medical history, allergies, and medications. Physical evaluation should include routine measures such as pulse, blood pressure, body temperature, and respiratory rate.

Other measures that should also be evaluated include pre- and post-entry body weight. This will provide invaluable information in discerning between dehydration and free water toxicity or overhydration. It has been established that prolonged excessive ingestion of water can lead to electrolyte derangement and hyponatremia. The physical signs and symptoms of this illness are often like the manifestations of dehydration. To that end, it is important that comparison weights be recorded so that an incorrect treatment course can be avoided.

(f) Evaluate the need to administer antidotes to affected patients

ALS providers infrequently encounter patients suffering significant illness because of a hazardous materials/WMD exposure and so are rarely required to administer antidotes to counter these exposures (see Exhibit II.5.2). When those situations occur, however, it is critical that the ALS provider understand the nature of the exposure and treat accordingly. Documenting and reporting those findings is a valuable tool for the continuum of care. A good report at the transfer of care is important.

EXHIBIT II.5.2

Atropine may have to be administered to reverse the effects of exposure to nerve agents. (Courtesy of Rob Schnepp)

(4) Participate in the termination of the incident by completing the following tasks:

(a) Participate in an incident debriefing

(b) Participate in an incident critique with the appropriate agencies

(c) Report and document the actions taken by the ALS responder at the scene of the incident

(5) Coordinate with the hazmat safety officer to complete the following tasks:

(a) Analyze potential health concerns, which might be inclusive of environmental issues

(b) Plan for treatment and services delivery for patients and responders

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5.2 Competencies — Analyzing the Hazardous Materials Incident.

Medical support personnel should be capable of understanding the common overt presentations of human and animal exposures. This capacity is necessary so that the information can be communicated to the IC and to the next level of pre-hospital care providers (if present) to provide valuable intelligence for strategic determinations.

5.2.1 Surveying Hazardous Materials/WMD Incidents. Given scenarios of hazardous materials/WMD incidents, the ALS responder shall assess the nature and severity of the incident as it relates to anticipated or actual EMS responsibilities at the scene.

5.2.1.1 Given examples of the following marked transport vehicles (and their corresponding shipping papers or identification systems) that can be involved in hazardous materials/WMD incidents, the ALS responder shall evaluate the general health risks based on the physical and chemical properties of the anticipated contents:

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

5.2.1.2 Given examples of various hazardous materials/WMD incidents at fixed facilities, the ALS responder shall demonstrate the ability to perform the following tasks:

Good situational awareness enables the ALS responder to see and interpret the overall picture at a hazardous materials/WMD incident. Without knowing anything about the nature of the product inside a container, the ALS responder should, simply by identifying the type of container, distinguish basic physical characteristics of the contained substance that could have an impact on an exposed patient. The same applies for other types of containers. Again, the ALS responder should hone the ability to pick out the important visual clues and link them to the delivery of patient care.

Even when the exact chemical name is unknown, it is still possible to formulate a treatment plan based on the broad hazards of a classification of a chemical. When no other information is known about the hazardous materials/WMD, routine medical care can be the most appropriate care provided.

Many EMS systems have a system of triage that manages the sorting of critical to noncritical patients. When dealing with hazardous materials/WMD, the lines of triage are blurred. Many chemicals act on different systems within the body that present symptoms immediately; other chemicals take time before the injury manifests. The responder should fall back on the chemical and physical properties of a material to identify triage modalities. Triage is based on a set of signs and symptoms that the patient will display. With chemicals, this constellation of signs and symptoms are in many cases delayed or even masked. Additionally underlying medical conditions can be exacerbated when exposed to certain classifications of chemicals. Understanding the chemical and physical properties and how they effect an individual will lead to appropriate patient care.

(1) Identify a variety of containers and their markings, including bulk and nonbulk packages and containers, drums, underground and aboveground storage tanks, specialized storage tanks, or any other specialized containers found in the AHJ's geographic area, and evaluate the general health risks based on the physical and chemical properties of the anticipated contents
(2) Identify the following job functions of health-related resource personnel available at fixed facility hazardous materials/WMD incidents:

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(a) Environmental health and safety representatives

Typically, environmental health and safety representatives are well informed about the chemical inventories, processes, and other important health- and safety-related issues at the site. These employees are typically trained in safety and industrial hygiene and are familiar with their workplaces and the hazards that might be present, whether they be stored chemicals or materials used in manufacturing processes.

(b) Radiation safety officers

The requirements for a fixed facility to have a radiation safety officer (RSO) vary with the type of license and/or the radioactive substances used. If ALS providers respond to a radiation exposure at a fixed facility, attempts should be made to contact the RSO. That person can provide useful guidance on the potential health effects of an exposure to radiation.

(c) Occupational physicians and nurses

These individuals can provide medical information pertaining to the victims (plant or site workers) to the medical support personnel.

(d) Site emergency response teams

Site-specific emergency response teams (ERTs) can be a useful asset to ALS responders called to the scene of a hazardous materials/WMD incident. In many cases, formalized fire brigades and ERTs can provide site-specific information from an emergency response perspective to the arriving responders.

(e) Specialized experts

These individuals might be industry experts who have the most complete and up-to-date understanding of the hazardous materials/WMD agents and their health effects. They might be public health experts or other such personnel who could assist with determining the most appropriate treatment of the exposed patients.

Δ **5.2.1.3** The ALS responder shall identify two ways to obtain a safety data sheet (SDS) at a hazardous materials/WMD incident and shall demonstrate the ability to identify the following health-related information:

(1) Substance name or synonyms
(2) Physical and chemical properties
(3) Health hazards of the material
(4) Signs and symptoms of exposure
(5) Routes of entry
(6) Permissible exposure limits
(7) Emergency medical procedures or recommendations
(8) Responsible party contact

When treating the victim of a chemical exposure, it is important for ALS responders to obtain a safety data sheet (SDS). Having this sheet enables the care provider to identify the physical and chemical properties of the substance as well as the expected signs and symptoms of exposure. An SDS, however, is not designed to provide detailed information on treatment options. The SDS should accompany the patient to the hospital and be given to the treating physician. This transfer of information can speed up further treatment in the hospital.

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5.2.1.4 Given scenarios at various fixed facilities, transportation incidents, pipeline release scenarios, maritime incidents, or any other unexpected hazardous materials/WMD incident, the ALS responder, working within an incident command system must evaluate the off-site consequences of the release, based on the physical and chemical nature of the released substance, and the prevailing environmental factors to determine the need to evacuate or shelter-in-place affected persons.

5.2.1.5* Given examples of the following biological threat agents, the ALS responder shall define the various types of biological threat agents, including the signs and symptoms of exposure, mechanism of toxicity, incubation periods, possible disease patterns, and likely means of dissemination:

(1) Variola major virus (smallpox)
(2) *Clostridium botulinum* (botulism)
(3) Coliforms (e.g., *E. coli* O157:H7)
(4) Ricin toxin
(5) *Bacillus anthracis* (anthrax)
(6) Venezuelan equine encephalitis virus
(7) *Rickettsia*
(8) *Yersinia pestis* (plague)
(9) *Francisella tularensis* (tularemia)
(10) Viral hemorrhagic fever
(11) Ebola

The web site for the U.S. Centers for Disease Control and Prevention (CDC) for bioterrorism agents and diseases states the following:

Category A Agents/Diseases

The U.S. public health system and primary healthcare providers must be prepared to address various biological agents, including pathogens that are rarely seen in the United States. High-priority agents include organisms that pose a risk to national security because they

- Can be easily disseminated or transmitted from person to person;
- Result in high mortality rates and have the potential for major public health impact;
- Might cause public panic and social disruption; and
- Require special action for public health preparedness.

Category B Agents/Diseases

Second highest priority agents include those that

- Are moderately easy to disseminate;
- Result in moderate morbidity rates and low mortality rates; and
- Require specific enhancements of CDC's diagnostic capacity and enhanced disease surveillance.

Category C Agents/Diseases

Third highest priority agents include emerging pathogens that could be engineered for mass dissemination in the future because of

- Availability;
- Ease of production and dissemination; and
- Potential for high morbidity and mortality rates and major health impact.

Source: U.S. Centers for Disease Control and Prevention, https://emergency.cdc.gov/agent/agentlist-category.asp

(12) Other CDC Category A, B, or C–listed organism

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A.5.2.1.5 Biodromes of common Category A bioterrorism agents are provided in Annex B, Table B.1; common bioagent mass casualty antidotes are provided in Annex B, Table B.2.

5.2.1.6* Given examples of various types of hazardous materials/WMD incidents involving toxic industrial chemicals, toxic industrial materials, blister agents, blood agents, nerve agents, choking agents, and irritants, the ALS responder shall describe the following to determine the general health risks to patients exposed to those substances and to identify those patients who might be candidates for antidotes:

Countless substances can harm civilians and responders alike. It is not the intention of 5.2.1.6 to require ALS responders to be familiar with every potentially hazardous substance. The ALS responder should, however, be familiar with the substances that are present in their jurisdiction, as well as the most common WMDs, toxic industrial chemicals (TICs), and toxic industrial materials (TIMs).

The U.S. Occupational Safety and Health Administration (OSHA) regulations state that TICs are industrial chemicals that are manufactured, stored, transported, and used throughout the world. The physical state of TICs can be gas, liquid, or solid. They can be chemical hazards (e.g., carcinogens, reproductive hazards, corrosives, or agents that affect the lungs or blood), or physical hazards (e.g., flammable, combustible, explosive, or reactive). See www.osha.gov for a table of TICs, and see www.osha.gov/SLTC/emergencypreparedness/guides/chemical.html for more information on chemicals.

The National Institute of Justice (NIJ) states that TIMs are like TICs but are chemicals other than chemical warfare agents that have harmful effects on humans [1]. They are used in a variety of settings such as manufacturing facilities, maintenance areas, and general storage areas.

Training programs for ALS responders should include a section on the basic physical and chemical properties of the broad classifications of hazardous materials/WMD they might encounter. Typically, the scope of practice for ALS responders is limited when it comes to handling exposures resulting from hazardous materials/WMD incidents. Therefore, training in this area should focus on recognizing the signs and symptoms of typical hazardous materials/WMD substances, basic treatment modalities, and the best practices to avoid becoming exposed.

(1) Identify the toxidrome for each TIC/TIM/military agent
(2) Determine the BLS and ALS medical modalities

A.5.2.1.6 Examples of toxic industrial materials are corrosives, reproductive hazards, carcinogens, flammable hazards, and explosive hazards. Toxidromes of common toxicants are provided in Annex B, Table B.3; antidotes for common toxicants are provided in Annex B, Table B.4.

5.2.1.7* Given examples of hazardous materials/WMD found at illicit laboratories, the ALS responder shall identify general health hazards associated with the chemical substances and describe the following:

A complete site risk assessment must be done before entry to identify potential hazards to the responders, the civilian population, and the community. Each lab process will have distinct hazards that must be anticipated before the event to identify existing and potential hazards the responder could encounter. In all cases, the appropriate level of personal protective equipment (PPE) must be worn. Common examples of general hazards include the following:

1. Confined spaces
2. Electrical hazards
3. Pathogen hazards
4. Damaged or unstable containers
5. Flammable, corrosive, oxygen-deficient, or enriched atmospheres

As with any emergency event, realizing potential hazards and health effects are critical parts of the risk assessment. In any incident, especially where an illicit lab might be present, a complete

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hazard-risk assessment must be accomplished. Concerns to consider when responding to an illicit lab include the following:

1. Large amounts of waste product(s) from the synthesis process might be present. For example, for every 1 pound of production within a methamphetamine lab, 5 to 6 pounds of waste can be generated.
2. The level of concern based on the precursors that are used within these processes must be established. Each lab type will create a different level of apprehension. A variety of acids, bases, and solvents are among the most common chemicals used.
3. Some chemical processes can cause reduced oxygen levels within enclosed environments, which are sometimes associated with flammable gases, as well as asphyxiating gases with ignition sources.

Potential health hazards fall into one or more of the following categories:

1. Flammable
2. Corrosive
3. Oxygen deficient/enriched
4. Asphyxiant

(1) Route of entry
(2) Mechanism of injury (target organ)

A.5.2.1.7 Some examples of hazardous materials/WMD found at illicit laboratories include but are not limited to the following:

(1) Ammonia
(2) Ephedrine and pseudoephedrine
(3) Flammable solvents such as ether compounds and methanol
(4) Fluorinated/chlorinated hydrocarbons (Freon)
(5) Hydrogen chloride
(6) Iodine
(7) Lithium and/or sodium metal
(8) Red phosphorus
(9) Sodium hydroxide or other caustic substances
(10) Category A, B, and C agents
(11) TICs
(12) TIMs
(13) Radioactive materials

5.2.1.8* Given examples of a hazardous materials/WMD incident involving radioactive materials, including radiation dispersion devices (RDD), radiation exposure devices (RED), and improvised nuclear devices (IND), the ALS responder shall determine the probable health risks and potential patient outcomes by completing the following tasks:

(1) Determine the types of radiation (alpha, beta, gamma, and neutron), the isotope if possible, and potential health effects of each

Radiation exposure occurs when a person is near a source of radiation. The person might receive a radiation exposure but not become radioactive. For example, a person having an x-ray receives a radiation exposure but does not become radioactive. Persons suffering a radiation exposure do not require decontamination before medical treatment.

Radioactive contamination occurs when loose particles contaminated with radiation settle on clothing, PPE, or skin. Testing is conducted on individuals to determine whether a person with radioactive contamination is radioactive (see Exhibit II.5.3). Radiation illness can result from inhaled or ingested particles. Persons with radioactive contamination must be decontaminated before medical transport.

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EXHIBIT II.5.3

Individuals are tested for radioactive contamination to determine decontamination priorities. (Courtesy of Huntstock/DisabilityImages/Thinkstock)

(2) Determine the most likely exposure pathways for a given radiation exposure, including inhalation, ingestion, injection, and direct skin exposure
(3) Describe the difference between radioactive contamination and radiation exposure
(4) Identify priorities for decontamination in scenarios involving radioactive materials
(5) Describe the manner in which acute medical illness or traumatic injury can influence decisions about decontamination and patient transport

A.5.2.1.8 ASTM E2601, *Standard Practice for Radiological Emergency Response*, provides guidance on the first 24 hours of response to such incidents; Table A1.3 of ASTM E2601 presents medical aspects of radiation injury (0 to 125 rem). CRCPD Publication 06-6, *Handbook for Responding to a Radiological Dispersal Device — First Responder's Guide — the First 12 Hours,* provides guidance on the first 12 hours of response to RDD incidents; Table 3 of the CRCPD Publication 06-6 provides "turn-back" exposure rates and dose guidelines.

5.2.1.9 Given examples of typical labels found on pesticide containers, the ALS responder shall define the following terms:

(1) Pesticide name
(2) Pesticide classification (e.g., insecticide, rodenticide, organophosphate, carbamate, organochlorine)
(3) Environmental Protection Agency (EPA) registration number
(4) Manufacturer name
(5) Ingredients broken down by percentage
(6) Cautionary statement (e.g., Danger, Warning, Caution, Keep from Waterways)
(7) Strength and concentration
(8) Treatment information

Each pesticide label must contain a signal word. The three signal words, in order of increasing toxicity, are *caution*, *warning*, and *danger*.

The following are the toxicity categories for pesticides established by the U.S. Environmental Protection Agency (EPA) (40 CFR 156) according to their acute (short-term) toxicity [7]:

- **Toxicity Category I:** All pesticide products meeting the criteria of Toxicity Category I must bear on the front panel the signal word "Danger." In addition, if the product was assigned to Toxicity Category I based on its oral, inhalation, or dermal toxicity (as distinct from skin and eye local effects), the word "Poison" must appear in red on a background of distinctly contrasting color and the skull and crossbones must appear in immediate proximity to the word "poison."
- **Toxicity Category II:** All pesticide products meeting the criteria of Toxicity Category II must bear on the front panel the signal word "Warning."

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- **Toxicity Category III:** All pesticide products meeting the criteria of Toxicity Category III must bear on the front panel the signal word "Caution."
- **Toxicity Category IV:** All pesticide products meeting the criteria of Toxicity Category IV must bear on the front panel the signal word "Caution."
- **Child Hazard Warning Statement:** The Child Hazard Warning Statement "Keep Out of Reach of Children" is required on all product labels, unless the requirement is waived. The warning statement requirement may be waived when the registrant (the individual or entity registering the pesticide with EPA) adequately demonstrates that the likelihood of contact with children during distribution, storage, or use is extremely remote or if the pesticide is approved for use on infants or small children.

The EPA uses the criteria shown in Commentary Table II.5.1 to determine the toxicity category of pesticides. These criteria are based on the results of animal tests done in support of registration of the pesticide.

Δ **5.2.2 Collecting and Interpreting Hazard and Response Information.** The ALS responder shall demonstrate the ability to utilize various reference sources at a hazardous materials/WMD incident, including the following:

(1) DOT *Emergency Response Guidebook*
(2) SDS
(3) CHEMTREC/CANUTEC/SETIQ
(4) Regional poison control centers
(5) NFPA 704 identification system
(6) Hazardous materials information system (HMIS)
(7) Local, state, federal, tribal, and provincial authorities
(8) Shipper/manufacturer contacts
(9) Agency for Toxic Substances and Disease Registry (ATSDR) medical management guidelines
(10) Allied professionals
(11) Electronic databases
(12) Radiation safety officer (RSO)

5.2.2.1 Identifying Secondary Devices. Given scenarios involving hazardous materials/WMD, the ALS responders shall describe the importance of evaluating the scene for secondary devices prior to rendering patient care, including the following safety points:

(1) Evaluate the scene for likely areas where secondary devices can be placed
(2) Visually scan operating areas for a secondary device before providing patient care

COMMENTARY TABLE II.5.1 *Pesticide Toxicity Category Criteria*

Hazard Indicators	*I*	*II*	*III*	*IV*
Oral LD_{50}	Up to and including 50 mg/kg	50 thru 500 mg/kg	500 thru 5,000 mg/kg	5,000 mg/kg
Dermal LD_{50}	Up to and including 200 mg/kg	200 thru 2000 mg/kg	2000 thru 20,000 mg/kg	20,000 mg/kg
Inhalation LC_{50}	Up to and including 0.2 mg/liter	0.2 thru 2 mg/liter	2 thru 20 mg/liter	20 mg/liter
Eye irritation	Corrosive; corneal opacity not reversible within 7 days	Corneal opacity reversible within 7 days; irritation persisting for 7 days	No corneal opacity; irritation reversible within 7 days	No irritation
Skin irritation	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation at 72 hours

Source: Title 40 CFR Part 156.62, Toxicity Category.

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(3) Avoid touching or moving anything that can conceal an explosive device
(4) Designate and enforce scene control zones
(5) Evacuate victims, other responders, and nonessential personnel as quickly and safely as possible

Secondary devices present a considerable challenge to the responder. The incident scene must be screened carefully for these devices, and extreme caution must be taken if any devices are discovered (see Exhibit II.5.4).

Planning the response can involve the medical response/support personnel as subject matter contributors to the IC, safety officer, or other responders, as appropriate. The strategic considerations that are directly addressed by medical specialists include hospital capability; hospital considerations; caregiver-to-victim ratios; special resources; medical logistics; and emergent, immediate, mid- and long-range clinical considerations.

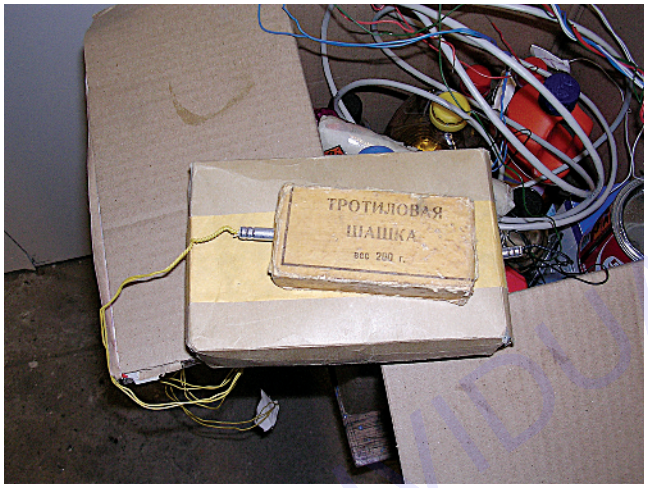

EXHIBIT II.5.4

Secondary devices can be found at hazmat/WMD incident scenes. This illustration shows an explosive device hidden in a cardboard storage box. (Courtesy of Rob Schnepp)

5.3 Competencies — Planning the Response.

5.3.1 Identifying High-Risk Areas for Potential Exposures.

5.3.1.1 The ALS responder, given an events calendar and pre-incident plans, which can include the local emergency planning committee plan as well as the agency's emergency response plan and SOPs, shall identify the venues for mass gatherings, industrial facilities, potential targets for terrorism, or any other locations where an accidental or intentional release of a harmful substance can pose an unreasonable health risk to any person within the local geographical area as determined by the AHJ and shall do the following:

(1) Identify locations where hazardous materials/WMD are used, stored, or transported
(2) Identify areas and locations presenting a potential for a high loss of life or rate of injury in the event of an accidental/intentional release of a hazardous materials/WMD substance
(3) Evaluate the geographic and environmental factors that can complicate a hazardous materials/WMD incident, including prevailing winds, water supply, vehicle and pedestrian traffic flow, ventilation systems, and other natural or man-made influences, including air and rail corridors

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The goal of 5.3.1.1 is to remind ALS responders that planning is essential. Almost every jurisdiction has an area of concern when it comes to hazardous materials/WMD events. It is unwise not to plan at these locations. A sound plan can be the difference between handling an event effectively and being completely overwhelmed.

5.3.2 Determining the Capabilities of the Local Hospital Network.

5.3.2.1 The ALS responder shall identify the methods and vehicles available to transport hazardous materials patients and shall determine the location and potential routes of travel to the following appropriate local and regional hospitals, based on patient need:

(1) Adult trauma centers
(2) Pediatric trauma centers
(3) Adult burn centers
(4) Pediatric burn centers
(5) Hyperbaric chambers
(6) Field hospitals
(7) Other specialty hospitals or medical centers

ALS responders should be familiar with local and regional health care systems when it comes to the location, type, and capabilities of local hospitals. During the planning process, it is necessary to identify the facilities capable of providing care to exposed patients. ALS responders should be aware of the level of preparedness of local hospitals.

5.3.2.2 Given a list of local receiving hospitals in the AHJ's geographic area, the ALS responder shall describe the location and availability of hospital-based decontamination facilities.

Methods used for decontamination vary from hospital to hospital. Responders need to be familiar with the capabilities of local and regional primary care facilities as they relate to guarding against cross contamination and treatment of hazardous materials exposures. This will aid in ensuring that the most appropriate receiving facility is chosen to ensure the best care for the patient and the safety of attending personnel.

5.3.2.3 The ALS responder shall describe the ALS protocols and SOPs developed by the AHJ and the prescribed role of medical control and poison control centers during mass casualty incidents, at hazardous materials/WMD incidents where exposures have occurred, and in the event of disrupted radio communications.

The local emergency response plan, protocols, and procedures must define the actions that the ALS responder should follow when confronted with a hazardous material–related mass casualty incident. The action plan should provide direction for times when normal communications are disrupted and alternative means of contacting medical control or poison control centers is required. Note that in the 2018 edition of NFPA 473, 5.3.2.4(5)(d) has been revised to "hydrocarbon/hydrocarbon derivatives."

5.3.2.4 The ALS responder shall identify the following mutual aid resources (hospital- and non-hospital-based) identified by the AHJ for the field management of multicasualty incidents:

(1) Mass-casualty trailers with medical supplies
(2) Mass-decedent capability
(3) Regional decontamination units

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(4) Replenishment of medical supplies during long-term incidents
(5) Locations and availability of mass-casualty antidotes for selected exposures, including but not limited to the following:
  (a) Nerve agents and organophosphate pesticides
  (b) Biological agents and other toxins
  (c) Asphyxiants
  (d) Hydrocarbon/hydrocarbon derivatives
  (e) Radiation exposures or contamination events
(6) Rehabilitation units for the EMS responders
(7) Replacement transport units for those vehicles lost to mechanical trouble, collision, theft, and contamination

5.3.2.5 The ALS responder shall identify the special hazards associated with inbound and outbound air transportation of patients exposed to hazardous materials/WMD.

The threat of a contaminant spread by inbound aircraft and the potential contamination of the aircraft by the release can pose a significant risk to responders, the public, and the aircraft itself. The threat to the outbound aircraft is the risk that exposed patients could emit a hazardous substance while the aircraft is in flight that would affect the flight crew. Additionally, the threat of contaminating the aircraft itself is another risk. The proper management of air operations at hazardous materials events is extremely important to both the aircraft flight crews and those on the ground. Before placing patients from any hazardous materials incident into an aircraft, a thorough hazard-risk assessment must be performed, including a validation of decontamination efforts, the risk from secondary exposure of contamination, the risk to the aircraft and crew from approach to the incident, and so on.

5.3.2.6 The ALS responder shall describe the available medical information resources concerning hazardous materials toxicology and response.

5.3.3 Identifying Incident Communications.

5.3.3.1 The ALS responder shall identify the components of the communication plan within the AHJ geographic area and determine that the EMS providers have the ability to communicate with other responders on the scene, with transport units, and with local hospitals.

5.3.3.2 Given examples of various patient exposure scenarios, the ALS responder shall describe the following information to be transmitted to the medical control or poison control center or the receiving hospital prior to arrival:

(1) The exact name of the substance(s) involved
(2) The physical and chemical properties of the substance(s) involved
(3) Number of victims being transported
(4) Age and sex of transported patients
(5) Patient condition and chief complaint
(6) Medical history
(7) Circumstances and history of the exposure, such as duration of exposure and primary route of exposure
(8) Air monitoring and detection values
(9) Any advanced detection information identified
(10) Vital signs, initial and current
(11) Symptoms described by the patient, initial and current
(12) Presence of associated injuries, such as burns and trauma
(13) Decontamination status

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ALS responders should understand that an accurate and complete report to the receiving hospital is important. This will provide the necessary lead time for hospital staff to prepare for accepting the exposed patient.

(14) Treatment rendered or in progress, including the effectiveness of antidotes administered
(15) Estimated time of arrival

5.3.4 Identifying the Role of the ALS Responder.

5.3.4.1 Given scenarios involving hazardous materials/WMD, the ALS responder shall identify his or her role during hazardous materials/WMD incidents as specified in the emergency response plan and SOPs developed by the AHJ, as follows:

The agency's hazardous materials emergency response plan should outline the role of the ALS responder. Primarily, that role includes responding to an emergency, assessing the nature of the incident, implementing protective measures, notifying other agencies, asking for additional assistance, establishing or working within an incident management system, and performing ALS medical triage, treatment, and transport in accordance with local protocols and procedures.

(1) Describe the purpose, benefits, and elements of the incident command system at it relates to the ALS responder

The ICS is an organized structure of roles, responsibilities, and procedures for the command and control of emergency operations. The ICS is modular and can expand or contract based on the need, size, and nature of an incident. It enables multiple disciplines and multiple jurisdictions to work together safely and effectively.

The ICS uses the following three management concepts: unity of command, span of control, and functional positions.

Unity of command stipulates that only one IC or unified command is ultimately responsible for the entire incident. The command structure encompasses clearly defined lines of authority in which everyone is responsible to, and directed by, one person.

Span of control is established so that only three to seven individuals report to one position so that no one position becomes overloaded, with optimum span of control at five.

The functional positions concept means that all resources assigned to one functional position [e.g., fire fighter, BLS responder, hazardous materials officer, and hazardous materials technician (HMT)] are to remain in that position until reassigned or released from the incident.

(2) Describe the typical incident command structure for the emergency medical component of a hazardous materials/WMD incident as specified in the emergency response plan and SOPs developed by the AHJ

The emergency medical component of the command structure will normally be a functional group directly under either the IC or the operations sections, if established. The function can be expanded to a medical branch, with a medical group performing treatment and triage, and a patient transportation group. Further expansion of the medical branch can include dividing the medical group into the triage group and treatment group, depending on the scope of the incident and available resources. Additional functions of the medical group could be extrication and air operations. ALS responders could be assigned to the medical unit under the logistics section if established. The medical unit would be responsible for responder medical treatment while the medical group/branch under the operations section would be responsible for public medical treatment. The size and complexity of the medical function will expand and collapse, depending on the needs of the incident.

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(3) Describe the role of the ALS responder within the incident command system

The ALS responder must be able to function within the ICS. The ALS responder first reports to the incident command post or staging area to check in. On receiving an assignment, the ALS responder reports to the assignment (i.e., incident or response area) and reports to the branch director/group supervisor at the incident or response area and performs the task assigned. On completion of the task, the ALS responder reports back to the supervisor for release or reassignment.

(4) Describe the role of the ALS responder within the incident command system during a hazardous materials/WMD incident when an ICS does not currently exist

The ALS responder might be the first on the scene of an emergency. When this happens, it is imperative that the ALS responder initiate the ICS and assume command until relieved by a more qualified or senior authority. The importance of this action is to ensure responder safety and coordination of resources to best effect the desired outcome of the incident.

(5) Identify the procedures for requesting additional resources at a hazardous materials/WMD incident

Responders at every level are required to know what types of resources are available and how to request them. The employer's emergency response plan and procedures should identify the processes by which the ALS responders will request additional resources both within and outside the organization.

5.3.4.2 Describe the hazardous materials/WMD ALS responder's role in the hazardous materials/WMD response plan developed by the AHJ or identified in the local emergency response plan as follows:

(1) Determine the toxic effect of hazardous materials/WMD

As early as possible in the incident, the identity or classification of the product should be obtained so that the ALS responder can take appropriate actions to minimize the impact of toxic effect on the patient(s). Once the material is identified or classified, the ALS responder can communicate with medical control for orders on treatment if no standing protocols exist. Information can also be obtained from a poison control center. Consideration must also be given to personal protection and decontamination of victims before patient treatment.

(2) Estimate the number of patients

As with any multicasualty incident, the estimate of the number of potential patients needs to be ascertained to determine the number and types of resources necessary to triage, treat, and transport the injured.

(3) Recognize and assess the presence and severity of symptoms

The ALS responder should be able to recognize symptoms consistent with the material exposure as confirming the determination of the toxic effects. Severity of symptoms might not be immediately known because some materials have delayed toxic effects. Depending on the material, symptoms are the result of a dose and the dose will dictate the effect on the body and their ability to intervene.

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(4) Assess the impact on the health care system

Once the number of patients and the identity or classification of the materials have been determined, the local health care system should be alerted and medical control notified. The number of decontaminated patients being transported and the number of self-transporting victims that may be en route to a facility should be communicated to medical control as early as possible. Every effort should be made to minimize the impact to a facility by notifying the facility of the numbers of injured being transported.

(5) Perform appropriate patient monitoring

Taking and recording vital signs such as respirations, pulse, and blood pressure on regular intervals assists in evaluating the severity of the exposure and monitoring the body's vital functions in response to toxic effects. ALS responders have more diagnostic tools available to them than BLS responders. The use and interpretation of these tools can provide more certainty in defining a patient's true condition.

(6) Communicate pertinent information

Information related to the incident, including the number of patients and the type and severity of exposure or injuries, should be communicated and updated regularly throughout the event to receiving facilities and medical control as well as to the ICS.

(7) Estimate pharmacological need

Based on the knowledge of the materials, the signs and symptoms of the patient, and the estimation of the dose, the ALS responder should be able to estimate the type and number of pharmaceuticals necessary for adequate intervention based on standing protocols or medical control.

(8) Address threat potential for clinical latency

Many materials demonstrate delayed effects related to the exposure to the material and the dose involved. It is usually necessary to watch patients closely for delayed symptomology or clinical latency. With known products, medical control or poison control centers may be able to alert the ALS responder to the threat of delayed onset of effects.

(9) Estimate exposure dosage

Given appropriate information, the ALS responder should be able to estimate the amount of time the patient was exposed and the amount of the product introduced into the body to determine an exposure estimate.

(10) Estimate treatment dosage
(11) Train in the following diagnostic monitoring equipment:

While treating and transporting patients, it is imperative that the patient be monitored closely to identify changes in condition, extent of symptoms, or impacts of underlying medical problems.

Also, the following should be noted:

- SaO_2: Describes the amount of oxygen in the blood bound to hemoglobin in arterial blood.
- Capnography: A monitoring device that measures the concentration of CO_2 in exhaled air.

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- Rainbow technology: A technology that will measure end-tidal carbon dioxide (ETCO2), pulse oximeter oxygen saturation (SpO2), carbon monoxide (SpCO), and methemoglobin (SpMet).

(a) SaO_2
(b) Capnography
(c) Rainbow technology

5.3.5 Supplemental Medical Resources. Given scenarios of various hazardous materials/WMD mass casualty incidents, the ALS responder shall identify the supplemental medical resources available to the AHJ, including the strategic national stockpile (SNS) program.

N **5.3.5.1** Describe the SNS program, including the following components:

(1) Intent and goals of the SNS program

The mission of the Strategic National Stockpile (SNS), which is maintained by the CDC, is to resupply large quantities of essential medical material to states and communities during an emergency within 12 hours of the federal decision to deploy.

The SNS is a complex program involving such programs as the Cities Readiness Initiative (CRI), Chem-Pak, the push package, the vendor-managed inventory, and the Pandemic Influenza Plan.

The CRI is designed for rapid deployment of antibiotic prophylaxis within 48 hours of identification of an anthrax attack. The Chem-Pak program is exclusive to nerve agents. It provides the positioning of EMS and hospital-tailored caches of antidotes.

The vendor-managed inventory is a sustainable, event-tailored inventory that can be initially delivered within 36 hours of the decision to deploy.

The Pandemic Influenza Plan is designed to meet the requirements of a large population of people threatened by pandemic influenza, by monitoring disease outbreaks, maintaining stockpiles of antivirals and vaccines, providing public education and communication, and preparing a network of federal, state, and local preparedness.

(2) Procedures and requirements for deploying the SNS to a local jurisdiction

Refer to your AHJ for the specific procedures that are required for deployment.

(3) Typical supplies contained in 12-hour push package

A push package, which is supplied by the CDC Strategic National Stockpile (SNS), is a general cache of medical supplies configured to restock hospitals and public health centers during times of large-scale emergencies. Generally, a state governor's office initiates the request for a push package. The push package can be on site within 12 hours of the decision to deploy.

(4) Role of the technical advisory response unit (TARU)

The metropolitan medical response system (MMRS) program is an initiative of the U.S. Department of Homeland Security, which assists highly populated regions of the country to develop plans, conduct training and exercises, acquire pharmaceuticals and PPE, and to achieve the enhanced capability to respond to a mass casualty event caused by a WMD terrorist act. This assistance supports the jurisdictions' activities to increase their response capabilities during the initial crucial hours of lifesaving and population protection.

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5.4 Competencies — Implementing the Planned Response.

The ALS responder will play a key role in the EMS part of the response plan for which the outcome for both patients and responders depends. Therefore, the ALS responder is required by Section 4.5 to know enough about the hazardous materials to analyze the incident and effectively determine the risks and medical care necessary for his or her part of the response.

Δ **5.4.1 Determining the Nature of the Incident and Providing Medical Care.** The ALS responder shall describe the ability to provide emergency medical care to those patients exposed to hazardous materials/WMD by completing the following tasks:

The ALS responder is required by 5.4.1 to be able to determine from clues presented during dispatch, response, and approach whether a hazardous material is present at the scene and whether the released material poses a risk to the patient and, in turn, to the responders at the scene. Typical indicators of the presence of a released hazardous material include the following: operators or witnesses, placards, the normal occupancy of buildings at the scene (such as chemical storage buildings), the type of containers involved, and the presence of fires or explosions.

It is critical that ALS responders have a good understanding of the many physical states of potentially released substances that may be present at a hazardous materials/WMD incident as they perform their emergency medical care duties. Understanding these states and the associated mechanisms of injury and health implications associated with the released substance in these various states is critical to their care of patients as well as their personal safety while performing medical care duties. It is also important for the ALS responder to be aware that the released substances might be in more than one condition at the incident and that there might be more than one released substance.

(1) The ALS responder shall determine the physical state of the released substance and the environmental influences surrounding the release, as follows:

(a) Solid

A solid is a material in the state of matter characterized by resistance to deformation and changes of volume. At the microscopic scale, a solid has the properties of the atoms or molecules being packed closely together, its constituent elements have fixed positions in space relative to each other, and because any solid has some thermal energy, its atoms vibrate. However, this movement is very small and rapid and cannot be observed under ordinary conditions. It is important to recognize that solid materials can rapidly change state — of most concern are the solids that rapidly volatilize under certain environmental conditions.

(b) Liquid

A liquid is a state of matter whose shape is usually determined by the container it fills. Liquid particles (normally molecules or clusters of molecules) are free to move within the liquid volume, but their mutual attraction limits ability of particles to leave the volume. The volume of a quantity of liquid is fixed by its temperature and pressure. It is also important to recognize that liquids can change state rapidly under certain environmental conditions (of concern are those liquids that rapidly volatilize under certain environmental conditions).

(c) Gas, vapor, dust, mist, aerosol

A gas is a state of matter that has atoms or molecules basically moving independently, with no forces keeping them together or pushing them apart. Hazardous substances in the gaseous state are of concern for the inhalation exposure route.

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A vapor refers to a gas-phase material that normally exists as a liquid or solid under a given set of environmental conditions. Vapors are composed of single gas-phase molecules. Many, but not all, vapors are colorless and therefore invisible. Vapors do not wet objects with which they come in contact.

A dust is fine (small) particles of dry matter. Dusts can be generated by handling, crushing, grinding, rapid impact, detonation, and breakdown of certain organic or inorganic materials, such as rocks, ore, metal, coal, wood, grains, or other such material. Particles ranging in size from 0.1 μm in diameter to about 30 μm in diameter and are referred to as total suspended particulate (TSP) matter. Particles in the size range between 0.1 μm and 10 μm are of concern for inhalation exposures.

A mist or fog is a microscopic suspension of liquid droplets in a gas. Do not confuse a mist with a vapor. Mists can generally be seen and reduce visibility. Mists generally wet objects with which they come in contact.

The ALS responder should also be aware of the environmental conditions at the incident and how these environmental conditions can alter the health effects and physical states of the released substances. For example, on very hot days or in situations where the event results in elevated temperature at the scene, a substance normally not very volatile can become quite volatile with increased gaseous releases.

Windy conditions can create lower concentrations of the released substance in the working area. If aware of these conditions, ALS responders can position themselves upwind of the source and away from higher exposures. By knowing about situations like this, ALS responders are better able perform their medical care duties safely and more efficiently.

(2)* The ALS responder shall identify potential routes of exposure and correlate those routes of exposure to the physical state of the released substance, to determine the origin of the illness or injury, as follows:

The ALS responder needs to be very aware of how the associated released substances can enter the patient — and themselves if they are not careful. Also, ALS responders should continually evaluate all routes of exposure as they prepare to give medical care to patients. For example, care must be taken to not introduce the released substance into a patient through ingestion or injection as they administer medications to the patient. Likewise, they should be aware that while administering to patients who have received inhalation doses of the released substance, they can be subjecting themselves as well as other patients to the substance from the exhalation of that patient. Again, it is important to consider all routes of exposure while proceeding to administer to patients at a hazardous materials/WMD incident.

A.5.4.1(2) See A.4.4.1(3).

(a) Inhalation

Inhalation is how contaminants enter the body through the normal respiratory process (i.e., uptake through normal breathing process, with contaminants deposited along the respiratory tract into the lungs).

(b) Absorption

Absorption is the process by which contaminants are absorbed into the body through the skin and other exposed tissue, and it is often referred to as *dermal absorption* or *dermal uptake*.

(c) Ingestion

Ingestion is the process of consuming contaminants through the normal ingestion process (i.e., usually through the process of consuming food and water).

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(d) Injection

Injection is the process by which contaminants are introduced directly into the bloodstream by means of a needle, cannula, or other mechanical process. Contaminants entering the bloodstream through an open wound are introduced by injection.

(3) The ALS responder shall describe the potential routes of entry into the body, the common signs and symptoms of exposure, and the ALS treatment options approved by the AHJ (e.g., advanced airway management, drug therapy), including antidote administration where appropriate, for exposure(s) to the following classification of substances:

The ALS responder should maintain a strong working knowledge of signs and symptoms of exposure from each class of substances. These signs and symptoms will provide the ALS responder with key insights to integrate with their awareness of the material(s) release, their associated routes of exposure, and their associated health effects and implications. These signs and symptoms are important checkpoints for an ALS responder to use to provide medical care to patient(s). It is also important for the ALS responder to understand the health implications of these classes of substances to protect themselves at the scene, as well as provide better medical care for their patients.

Patients exposed to hazardous materials could pose a risk of contamination to others who encounter them, including the ALS responder. An ALS responder's knowledge of toxic exposure, patient assessment, and decontamination procedures is essential for the responder to determine the necessary actions for preparing patients to be treated and transported safely. In some cases, treatment might need to wait until the HMTs at the scene decontaminate and transfer a patient to the cold zone.

(a) Corrosives

Corrosives are chemicals that cause visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. A chemical is corrosive if, when tested on the intact skin of albino rabbits by the method described in Appendix A of Title 49 CFR Part 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of 4 hours [2]. For purposes of this standard, the term does not refer to action on inanimate surfaces.

(b) Pesticides

A pesticide is a substance or mixture of substances intended for preventing, destroying, repelling, or mitigating a pest. A pesticide might be a chemical substance or biological agent (such as a virus or bacteria) used against pests including insects, plant pathogens, weeds, mollusks, birds, mammals, fish, nematodes (roundworms), and microbes that compete with humans for food, destroy property, spread disease, or are a nuisance. Many pesticides are poisonous to humans.

(c) Chemical asphyxiants

Chemical asphyxiants reduce the body's ability to absorb, transport, or use inhaled oxygen. They are often active at very low concentrations — a few parts per million (ppm).

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(d) Simple asphyxiants

An asphyxiant is a substance that can cause unconsciousness or death by suffocation (asphyxiation). Asphyxiants that have no other health effects are referred to as simple asphyxiants. Asphyxiation is an extreme hazard when working in enclosed spaces. Responders must be trained in confined space entry before working in sewers, storage tanks, and the like, where gases such as methane can displace oxygen from the atmosphere.

(e) Organic solvents

Organic solvents are a chemical class of compounds that are used routinely in commercial industries. They share a common structure (at least 1 carbon atom and 1 hydrogen atom), low molecular weight, lipophilicity, and volatility, and they exist in liquid form at room temperature. They can be grouped further into aliphatic-chain compounds, such as *n*-hexane, and as aromatic compounds with a 6-carbon ring, such as benzene or xylene. Aliphatics and aromatics can contain a substituted halogen element and might be referred to as halogenated hydrocarbons, such as perchloroethylene (PCE or PER), trichloroethylene (TCE), and carbon tetrachloride. Alcohols, ketones, glycols, esters, ethers, aldehydes, and pyridines are substitutions for a hydrogen group. Organic solvents can dissolve oils, fats, resins, rubber, and plastics.

(f) Nerve agents

The following information on nerve agents is extracted from the Federation of American Scientists' web site:

> Nerve agents are a group of particularly toxic chemical warfare agents. They were developed just before and during World War II and are related chemically to the organophosphorus insecticides. The principle agents in this group are:
>
> - GA - tabun
> - GB - sarin
> - GD - soman
> - GF - cyclosarin
> - VX - methylphosphonothioic acid
>
> The "G" agents tend to be non-persistent whereas the "V" agents are persistent. Some "G" agents may be thickened with various substances to increase their persistence, and therefore the total amount penetrating intact skin. At room temperature GB is a comparatively volatile liquid and therefore non-persistent. GD is also significantly volatile, as is GA though to a lesser extent. VX is a relatively non-volatile liquid and therefore persistent. It is regarded as presenting little vapor hazard to people exposed to it. In the pure state nerve agents are colorless and mobile liquids. In an impure state nerve agents may be encountered as yellowish to brown liquids. Some nerve agents have a faint fruity odor.
>
> - GB and VX doses which are potentially life threatening may be only slightly larger than those producing least effects. Death usually occurs within 15 minutes after absorption of a fatal VX dosage.
> - Although only about half as toxic as GB by inhalation, GA in low concentrations is more irritating to the eyes than GB. Symptoms appear much more slowly from a skin dosage than from a respiratory dosage. Although skin absorption great enough to cause death may occur in 1 to 2 minutes, death may be delayed for 1 to 2 hours. Respiratory lethal dosages kill in 1 to 10 minutes, and liquid in the eye kills almost as rapidly.

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Toxicological Data

Route	*Form*	*Effect*	*Type*	*GA*	*GB*	*GD*	*VX*	*Dosage*
Ocular	Vapor	Miosis	ECt_{50}	—	<2	<2	<0.09	mg · min/m^3
Inhalation at RMV = 15 1/min	Vapor	Runny Nose	ECt_{50}	—	<2	<2	<0.09	mg · min/m^3
Inhalation at RMV = 15 liters/min	Vapor	Incapacitation	ICt_{50}	—	35	35	25	mg · min/m^3
Inhalation at RMV = 15 liters/min	Vapor	Death	LCt_{50}	135	70	70	30	mg · min/m^3
Percutaneous	Liquid	Death	LD_{50}	4,000	1,700	350	10	mg

Ct (Concentration time; mg min/m^3) - A measure of exposure to a gas, the effective vapor exposure, determined by the concentration of the gas (mg/m^3) and the length of exposure (min).

ECt_{50} (Effective Concentration Time; mg^{3}min/m^3) - The Ct at which a gas debilitates 50% of the exposed population in a specific way.

ICt_{50} (Incapacitating Concentration Time; mg min/m^3) - The Ct at which a gas incapacitates 50% of the exposed population.

LCt_{50} (Lethal concentration time; mg min/m^3) - The Ct at which a gas kills 50% of the exposed population.

LD_{50} (Lethal dose; mg) - The dose or amount at which a substance kills 50% of the exposed population.

RMV (Respiratory minute volume; liters/min) - Volume of air inhaled per minute.

The values are estimates of the doses, which have lethal effects on a 70 kg man. Effective dosages of vapor are estimated for exposure durations of 2–10 minutes. The effects of the nerve agents are mainly due to their ability to inhibit acetylcholinesterase throughout the body. Since the normal function of this enzyme is to hydrolyse acetylcholine wherever it is released, such inhibition results in the accumulation of excessive concentrations of acetylcholine at its various sites of action. These sites include the endings of the parasympathetic nerves to the smooth muscle of the iris, ciliary body, bronchial tree, gastrointestinal tract, bladder and blood vessels; to the salivary glands and secretory glands of the gastrointestinal tract and respiratory tract; and to the cardiac muscle and endings of sympathetic nerves to the sweat glands.

The sequence of symptoms varies with the route of exposure. While respiratory symptoms are generally the first to appear after inhalation of nerve agent vapor, gastrointestinal symptoms are usually the first after ingestion. Tightness in the chest is an early local symptom of respiratory exposure. This symptom progressively increases, as the nerve agent is absorbed into the systemic circulation, whatever the route of exposure. Following comparable degrees of exposure, respiratory manifestations are most severe after inhalation, and gastrointestinal symptoms may be most severe after ingestion.

The lungs and the eyes absorb nerve agents rapidly. In high vapor concentrations, the nerve agent is carried from the lungs throughout the circulatory system; widespread systemic effects may appear in less than 1 minute.

- The earliest ocular effect, which follows minimal symptomatic exposure to vapor, is miosis. The pupillary constriction may be different in each eye. Within a few minutes after the onset of exposure, there also occurs redness of the eyes. Following minimal exposure, the earliest effects on the respiratory tract are a watery nasal discharge, nasal hyperaemia, sensation of tightness in the chest and occasionally prolonged wheezing.
- Exposure to a level of a nerve agent vapor slightly above the minimal symptomatic dose results in miosis, pain in and behind the eyes and frontal headache. Some twitching of the eyelids may occur. Occasionally there is nausea and vomiting.
- In mild exposures, the systemic manifestations of nerve agent poisoning usually include tension, anxiety, jitteriness, restlessness, emotional lability, and giddiness. There may be insomnia or excessive dreaming, occasionally with nightmares.

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- If the exposure is more marked, the following symptoms may be evident: headache, tremor, drowsiness, difficulty in concentration, impairment of memory with slow recall of recent events, and slowing of reactions. In some casualties there is apathy, withdrawal and depression.
- With the appearance of moderate systemic effects, the casualty begins to have increased fatigability and mild generalized weakness, which is increased by exertion. This is followed by involuntary muscular twitching, scattered muscular fasciculation's and occasional muscle cramps. The skin may be pale due to vasoconstriction and blood pressure moderately elevated.
- If the exposure has been severe, the cardiovascular symptoms will dominate and twitching (which usually appear first in the eyelids and in the facial and calf muscles) becomes generalized. Many rippling movements are seen under the skin and twitching movements appear in all parts of the body. This is followed by severe generalized muscular weakness, including the muscles of respiration. The respiratory movements become more labored, shallow and rapid; then they become slow and finally intermittent.
- After moderate or severe exposure, excessive bronchial and upper airway secretions occur and may become very profuse, causing coughing, airway obstruction and respiratory distress. Bronchial secretion and salivation may be so profuse that watery secretions run out of the sides of the mouth. The secretions may be thick and tenacious. If the exposure is not so overwhelming as to cause death within a few minutes, other effects appear. These include sweating, anorexia, nausea and heartburn. If absorption of nerve agent has been great enough, there may follow abdominal cramps, vomiting, diarrhea, and urinary frequency. The casualty perspires profusely, may have involuntary defecation and urination and may go into cardio respiratory arrest followed by death.
- If absorption of nerve agent has been great enough, the casualty becomes confused and ataxic. The casualty may have changes in speech, consisting of slurring, difficulty in forming words, and multiple repetition of the last syllable. The casualty may then become comatose, reflexes may disappear and generalized convulsions may ensue. With the appearance of severe central nervous system symptoms, central respiratory depression will occur and may progress to respiratory arrest.
- After severe exposure the casualty may lose consciousness and convulse within a minute without other obvious symptoms. Death is usually due to respiratory arrest requires prompt initiation of assisted ventilation to prevent death. If assisted ventilation is initiated, the individual may survive several lethal doses of a nerve agent.
- If the exposure has been overwhelming, amounting to many times the lethal dose, death may occur despite treatment as a result of respiratory arrest and cardiac arrhythmia. When overwhelming doses of the agent are absorbed quickly, death occurs rapidly without orderly progression of symptoms.

Nerve agent poisoning may be identified from the characteristic signs and symptoms. If exposure to vapor has occurred, the pupils will be very small, usually pin-pointed. If exposure has been cutaneous or has followed ingestion of a nerve agent in contaminated food or water, the pupils may be normal or, in the presence of severe systemic symptoms, slightly to moderately reduced in size. In this event, the other manifestations of nerve agent poisoning must be relied on to establish the diagnosis. No other known chemical agent produces muscular twitching and fasciculation's, rapidly developing pinpoint pupils, or the characteristic train of muscarinic, nicotinic and central nervous system manifestations.

The rapid action of nerve agents call for immediate self-treatment. Unexplained nasal secretion, salivation, tightness of the chest, shortness of breath, constriction of pupils, muscular twitching, or nausea and abdominal cramps call for the immediate intramuscular injection of 2 mg of atropine, combined if possible with oxime.

Source: Federation of American Scientists, www.fas.org/cw/cwagents.htm.

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(g) Vesicants

The following information on vesicant agents is extracted from the Federation of American Scientists' web site:

Blister or vesicant agents are likely to be used both to produce casualties and to force opposing troops to wear full protective equipment thus degrading fighting efficiency, rather than to kill, although exposure to such agents can be fatal. Blister agents can be thickened to contaminate terrain, ships, aircraft, vehicles or equipment with a persistent hazard.

Vesicants burn and blister the skin or any other part of the body they contact. They act on the eyes, mucous membranes, lungs, skin and blood-forming organs. They damage the respiratory tract when inhaled and cause vomiting and diarrhea when ingested. The vesicant agents include:

- HD - sulfur mustard
- HN - nitrogen mustard
- L - lewisite (arsenical vesicants may be used in a mixture with HD)
- CX - phosgene (properties and effects are very different from other vesicants)

HD and HN are the most feared vesicants historically, because of their chemical stability, their persistency in the field, the insidious character of their effects by attacking skin as well as eyes and respiratory tract, and because no effective therapy is yet available for countering their effects. Since 1917, mustard has continued to worry military personnel with the many problems it poses in the fields of protection, decontamination and treatment. It should be noted that the ease with which mustard can be manufactured and its great possibilities for acting as a vapor would suggest that in a possible future chemical war HD would be preferred to HN.

Due to their physical properties, mustards are very persistent in cold and temperate climates. It is possible to increase the persistency by dissolving them in non-volatile solvents. In this way thickened mustards are obtained that are very difficult to remove by decontaminating processes.

Exposure to mustard is not always noticed immediately because of the latent and sign-free period that may occur after skin exposure. This may result in delayed decontamination or failure to decontaminate at all. Whatever means is used has to be efficient and quick acting. Within 2 minutes contact time, a drop of mustard on the skin can cause serious damage. Chemical inactivation using chlorination is effective against mustard and lewisite, less so against HN, and is ineffective against phosgene oxime.

- In a single exposure the eyes are more susceptible to mustard than either the respiratory tract or the skin. The effects of mustard on the eyes are very painful. Conjunctivitis follows exposure of about 1 hour to concentrations barely perceptible by odor. This exposure does not affect the respiratory tract significantly. A latent period of 4 to 12 hours follows mild exposure, after which there is lachrymation and a sensation of grit in the eyes. The conjunctival and the lids become red. Heavy exposure irritates the eyes after 1 to 3 hours and produces severe lesions.
- The hallmark of sulfur mustard exposure is the occurrence of a latent symptom and sign free period of some hours post exposure. The duration of this period and the severity of the lesions are dependent upon the mode of exposure, environmental temperature and probably on the individual himself. High temperature and wet skin are associated with more severe lesions and shorter latent periods.
- If only a small dose is applied to the skin, the skin turns red and itches intensely. At higher doses blister formation starts, generally between 4 and 24 hours after contact, and this blistering can go on for several days before reaching its maximum. The blisters are fragile and usually rupture spontaneously giving way to a suppurating and necrotic wound. The necrosis of the epidermal cells is extended to the underlying tissues, especially to the dermis. The damaged tissues are covered with slough and are extremely susceptible to infection. The regeneration of these tissues is very slow, taking from several weeks to several months.

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- Mustard attacks all the mucous membranes of the respiratory tract. After a latent period of 4 to 6 hours, it irritates and congests the mucous membranes of the nasal cavity and the throat, as well as the trachea and large bronchi. Symptoms start with burning pain in the throat and hoarseness of the voice. A dry cough gives way to copious expectoration. Airway secretions and fragments of necrotic epitheliums may obstruct the lungs. The damaged lower airways become infected easily, predisposing to pneumonia after approximately 48 hours. If the inhaled dose has been sufficiently high the victim dies in a few days, either from pulmonary edema or mechanical asphyxia due to fragments of necrotic tissue obstructing the trachea or bronchi, or from superimposed bacterial infection, facilitated by an impaired immune response.

The great majority of mustard gas casualties survive. There is no practical drug treatment available for preventing the effects of mustard. Infection is the most important complicating factor in the healing of mustard burns. There is no consensus on the optimum form of treatment.

A full protective ensemble can only achieve protection against these agents. The respirator alone protects against eye and lung damage and gives some protection against systemic effects. No drug is available for the prevention of the effects of mustard on the skin and the mucous membranes caused by mustards. It is possible to protect the skin against very low doses of mustard by covering it with a paste containing a chlorinating agent, e.g., chloramine. The only practical prophylactic method is physical protection such as is given by the protective respirator and special clothing.

In a pure form lewisite is a colorless and odorless liquid, but usually contains small amounts of impurities that give it a brownish color and an odor resembling geranium oil. It is heavier than mustard, poorly soluble in water but soluble in organic solvents. L is a vesicant (blister agent); also, it acts as a systemic poison, causing pulmonary edema, diarrhea, restlessness, weakness, subnormal temperature, and low blood pressure. In order of severity and appearance of symptoms, it is: a blister agent, a toxic lung irritant, absorbed in tissues, and a systemic poison. When inhaled in high concentrations, may be fatal in as short a time as 10 minutes.

- Liquid arsenical vesicants cause severe damage to the eye. On contact, pain and blepharospasm occur instantly. Edema of the conjunctival and lids follow rapidly and close the eye within an hour. Inflammation of the iris usually is evident by this time. After a few hours, the edema of the lids begins to subside, while haziness of the cornea develops.
- Liquid arsenical vesicants produce more severe lesions of the skin than liquid mustard. Stinging pain is felt usually in 10 to 20 seconds after contact with liquid arsenical vesicants. The pain increases in severity with penetration and in a few minutes becomes a deep, aching pain. Contamination of the skin is followed shortly by erythema, then by vesication, which tends to cover the entire area of erythema. There is deeper injury to the connective tissue and muscle, greater vascular damage, and more severe inflammatory reaction than are exhibited in mustard burns. In large, deep, arsenical vesicant burns, there may be considerable necrosis of tissue, gangrene and slough.
- The vapors of arsenical vesicants are so irritating to the respiratory tract that conscious casualties will immediately put on a mask to avoid the vapor. No severe respiratory injuries are likely to occur except among the wounded that cannot put on masks or the careless, caught without masks. Lewisite is irritating to nasal passages and produces a burning sensation followed by profuse nasal secretion and violent sneezing. Prolonged exposure causes coughing and production of large quantities of froth mucus. Injury to respiratory tracts, due to vapor exposure is similar to mustard's; however, edema of the lung is more marked and frequently accompanied by pleural fluid.

An antidote for lewisite is dimercaprol (British anti-lewisite [BAL]). This ointment may be applied to skin exposed to lewisite before actual vesication has begun. Some blistering is inevitable in most arsenical vesicant cases. The treatment of the erythema, blisters and denuded areas is identical with that for similar mustard lesions. Burns severe enough to

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cause shock and systemic poisoning are life threatening. Even if the patient survives the acute effects, the prognosis must be guarded for several weeks.

Phosgene oxime (CX) is a white crystalline powder. It melts between 39–40°C, and boils at 129°C. By the addition of certain compounds it is possible to liquefy phosgene oxime at room temperature. It is fairly soluble in water and in organic solvents. In aqueous solution phosgene oxime is hydrolyses fairly rapidly, especially in the presence of alkali. It has a high vapor pressure and its odor is very unpleasant and irritating. Even as a dry solid, phosgene oxime decomposes spontaneously and has to be stored at low temperatures.

In low concentrations, phosgene oxime severely irritates the eyes and respiratory organs. In high concentrations, it also attacks the skin. A few milligrams applied to the skin cause severe irritation, intense pain, and subsequently a necrotizing wound. Very few compounds are as painful and destructive to the tissues.

Phosgene oxime also affects the eyes, causing corneal lesions and blindness and may affect the respiratory tract causing pulmonary edema. The action on the skin is immediate: phosgene oxime provokes irritation resembling that caused by a stinging nettle. A few milligrams cause intense pain, which radiates from the point of application, within a minute the affected area turns white and is surrounded by a zone of erythema (skin reddening), which resembles a wagon wheel in appearance. In 1 hour the area becomes swollen, and within 24 hours, the lesion turns yellow and blisters appear. Recovery takes 1 to 3 months.

Source: Federation of American Scientists, www.fas.org/cw/cwagents.htm.

(h) Irritants (riot control agents)

An irritant is a chemical that is not corrosive but causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. A chemical is a skin irritant if, when tested on the intact skin of albino rabbits by the methods of Title 16 CFR Part 1500.41 for 4 hours exposure or by other appropriate techniques, it results in an empirical score of five or more [3]. A chemical is an eye irritant if so determined under the procedure listed in Title 16 CFR Part 1500.42 or other appropriate techniques [4].

(i) Biological agents and toxins

Biological warfare (BW), also known as germ warfare, is the use of any pathogen (bacterium, virus, or other disease-causing organism) or toxin found in nature as a weapon of war. BW agents might be intended to kill, incapacitate, or seriously impede an adversary. Ideal characteristics of biological agents and toxins are high infectivity, high potency, availability of vaccines, and delivery as an aerosol. Diseases most likely to be considered for use as biological weapons are contenders because of their lethality (if delivered efficiently) and robustness (making aerosol delivery feasible).

The biological agents used in biological weapons can often be manufactured quickly and easily. The primary difficulty is not the production of the biological agent but delivery in an infective form to a vulnerable target. For example, anthrax is considered an effective agent for several reasons. First, it forms hardy spores, perfect for dispersal aerosols. Second, pneumonic (lung) infections of anthrax usually do not cause secondary infections in other people. Thus, the effect of the agent is usually confined to the target. A pneumonic anthrax infection starts with ordinary cold symptoms and quickly becomes lethal, with a fatality rate that is 80 percent or higher. Finally, friendly personnel can be protected with suitable antibiotics.

A mass attack using anthrax would require the creation of aerosol particles of 1.5 μm to 5 μm. Too large and the aerosol would be filtered out by the respiratory system. Too small and the aerosol would be inhaled and exhaled. Also, at this size, nonconductive powders tend to clump and cling because of electrostatic charges, which hinders dispersion. So, the material must be treated with silica to insulate and discharge the charges. The aerosol must be delivered so that rain and sun do not rot it, and yet the human lung can be infected. There are other technological difficulties as

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well. Diseases considered for weaponization or known to be weaponized include anthrax, Ebola, bubonic plague, cholera, tularemia, brucellosis, Q fever, Machupo, coccidioides mycosis, glanders, melioidosis, shigella, Rocky Mountain spotted fever, typhus, psittacosis, yellow fever, Japanese B encephalitis, Rift Valley fever, and smallpox. Naturally occurring toxins that can be used as weapons include ricin, SEB, botulism toxin, saxitoxin, and many mycotoxins. The organisms causing these diseases are known as select agents. Their possession, use, and transfer are regulated by the CDC's Select Agent Program.

(j) Incapacitating agents

The term *incapacitating agent* is defined by the U.S. Department of Defense as follows:

> An agent that produces temporary physiological or mental effects, or both, which will render individuals incapable of concerted effort in the performance of their assigned duties. [5]

Incapacitating agents are not primarily intended to kill, but supposedly nonlethal incapacitating agents can kill many of those exposed to them. The term *incapacitation*, when used in a general sense, is roughly equivalent to the term *disability* as used in occupational medicine and denotes the inability to perform a task because of a quantifiable physical or mental impairment. In this sense, any of the chemical warfare agents can incapacitate a victim; however, again by the military definition of this type of agent, incapacitation refers to impairments that are temporary and nonlethal. Thus, riot-control agents are incapacitating because they cause temporary loss of vision due to blepharospasm, but they are not considered military incapacitants because the loss of vision does not last long. Although incapacitation can result from physiological changes such as mucous membrane irritation, diarrhea, or hyperthermia, the term *incapacitating agent* as militarily defined refers to a compound that produces temporary and nonlethal impairment of military performance by virtue of its psychobehavioral or central nervous system (CNS) effect.

(k) Radioactive materials

The following information is extracted from the EPA's web site:

> Three basic concepts apply to all types of ionizing radiation. When developing regulations or standards that limit how much radiation a person can receive in a particular situation, one considers how these concepts affect a person's exposure.
>
> **BASIC CONCEPTS OF RADIATION PROTECTION**
>
> **Time.** The amount of radiation exposure increases and decreases with the time people spend near the source of radiation.
>
> In general, think of the exposure time as how long a person is near radioactive material. It's easy to understand how to minimize the time for external (direct) exposure. Gamma and X-rays are the primary concern for external exposure.
>
> However, if radioactive material gets inside the body, one can't move away from it. The only options once internal uptake occurs are to wait until it decays or until the body can eliminate it. When this happens, the biological half-life of the radionuclide controls the time of exposure. Biological half-life is the amount of time it takes the body to eliminate one half of the radionuclide initially present. Alpha and beta particles are the main concern for internal exposure.
>
> When establishing a radiation standard that assumes an exposure over a certain period, the concept of time is applied. For example, exposures are often expressed in terms of a committed dose. A committed dose is one that accounts for continuing exposures over long periods of time (such as 30, 50, or 70 years). It refers to the exposure received from radioactive material that enters and remains in the body for many years.

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When assessing the potential for exposure in a situation, consider the amount of time a person is likely to spend in the area of contamination. For example, in assessing the potential exposure from radon in a home, estimate how much time people are likely to spend in the basement.

Distance. The farther away a person is from a radiation source, the less their exposure. How close to a source of radiation one can get without getting a high exposure depends on the energy of the radiation and the size (or activity) of the source. Distance is a prime concern when dealing with gamma rays, because they can travel long distances. Alpha and beta particles don't have enough energy to travel very far.

As a rule, if you double the distance, you reduce the exposure by a factor of four (i.e., halving the distance increases the exposure by a factor of four). The area of the circle depends on the distance from the center to the edge of the circle (radius). It is proportional to the square of the radius. As a result, if the radius doubles, the area increases four times. Using the light bulb analogy, think of the radiation source as a bare light bulb. The bulb gives off light equally in every direction, in a circle. The energy from the light is distributed evenly over the whole area of the circle. When the radius doubles, the radiation is spread out over four times as much area, so the dose is only one fourth as much. (In addition, as the distance from the source increases so does the likelihood that some gamma rays will lose their energy.

The exposure of an individual sitting 4 feet from a radiation source will be 1/4 the exposure of an individual sitting 2 feet from the same source.

Shielding. The greater the shielding around a radiation source, the smaller the exposure. Shielding simply means having something that will absorb radiation between you and the source of the radiation. The amount of shielding required to protect against different kinds of radiation depends on how much energy they have.

α (Alpha) A thin piece of light material, such as paper, or even the dead cells in the outer layer of human skin provides adequate shielding because alpha particles can't penetrate it. However, living tissue inside body, offers no protection against inhaled or ingested alpha emitters.

β (Beta) Additional covering, for example heavy clothing, is necessary to protect against beta-emitters. Some beta particles can penetrate and burn the skin.

γ (Gamma) Thick, dense shielding, such as lead, is necessary to protect against gamma rays. The higher the energy of the gamma ray, the thicker the lead must be. X-rays pose a similar challenge, so X-ray technicians often give patients receiving medical or dental X-rays a lead apron to cover other parts of their body.

DIRTY BOMBS/RADIOACTIVE DISPERSAL DEVICES (RDDS)

Although "dirty bombs," or radioactive dispersal devices (RDDs), are not weapons of mass destruction, in the past few years terrorists have indicated their interest in acquiring such weapons. RDDs disperse radioactive material by using conventional explosives or other means. There are only a few radioactive sources that can be used effectively in an RDD. The greatest security risk is posed by Cobalt-60, Cesium-137, Iridium-192, Strontium-90, Americium-241, Californium-252, and Plutonium-238.

Source: U.S. Environmental Protection Agency, www.epa.gov/radiation.

(l) Nitrogen compounds

Nitrogen oxides are produced during most combustion processes. About 80 percent of the immediately released nitrogen oxide is in the form nitric oxide (NO). Small amounts of nitrous oxide (N_2O) are also produced. Nitric oxide reacts with oxygen in the air to produce nitrogen dioxide (NO_2). Further oxidation during the day causes the nitrogen dioxide to form nitric acid and nitrate particles. In the dark, nitrogen dioxide can react with ozone and form a very reactive free radical. The free radical

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then can react with organic compounds in the air to form nitrogenated organic compounds, some of which have been shown to be mutagenic and carcinogenic.

Nitrogen dioxide is the most important nitrogen oxide compound with respect to acute adverse health effects. Under most chemical conditions, it is an oxidant. However, it takes about 10 times more nitrogen dioxide than ozone to cause significant lung irritation and inflammation.

Nitrates and nitrites are known to cause several health effects. In general, the following are the most common effects:

- Reactions with hemoglobin in blood, causing the oxygen-carrying capacity of the blood to decrease (nitrite)
- Decreased functioning of the thyroid gland (nitrate)
- Vitamin A shortages (nitrate)
- Formation of nitro amines, which are known as one of the most common causes of cancer (nitrates and nitrites)

(m) Hydrocarbon/hydrocarbon derivatives

A hydrocarbon compound is made up of carbon and hydrogen atoms bound together. Hydrocarbon derivatives contain different elements attached to the carbon instead of or in addition to hydrogen atoms. For example, hydrocarbon derivatives include alcohol compounds (methyl and ethyl alcohol), ketones (methyl ethyl ketone), and aldehydes (formaldehyde and glutaraldehyde).

(n) Fluorine compounds

Pure fluorine (F_2) is a corrosive pale yellow or brown gas that is a powerful oxidizing agent. It is the most reactive of all the elements and readily forms compounds with most other elements. Fluorine even combines with the noble gases, krypton, xenon, and radon. Even in dark, cool conditions, fluorine reacts explosively with hydrogen. It is so reactive that glass, metals, and even water, as well as other substances, burn with a bright flame in a jet of fluorine gas. It is far too reactive to be found in elemental form and has such an affinity for most elements, including silicon, that it can neither be prepared nor be kept in ordinary glass vessels. Instead, it must be kept in specialized quartz tubes lined with a very thin layer of fluorocarbons. In moist air, it reacts with water to form (also dangerous) hydrofluoric acid.

Fluorides are compounds that combine fluorine with some positively charged counterpart. They often consist of crystalline ionic salts. Fluorine compounds with metals are among the most stable of the salts. Both elemental fluorine and fluoride ions are highly toxic and must be handled with great care. Contact with skin and eyes should be strictly avoided. In its free element state, fluorine has a characteristic pungent odor that is detectable in concentrations as low as 20 nL/L.

Hydrofluoric acid (HF) contact with exposed skin poses one of the most extreme and dangerous hazards. These effects are intensified by the fact that HF damages nerves in such a way as to make such burns initially painless. The HF molecule is capable of rapidly migrating through lipid layers of cells that would ordinarily stop an ionized acid, and the burns are typically deep. HF can react with calcium, permanently damaging the bone. More seriously, reaction with the body's calcium can cause cardiac arrhythmias, followed by cardiac arrest brought on by sudden chemical changes within the body. These cannot always be prevented with local or intravenous injection of calcium salts. HF spills covering just 2.5 percent of the body's surface area, despite copious immediate washing, have been fatal (this corresponds with an area of about 9 $in.^2$ or 23 cm^2). If the patient survives, HF burns typically produce open wounds of an especially slow-healing nature.

(o) Phenolic compounds

Phenols, sometimes called phenolics, are a class of chemical compounds consisting of a hydroxyl group (OH) attached to an aromatic hydrocarbon group. The simplest of the class is phenol (C_6H_5OH).

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Although similar to alcohols, phenols have unique properties and are not classified as alcohols (because the hydroxyl group is not bonded to a *saturated* carbon atom). They have relatively higher acidities due to the aromatic ring tightly coupling with the oxygen and a relatively loose bond between the oxygen and hydrogen.

A number of health effects from breathing phenol in air have been reported. Short-term effects include respiratory irritation, headaches, and burning eyes. Chronic effects of high exposures include weakness, muscle pain, anorexia, weight loss, and fatigue. Effects of long-term, low-level exposures include increases in respiratory cancer, heart disease, and effects on the immune system. In animal laboratory studies, exposure to high concentrations of phenol in air for a few minutes irritates the lungs, and repeated exposure for several days produces muscle tremors and loss of coordination. Exposure to high concentrations of phenol in the air for several weeks results in paralysis and severe injury to the heart, kidneys, liver, and lungs, followed by death in some cases. When exposures involve the skin (dermal uptake), the size of the total surface area of exposed skin can influence the severity of the toxic effects. Ingestion of very high concentrations of phenol has resulted in death.

Effects reported in humans following dermal exposure to phenol include liver damage, diarrhea, dark urine, and red blood cell destruction. Skin exposure to a relatively small amount of concentrated phenol has resulted in the death of humans. Small amounts of phenol applied to the skin of laboratory animals for brief periods can produce blisters and burns on the exposed surface, and spilling diluted phenol solutions on large portions of the body (greater than 25 percent of the body surface) can result in death.

(4) The ALS responder shall describe the basic toxicological principles relative to assessment and treatment of persons exposed to hazardous materials, including the following:

An understanding of the toxicological principles of the various classes of compounds, coupled with the clinical signs and symptoms associated with exposure to these compounds, is critical for the ALS responder to provide medical care to their patients and to protect themselves at an incident. While managing acute effects is often crucial to the survival of the patient, the ALS responder should also be aware of delayed (chronic) effects. An understanding of both acute and chronic effects of the released materials will help the ALS responder give the most prudent care to the patients. It is the dose–response relationship of the release material that can provide the ALS responder with the best insights on the health effects associated with the different internal concentration levels of an exposed patient.

(a) Acute and chronic effects

Acute toxicity refers to the sudden, severe onset of symptoms due to an exposure to the contaminant(s) of concern. Delayed toxicity might not develop for hours, days, or even years following an exposure to the contaminant(s) of concern. In some cases, such as exposure to biological agents, symptoms might not appear until three or more days following an exposure to such agents.

(b) Local and systemic effects

Local effects are those in which a toxic substance comes in direct contact with the skin or other sensitive tissue. Systemic effects are the effects of a toxic substance on either the entire body or a specific organ or organ system.

(c) Dose-response relationship

The chemical, biological, or radiological dose–response relationship refers to the response a specific dose produces in the human body. The magnitude of the body's response depends on the

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on-scene concentration (as can be measured by monitoring systems) of the hazardous substance, the patient exposure concentration and duration, and the actual dose (considering uptake rate for each applicable exposure route) received by the patient. The maximum ambient concentration at the scene determines the maximum concentration available for exposure. The exposure concentration is the concentration available to the pertinent routes of exposure, and the duration is the amount of time the patient is exposed to this available concentration. The actual dose is that amount taken up by the patient through the applicable uptake mechanisms. The dose will be the total amount of a patient's uptake during the exposure time, considering all routes of uptake.

(5) Given examples of various hazardous substances, the ALS responder shall define the basic toxicological terms as they relate to the treatment of an exposed patient, as follows:

(a) *Threshold limit value — time weighted average* (TLV-TWA)

The threshold limit value–time-weighted average (TLV–TWA) is the time-weighted average concentration for a conventional 8-hour workday and 40-hour workweek to which it is believed that nearly all workers might be repeatedly exposed, day after day, without adverse health effects.

(b) *Lethal doses* and *lethal* concentrations, as follows:

The lethal dose (LD) of a material is a single dose that causes the death of a specified number of the group of test animals exposed by any route other than inhalation. The lethal concentration (LC) is the median lethal concentration of a hazardous material. The LC is defined as the concentration of a material in air that, based on laboratory tests (inhalation route), is expected to kill a specified number of the group of test animals when administered over a specified period of time. The following are the various types of LD and LC:

1. LD_{lo} is the lowest dosage per unit of bodyweight (typically stated in milligrams per kilogram) of a substance known to have resulted in fatality in a particular animal species. This is also called the lowest dosage causing death, lowest detected lethal dose, and lethal dose low.
2. LD_{50} or median lethal dose of a toxic material is the dose required to kill half (50 percent) of the members of a tested population. LD_{50} figures are frequently used as a general indicator of a substance's toxicity.
3. LD_{hi} or LD_{100} is the absolute dose of a toxic material required to kill all (100 percent) of the members of a tested population.
4. LC_{lo} is the lowest lethal concentration of a material reported to cause death in a particular animal species, when administered via the inhalation route. It is the lowest lethal concentration for gases, dusts, vapors, and mists.
5. LC_{50} is the lethal concentration of a material in air that is expected to kill 50 percent of the group of a particular animal species when administered via the inhalation route.
6. LC_{hi} or LC_{100} is the absolute lethal concentration of a toxic material required to kill all (100 percent) of the members of a tested population, administered via inhalation route.

i. LD_{lo}
ii. LD_{50}
iii. LC_{lo}
iv. LC_{50}

(c) *Parts per million/parts per billion/parts per trillion* (ppm/ppb/ppt)

The values used to establish the exposure limits are quantified in parts per million, parts per billion, or parts per trillion. A good reference to remember is that 1 percent equals 10,000 ppm, 1 ppm equals

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1,000 ppb, and 1 ppb equals 1,000 ppt. Thus, a reading from a sampling instrument of 0.5 percent is equivalent to 5,000 ppm, 5,000,000 ppb, or 5,000,000,000 ppt. If the TLV is determined to be 7,500 ppm, the reading from the instrument can be related to determine the degree of hazard that exposure concentration represents.

(d) *Immediately dangerous to life and health* (IDLH)

Immediate danger to life and health (IDLH) is the maximum level to which a healthy worker can be exposed for 30 minutes and escape without suffering irreversible health effects or impairment. If possible, exposure to this level should be avoided. If that is not possible, responders must wear positive pressure self-contained breathing apparatus (SCBA) or a positive pressure supplied-air respirator (SAR) with an auxiliary escape system. This limit is established by OSHA and NIOSH.

(e) *Permissible exposure limit* (PEL)

Permissible exposure limit (PEL) is a term OSHA uses in its health standards covering exposures to hazardous chemicals. It is like the TLV–TWA established by the American Conference of Governmental Industrial Hygienists (ACGIH). The PEL, which generally relates to the legally enforceable TLV limits, is the maximum concentration, averaged over 8 hours, to which 95 percent of healthy adults can be repeatedly exposed for 8 hours per day, 40 hours per week.

(f) *Recommended exposure limit* (REL)
(g) *Threshold limit value — short-term exposure limit* (TLV-STEL)

Threshold limit value–short-term exposure limit (TLV–STEL) is the maximum average concentration, averaged over a 15-minute period, to which healthy adults can be exposed safely for up to 15 minutes continuously. Exposure should not occur more than four times a day with at least 1 hour between exposures.

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

Threshold limit value–ceiling (TLV–C) is the maximum concentration to which a healthy adult can be exposed without risk of injury. TLV–C is comparable to the IDLH, and exposures to higher concentrations should not occur.

(i) *Solubility*

Solubility, or the degree to which a substance is soluble in water, is useful in determining effective extinguishing agents and methods. Solubility should be considered along with specific gravity.

(j) *Poison* — a substance that causes injury, illness, or death

Poisons are substances that can cause injury, illness, or death to organisms, usually by chemical reaction or other activity on the molecular scale, when a sufficient quantity is absorbed by an organism.

(k) *Toxic* — harmful nature related to amount and concentration

Toxicity is a measure of the degree to which something is toxic or poisonous. The study of poisons is known as toxicology. Toxicity can refer to the effect on a whole organism, such as a human, bacterium,

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or plant, or to a substructure, such as a cell (cytotoxicity) or the liver. Toxicity addresses the harmful nature of a hazardous material related to its amount and concentration.

(6) Given examples of hazardous materials/WMD incidents with exposed patients, the ALS responder shall evaluate the progress and effectiveness of the medical care provided at a hazardous materials/WMD incident, to ensure that the overall incident response objectives, along with patient care goals, are being met by completing the following tasks:
  (a) Locate and track all exposed patients at a hazardous materials/WMD incident, from priority conditions and treatment to transport to the appropriate hospital
  (b) Review the incident objectives at periodic intervals to ensure that patient care is being carried out within the overall incident response plan
  (c) Ensure that the incident command system forms are completed, along with the patient care forms required by the AHJ, during the course of the incident
  (d) Evaluate the need for trained and qualified EMS personnel, medical equipment, transport units, and other supplies, including antidotes based on the scope and duration of the incident

Understanding these critical factors under 5.4.1 for a hazardous material released at an incident is essential for a responder to determine the nature of the hazards to both the patients and the responders themselves. The *Emergency Response Guidebook* is an excellent reference to use in finding the needed information [6].

It is essential for responders to know which references and on-line databases provide the information necessary to determine the health effects of the hazardous materials involved in an incident to establish the medical treatment that can be used to combat them, in consultation with medical control. They must also understand which properties affect a patient's reactions and the medical care the patient must receive. These references become critical resources to perform these tasks. Sources of this information include EMS reference books, the poison control center, EMS/HM data systems, and the Agency for Toxic Substances and Disease Registry (ATSDR), which is part of the CDC. ATSDR can be contacted using its web address: www.atsdr.cdc.gov. Contact information for voice and data communications for these resources should be part of the EMS responders' resources.

The ALS responder must be able to apply the information from these reference sources on the released material to the information obtained while assessing the patient to determine the risk of secondary contamination to others.

5.4.2* Decontaminating Exposed Patients. Given the emergency response plan and SOPs developed by the AHJ and given examples of hazardous materials/WMD incidents with exposed patients, the ALS responder shall do as follows:

(1) Given the emergency response plan and SOPs developed by the AHJ, identify and evaluate the patient decontamination activities performed prior to accepting responsibility for and transferring care of exposed patients

It is important for the ALS responder to evaluate the effectiveness of decontamination conducted on exposed patients before accepting responsibility for exposed patients (see Exhibit II.5.5).

(2) Determine the need and location for patient decontamination, including mass-casualty decontamination, in the event none has been performed prior to arrival of EMS personnel, and complete the following tasks:

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EXHIBIT II.5.5

Before accepting responsibility for exposed patients, the ALS responder must first determine the degree of decontamination conducted. (Courtesy of Rob Schnepp)

(a) Given the emergency response plan and SOPs developed by the AHJ, identify and evaluate the patient decontamination activities performed prior to accepting responsibility for and transferring care of exposed patients; identify sources of information for determining the appropriate decontamination procedure and how to access those resources in a hazardous materials/WMD incident

To anticipate and understand patient decontamination requirements, the ALS responder must make every effort to learn about the released substance. This information will help the ALS responder make an informed decision on performing decontamination or more fully evaluate the effectiveness of the decontamination attempted. These are important decisions, especially for transporting agencies. It is unwise to accept a contaminated patient into a transport unit or to be unsure of the level of decontamination performed. A poor decision in the field can have significant ramifications at the door of the hospital. If hospital staff are unconvinced that proper decontamination was performed in the field, they might require further decontamination before accepting the patient. This may delay care and have an adverse effect on the patient.

There may be a need to balance decontamination with providing emergency medical care. In some cases, it might be wise to provide airway management, bleeding control, basic trauma care, or CPR before or concurrent with decontamination. There are no clear-cut guidelines for these situations. The ALS responder must weigh the benefits and risks of the need to provide ALS with the need to decontaminate.

As with all other sections in this handbook, the NFPA 473 section is designed to promote thoughtful and informed medical care. It is impossible to expect a standard to address all possible situations. To that end, the ALS responder, at the moment he or she must decide regarding patient care, should be well trained and confident to make that decision.

ALS responders must weigh all options and make reasonable decisions in the field. Again, it is important to understand the nature and level of contamination to make the best decision regarding decontamination and patient care.

(b) Given the emergency response plan and SOPs developed by the AHJ, identify and evaluate the patient decontamination activities performed prior to accepting responsibility for and transferring care of exposed patients

The ALS responder should access and apply information from reliable reference sources to determine appropriate decontamination procedures. These reference sources include safety data sheets (SDSs), CHEMTREC/CANUTEC/SETIQ, regional poison control centers, the U.S. Department of Transportation

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(DOT) *Emergency Response Guidebook*, the Hazardous Materials Information System (HMIS), shipper/manufacturer contacts, Agency for Toxic Substances and Disease Registry (ATSDR) medical management guidelines, medical toxicologists, and electronic databases.

Decontamination efforts are influenced by the number of ambulatory and nonambulatory patients and must be addressed accordingly. It is more difficult and requires more personnel to decontaminate nonambulatory patients. The ALS responder should be familiar enough with the concepts and procedures for decontamination to adapt to the situation. Flexibility is the key to handling decontamination issues when it comes to life safety. Patient decontamination should be rapid, complete, and geared at getting the patient clean enough to treat and transport.

(c) Given the emergency response plan and SOPs provided by the AHJ, identify the supplies and equipment required to set up and implement technical or mass-casualty decontamination operations for ambulatory and nonambulatory patients
(d) Given the emergency response plan and SOPs developed by the AHJ, identify the procedures, equipment, and safety precautions for securing evidence during decontamination operations at hazardous materials/WMD incidents
(e) Identify procedures, equipment, and safety precautions for handling tools, equipment, weapons, and law enforcement and K-9 search dogs brought to the decontamination corridor at hazardous materials/WMD incidents
(f) Identify procedures, equipment, and safety precautions for communicating with critically, urgently, and potentially exposed patients, and population prioritization and management techniques

The intent of 5.4.2(2)(f) is to remind responders of the importance of communicating with large groups of people who might be ill or injured. Panic can be contagious, and a lack of crowd control can create significant problems for the responders. ALS responders should expect panic and unexpected behaviors from groups of people exposed to a hazardous materials/WMD.

(g) Determine the threat of cross contamination to all responders and patients by completing the following tasks:
   i. Identify hazardous materials/WMD with a high risk of cross contamination
   ii. Identify hazardous materials/WMD agents with a low risk of cross contamination
   iii. Describe how the physical state of the hazardous materials/WMD provides clues to its potential for secondary contamination, when the exact identity of the hazardous materials/WMD is not known

It is extremely important to understand the potential for cross contamination. All patients involved in an incident will not be contaminated equally.

Δ **A.5.4.2** Most ALS medical treatment at hazardous materials/WMD incidents will be delivered in the cold zone, after decontamination. In some cases, ALS skills need to be delivered in the warm or hot zone prior to or concurrent with decontamination. In those situations, ALS responders need to balance the need for performing life-saving interventions with decontamination, taking into consideration the nature and severity of the incident; the medical needs of the patient; and the need to perform decontamination prior to rendering care.

Life safety of the responder is paramount. ALS responders who anticipate functioning under these conditions should receive training and meet the mission-specific PPE competencies as defined in Section 6.2 of NFPA 472.

It is critical that EMS providers review their responsibilities within their local emergency response plan before an incident occurs to ensure that EMS responders are adequately trained

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for their expected roles within the IMS/ICS at the hazardous materials/WMD incident. The priorities for priority conditions, treatment, or decontamination in the setting of other significant injuries should be based on the following requirements:

(1) *Priority I — Medical Care First.* Medical care outweighs immediate decontamination, and patients should be grossly decontaminated only as priority to transport. Contaminated patients with serious or critical illness, trauma, or burns should be decontaminated while their life-threatening injuries are being addressed.
(2) *Priority II — Combined Priorities.* Medical care needs are balanced with a priority to decontaminate. These patients present with a serious illness other than from the chemical exposure, have trauma or burn injuries, and have not been decontaminated but might have a high level of contamination. There might be a risk to the EMS provider from an ongoing exposure to the hazardous substance. In this situation, it might not be safe to render medical care without the appropriate PPE. The ABCs (airway/breathing/circulation) and threats to life should be managed along with rapid decontamination.
(3) *Priority III — Decontaminate First.* Decontamination should be performed prior to providing medical care. In this situation, it might not be safe to render medical care without the appropriate PPE.

Patient conditions are categorized as follows:

(1) A = Critical condition: airway compromised, serious signs or symptoms of shock, cardiac arrest, life-threatening trauma or burns
(2) B = Unstable condition: shortness of breath, unstable vital signs, altered level of consciousness after the exposure, significant trauma or burns
(3) C = Stable condition: stable vital signs, no altered level of consciousness, no significant trauma or burns

See Table A.5.4.2.

Δ ***TABLE A.5.4.2*** *Patient Priority Levels*

	Priority Based on Condition		
Level of Contamination	***Medically Critical (A)***	***Medically Unstable (B)***	***Medically Stable (C)***
Heavily contaminated with highly toxic substance	II	III	III
Heavily contaminated with low-toxicity substance	I	II	II
Low-level contamination with highly toxic substance	II	III	III
Low-level contamination with low-toxicity substance	I	I	II
Chemical in eyes: Decontaminate eyes immediately and thoroughly.			

5.4.3 Evaluating the Need for Medical Supplies. Given examples of single-patient and multicasualty hazardous materials/WMD incidents, the ALS responder shall determine if the available medical equipment, transport units, and other supplies, including antidotes, will meet or exceed expected patient care needs throughout the duration of the incident.

Multicasualty incidents present different challenges than a single-patient medical response. Multicasualty incidents require more personnel and equipment and are usually more chaotic. In these cases, the ALS responder should look at the entire incident and determine the need for medical equipment, large decontamination capabilities, qualified EMS personnel, and transport units. These and other resources should be called to the scene as soon as possible. Additionally, the ICS should be implemented as soon as possible to ensure responder accountability and the most efficient use of on-scene resources.

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5.4.4 Evidence Preservation. Given examples of hazardous materials/WMD incidents where criminal acts are suspected, the ALS responder shall make every attempt to preserve evidence during the course of delivering patient care by completing the following tasks:

(1) Determine if the incident is potentially criminal in nature and cooperate with the law enforcement agency having investigative jurisdiction
(2) Identify the unique aspects of criminal hazardous materials/WMD incidents, including crime scene preservation, evidence preservation, and destruction of potential evidence found on medical patients, and/or the destruction of evidence during the decontamination process
(3) Ensure that any information regarding suspects, sequence of events during a potential criminal act, or observations made based on patient presentation or during patient assessment are documented and communicated and passed on to the law enforcement agency having investigative jurisdiction

The rationale behind 5.4.4 is to remind ALS responders that they have a role in identifying and preserving evidence at a crime scene. If there is a suspicion that the event might be criminal in nature, it is incumbent on the ALS responder to be vigilant; pay attention to what is touched or moved; understand patient presentations relative to the suspected hazardous materials/WMD; observe and note the locations of patients, and so forth. Furthermore, complete and thorough documentation is important and could be used in the prosecution of suspects. These and other actions taken by ALS responders will assist law enforcement with the criminal investigation.

5.4.5 Medical Support at Hazardous Materials/WMD Incidents. Given examples of hazardous materials/WMD incidents, the ALS responder shall describe the procedures of the AHJ for performing medical monitoring and support of hazardous materials incident response personnel, and shall complete the following tasks:

The use of a systematic approach to medical monitoring is required of the hazmat responder, especially when entry into a hazardous environment is prolonged, affected by meteorological factors, or difficult to mitigate. In conditions when the primary objective is potential rescue, on-scene medical personnel might default back to the annual "fit to work" physical. In either case, at an absolute minimum, the responder should be evaluated for heat stress, which includes hydration and potential exposure.

(1) The ALS responder responsible for pre-entry medical monitoring shall obtain hazard and toxicity information on the released substance from the designated hazardous materials technical reference resource or other reliable sources of information at the scene. The following information shall be conveyed to the entry team, incident safety officer, hazardous materials officer, other EMS personnel at the scene, and any other responders responsible for the health and well-being of those personnel operating at the scene:

The medical monitoring station can serve many purposes at the scene of a hazardous materials event. The primary role of the medical monitoring station is to evaluate the core vitals of the entry team. This may include the backup team and the decontamination line personnel. Everyone assigned to work at the medical monitoring station should observe all responders for any physiological response that could become detrimental toward the responder and the task of that responder.

The basic setup of the monitoring station should facilitate taking vital signs along with pulse oximetry, weight, skin status, body temperature, and hydration. Medical monitoring stations should be positioned to protect responders from adverse weather conditions.

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In large incidents, a medical manager within the incident command structure must organize his or her resources to compile basic physiological information from each responder, as well as anticipate future medical needs of the hazmat technician. This could include, but is not limited to, specialized transport capability, on-scene advanced life support, and analysis of the capacity of the health care system.

ALS responders should be trained to recognize and treat various types of heat/cold stress. Heat stroke is the most dangerous of all the heat-related illnesses. ALS care providers should understand the need for prompt recognition of the early signs of heat stroke.

Aggressive monitoring of individuals will become the priority for the ALS care providers. Once heat or cold stress has been identified, treatment might only include monitoring of the individual and oral hydration. All medical providers that are used at a hazardous materials/WMD incident must always look for the signs and symptoms of heat stress, especially when the environmental factors are present along with the use of encapsulating protective equipment.

(a) Substance name

Looking up synonyms and trade names can give the responder additional information when databases are referenced.

(b) Hazard class

Although direct information about medical application is limited, it may give clues about the type of injury observed. For example, Class 2 gases (pressurized or liquefied) give the highest potential for a respiratory hazard if PPE is not worn or not worn properly, or if a breach has occurred.

(c) Hazard and toxicity information

Many chemicals have multiple hazards, and it is up to medical personnel to fully reference the suspected/confirmed substance. Understanding how these factors affect individuals allows the medical staff to have a proactive treatment plan.

(d) Applicable decontamination methods and procedures

ALS responders should be familiar with the local procedures used for victim decontamination. In some jurisdiction, decontamination is considered to be a form of medical treatment. The ALS responder should look at the overall scene and balance decontamination efforts with the need to provide patient care.

(e) Potential for secondary contamination

Liquids and solids provide the highest level of cross contamination; gases rarely have any cross-contamination issues. The organophosphates as a chemical family have the highest level of cross contamination due to the routes of exposure. Again, one must understand the state of matter, hazards associated with the substance at different concentrations, and the multiple hazards that a substance might have.

(f) Procedure for transfer of patients from the constraints of the incident to the emergency medical system
(g) Prehospital management of medical emergencies and exposures, including antidote administration

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As with any medical emergency that occurs outside of a hospital, rapid evaluation, BLS measures, and transportation with information transfer are the keys toward a positive outcome. This includes, but is not limited to, the type of substance involved, the action(s) at time of incident, referenced information of the substance, and the potential degree of exposure.

(2) The ALS responder shall evaluate the pre-entry health status of hazardous materials/WMD responders prior to donning PPE by performing the following tasks:

(a) Record vital signs

Vital signs should include, but are not limited to, body temperature, pulse, respiration (rate and character), and blood pressure.

(b) Record body weight measurements

Fluid loss is best measured in the field by measuring the responder's pre- and post-entry body weight. By achieving a percent loss of body weight, the ALS care provider can estimate the level of hydration. Hydration procedures should have input from the medical control officer (medical director). Fluid loss will become the most important factor to monitor and observe for working effectively within protective ensembles.

(c) Record general health observations

An idea of the responder's general health status can be obtained by observing his or her physical appearance and asking specific questions about their well-being. Anyone who has had signs and symptoms of general common illness, such as a cold or the flu, or has just been released to work after having a general illness should be further evaluated and should consult with the medical director.

(3) The ALS responder shall determine the medical fitness of those personnel charged with donning chemical protective clothing, using the criteria set forth in the emergency action plan (EAP) and the SOP developed by the AHJ. Consideration shall be given to excluding responders from working in personal protective equipment if they exhibit any significant abnormalities in the following areas:

(a) Body temperature (taking temperature or skin temperature does not correlate to body temperature)

In many cases, hazmat teams have relied on either oral or tympanic methods to assess body temperature during medical monitoring. There are challenges to using either method for obtaining an accurate measurement in the field. Responders should know that whatever method is used, the benefits and limitations of the method should be understood, and the reading obtained should always be placed in the context of the responder's other vital signs, overall health observations, and mental status.

(b) Vital signs

(4) The ALS responder shall determine how the following factors influence heat stress on hazardous materials/WMD response personnel:

Heat stress can affect the performance of any responder. It is up to the ALS care provider to recognize, evaluate, and treat the responder who may be suffering from a heat stress event. This type of event should have input from the local medical control officer for guidance within the systems response manual. This guidance is a blueprint for the medical authority to provide the necessary evaluation and treatment for a responder who may be subject to heat stress.

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(a) Baseline level of hydration
(b) Underlying physical fitness
(c) Environmental factors
(d) Activity levels during the entry
(e) Level of PPE worn
(f) Duration of entry
(g) Cold stress

(5) Given examples of various hazardous materials/WMD incidents requiring the use of chemical protective ensembles, the ALS responder shall complete the following tasks:

(a) Demonstrate the ability to set up and operate a medical monitoring station
(b) Demonstrate the ability to recognize the signs and symptoms of heat stress, heat exhaustion, and heat stroke
(c) Determine the ALS needs for responders exhibiting the effects of heat stress, cold stress, and heat exhaustion
(d) Describe the medical significance of heat stroke and the importance of rapid transport to an appropriate medical receiving facility

(6) Given a simulated hazardous materials/WMD incident, the ALS responder shall demonstrate documentation of medical monitoring activities.

(7) The ALS responder shall evaluate all team members after decontamination and PPE removal, using the following criteria:

Each organization should develop and have planned medical monitoring protocols that identify conditions that are the basic evaluative concerns for the first responder. Within 3 to 5 minutes of exit from the protective ensemble, all vitals should be close to the pre-entry physical. Temperature should be monitored longer and evaluated. This is especially important when performing entry functions within the two extreme conditions of heat and cold.

(a) Pulse rate — done within the first minute
(b) Pulse rate — 3 minutes after initial evaluation
(c) Temperature
(d) Body weight
(e) Blood pressure
(f) Respiratory rate

(8) The ALS responder shall recommend that any hazardous materials team member exhibiting any of the following signs be prohibited from redonning chemical protective clothing:

The use of exclusion criteria is important to establish guidelines for the post exam and for team members re-entering a hazardous environment. Again, the NFPA 473 committee encourages a reasonable approach to medical monitoring. The standard is designed to provide a framework for monitoring, but the limits and exclusion points should be determined on a case-by-case basis, adhering to the standard of care of the AHJ.

(a) Signs or symptoms of heat stress or heat exhaustion
(b) Abnormal vital signs
(c) Abnormal core body temperature
(d) Abnormal heart rate or rhythm
(e) Significant acute body weight loss

(9) The ALS responder shall notify immediately the appropriate persons designated by the emergency response plan if a team member requires significant medical treatment or transport (arranged through the appropriate designee identified by the emergency response plan).

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The intent of Section 5.5 is to offer basic guidance in the area of documentation. Each jurisdiction has unique characteristics and requirements for patient care reports and incident documentation. The ALS responder should, in all cases, write timely documentation that is accurate and reflective of his or her actions on the scene. When it comes to hazardous materials/WMD incidents, patient care reports might be used during a criminal prosecution. To that end, the report should be written in a professional manner.

5.5 Competencies — Terminating the Incident.

Upon termination of the hazardous materials/WMD incident, the ALS responder shall complete the reporting, documentation, and EMS termination activities as required by the local emergency response plan or the organization's SOPs and shall meet the following requirements:

(1) Identify the reports and supporting documentation required by the emergency response plan or SOPs
(2) Demonstrate completion of the reports required by the emergency response plan or SOPs
(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 personal protective equipment logs
(9) Identify the requirements for filing documents and maintaining records, as follows:
    (a) List the information to be gathered regarding the exposure of all patient(s) and describe the reporting procedures, including the following:
        i. Detailed information on the substances released
        ii. Pertinent information on each patient treated or transported
        iii. Routes, extent, and duration of exposures
        iv. Actions taken to limit exposure
        v. Decontamination activities
    (b) Identify the methods used by the AHJ to evaluate transport units for potential contamination and the process and locations available to decontaminate those units

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References Cited in Commentary

1. "Guide 100-00: Guide for the Selection of Chemical Agent and Toxic Industrial Material Detection Equipment for Emergency First Responders," U.S. Department of Justice, National Institute of Justice, Office of Science and Technology, Washington, DC, June, 2000. Available online at www.ncjrs.gov/pdffiles1/nij/184449.pdf.
2. Title 49, Code of Federal Regulations, Part 173, "Shippers — General Requirements for Shipments and Packagings," U.S. Government Publishing Office, Washington, DC.
3. Title 16, Code of Federal Regulations, Part 1500.41, Hazardous Substances and Articles; Administration and Enforcement Regulations, "Method of testing primary irritant substances," U.S. Government Publishing Office, Washington, DC.
4. Title 16, Code of Federal Regulations, Part 1500.42, Hazardous Substances and Articles; Administration and Enforcement Regulations, "Test for eye irritants," U.S. Government Publishing Office, Washington, DC.

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5. Publication 1-02, *Dictionary of Military and Associated Terms*, U.S. Department of Defense, Washington, DC, 2007. Available online at www.dtic.mil/doctrine/new_pubs/dictionary.pdf

6. *Emergency Response Guidebook* (ERG). Office of Hazardous Materials Initiatives and Training, PHH-50, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, 1200 New Jersey Avenue, SE East Building, 2nd Floor, Washington, DC 20590, http://phmsa.dot.gov/hazmat/library/erg, 2016.

7. Title 40, Code of Federal Regulations, Part 156, "Labeling Requirements for Pesticides and Devices," U.S. Government Publishing Office, Washington, DC.

Additional Reference

Agency for Toxic Substances and Disease Registry (ATSDR), U.S. Centers for Disease Control and Prevention. See www.atsdr.cdc.gov.

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Competencies for Advanced Life Support (ALS) Responders Assigned Mission-Specific Responsibilities

6

This chapter addresses some of the unique aspects of providing emergency medical services (EMS) at hazardous materials/weapons of mass destruction (WMD) incidents. Some of the content is designed to address programmatic responsibilities of EMS providers, some is aimed at providing patient care guidance in the field, and other content is focused on specialized clinical aspects such as treating smoke inhalation. The technical committee's intent is to give EMS providers more information and different perspectives on the intersection of hazardous materials and EMS response.

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6.1 General.

6.1.1 Introduction.

Δ **6.1.1.1** This chapter shall address competencies for the following advanced life support (ALS) responders who are assigned mission-specific responsibilities at hazardous materials/WMD incidents by the authority having jurisdiction (AHJ) beyond the competencies of the hazardous materials/WMD ALS responder (see Chapter 5):

(1) ALS responder assigned to a hazardous materials team
(2) ALS responder assigned to provide clinical interventions at a hazardous materials/WMD incident
(3) ALS responders assigned to treatment of smoke inhalation victims

6.1.1.2 The ALS responder assigned mission-specific responsibilities at hazardous materials/WMD incidents shall be trained to meet all competencies at the basic life support (BLS) responder level *(see Chapter 4)*, all competencies at the advanced life support (ALS) responder level *(see Chapter 5)*, and all competencies for the assigned responsibilities in the applicable section(s) in this chapter.

Δ **6.1.1.3** The ALS responder assigned mission-specific responsibilities at hazardous materials/WMD incidents shall also be trained to meet all competencies at the NFPA 472, awareness level (Chapter 4) and operations level core (Chapter 5).

6.1.1.4 The ALS responder assigned mission-specific responsibilities at hazardous materials/WMD incidents shall receive additional training to meet applicable governmental occupational health and safety regulations.

6.1.1.5 The ALS responder assigned mission-specific responsibilities at hazardous materials/WMD incidents shall operate under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures.

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6.1.1.6 The development of assigned mission-specific knowledge and skills shall be based on the tools, equipment, and procedures provided by the AHJ for the mission-specific responsibilities assigned.

6.1.2 Goal. The goal of the competencies in this chapter shall be to provide the operations level responder assigned mission-specific responsibilities at hazardous materials/WMD incidents by the AHJ with the knowledge and skills to perform the assigned mission-specific responsibilities safely and effectively.

6.1.3 Mandating of Competencies. This standard shall not mandate that the response organizations perform mission-specific responsibilities.

6.1.3.1 ALS responders assigned mission-specific responsibilities at hazardous materials/WMD incidents, operating within the scope of their training in this chapter, shall be able to perform their assigned mission-specific responsibilities.

6.1.3.2 If a response organization desires to train some or all of its operations level responders to perform mission-specific responsibilities at hazardous materials/WMD incidents, the minimum required competencies shall be as set out in this chapter.

6.2 Mission-Specific Competencies: Advanced Life Support (ALS) Responder Assigned to a Hazardous Materials Team.

6.2.1 General.

6.2.1.1 Introduction.

6.2.1.1.1 The ALS responder assigned to a hazardous materials team shall be that person assigned to provide direct medical support and intervention to the members of an established hazardous materials team.

The intended audience of this competency is the advanced life support (ALS) responder who is assigned directly to a hazardous materials team, with primary focus on medical support and the welfare of the team members. ALS response personnel dedicated to hazardous materials teams can act as medical advocates for the members of the team and more efficiently build a local medical plan in support of team operations.

This mission-specific competency is not intended for the ALS provider who is responding as part of an EMS to hazardous materials incidents, as those competencies are covered in Chapter 5.

6.2.1.1.2 The ALS responder assigned to a hazardous materials team shall be trained to meet all competencies for the assigned responsibilities in Chapters 4 and 5, and all competencies in this section.

The ALS responder assigned to a hazardous materials team should be competent in both the basic life support (BLS) and ALS chapters of NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents*. The intent of this competency is for the ALS responder assigned to a hazardous materials team to be more knowledgeable in all areas of hazmat medical response than a "traditional" hazmat medical responder.

Δ **6.2.1.1.3** The ALS responder assigned to a hazardous materials team shall be trained to meet all competencies of NFPA 472, Chapters 4 and 5.

The ALS responder assigned to a hazardous materials team ideally should participate in team activities, including training in all aspects of the authority having jurisdiction's (AHJ's) identified areas of

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competency. Knowledge of the physical challenges, mental stressors, and equipment limitations that the team members face can assist the responder during medical planning sessions and response operations.

6.2.1.1.4 The ALS responder assigned to a hazardous materials team shall receive the additional training necessary to meet the specific needs of the AHJ.

6.2.1.1.5 The ALS responder assigned mission-specific responsibilities at hazardous materials/WMD incidents shall receive additional training to meet applicable governmental response and occupational health and safety regulations.

The ALS responder assigned to a hazardous materials team may respond to other incidents with the team that require additional training and certification from the AHJ — for example, such areas as permit-required confined spaces, trenches and excavations, or rope operations.

6.2.1.1.6 The ALS responder assigned mission-specific responsibilities at hazardous materials/WMD incidents shall operate under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures.

6.2.1.1.7 The development of assigned mission-specific knowledge and skills shall be based on the tools, equipment, and procedures provided by the AHJ for the mission-specific responsibilities assigned.

6.2.1.2 Goal. The goal of the mission specific competencies in this section shall be to provide the ALS responder assigned to a hazardous materials team with the knowledge and skills to perform the following tasks safely and effectively:

(1) Plan a response within the authority of the AHJ to support hazardous materials team operations
(2) Implement the planned response consistent with the standard operating procedures of the AHJ to support hazardous materials team operations
(3) Terminate the incident consistent with the standard operating procedures of the AHJ to document hazardous materials team operations

6.2.2 Competencies: Analyzing the Incident. (Reserved)

6.2.3 Competencies: Planning the Response.

Each competency identified for planning the response is designed to build a medical plan to support the team during operations. By identifying and addressing potential areas of concern before the response, the ALS responder assigned to a hazardous materials team can give team members more efficient medical care in the event of injury, illness, or exposure.

Many EMS have a system of triage that manages sorting of critical to noncritical patients. When dealing with hazardous materials/WMD, the lines of triage are blurred. Many chemicals act on systems in the body that produce symptoms immediately; other chemicals take more time before the injury manifests. The responder should refer to the chemical and physical properties of a material to identify triage modalities. Triage is based on a set of signs and symptoms that the patient will display. With chemicals, this constellation of signs and symptoms are, in many cases, delayed or even masked. Additional underlying medical conditions can be exacerbated when exposed to certain classifications of chemicals. Understanding the chemical and physical properties and how they effect a human body will lead to appropriate patient care.

6.2.3.1 Given the standard operating procedures of the AHJ, the ALS responder assigned to a hazardous materials team shall create baseline medical information for each hazardous materials team member in compliance with the AHJ and OSHA requirements for confidentiality.

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The ALS responder assigned to a hazardous materials team should obtain baseline medical information from team members and develop a mechanism to retrieve that information during medical emergencies. Information such as allergies, current medications, previous medical history (e.g., traumatic injuries, surgeries, and benign cardiac arrhythmias), and medical contact information (e.g., primary care physician, specialists) may prove beneficial during medical treatment following injury, illness, or exposure.

Care must be taken to comply with all applicable mandates for patient confidentiality by keeping team records secure.

6.2.3.2 Given existing guidance from the AHJ, The ALS responder assigned to a hazardous materials team shall explain the importance of becoming an advocate for team member physical fitness and encouraging proper exercise and nutrition for team members.

The ALS responder assigned to a hazardous materials team should focus on injury and illness prevention as much as treatment protocols. The ALS responder assigned to a hazardous materials team should become an advocate for the team members, developing wellness and physical fitness programs for the members in conjunction with the medical director for the AHJ. Physical conditioning of team members may contribute positively to a reduction in team injuries and enable efficient operations.

6.2.3.3 Given existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall establish and implement an awareness program to encourage proper hydration and medical surveillance actions by hazardous materials team members prior to hazardous materials response operations.

The ALS responder assigned to a hazardous materials team should work to educate each member of the team on the importance of hydration before entry operations and, when appropriate per AHJ guidelines, should acquire pre-entry vital signs and ascertain responder mental status. Incorporation of these activities during all team operations, including training, should become expected from team members.

6.2.3.4 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall establish and maintain a liaison with local and regional medical direction and medical control entities that may be involved with hazardous materials team medical care.

The ALS responder assigned to a hazardous materials team should develop a relationship with local and regional EMS medical direction and medical control entities and supply them with information about the hazardous materials team, team medical treatment protocols, and decontamination policies, and request participation in facility hazardous materials response planning.

6.2.3.5 Given the emergency response plan and existing guidance from the AHJ, the ALS responder shall advise the following local and regional medical direction and medical control entities on the potential hazardous exposures and physical stressors on hazardous materials team members at a hazardous materials/WMD incident.

The ALS responder assigned to a hazardous materials team should provide local and regional medical direction and medical control entities with information on industrial facilities with hazmat concerns, hazmat transportation corridors, local emergency planning committee tier II lists, and other planning information to familiarize receiving medical facilities with potential hazardous exposures to team personnel during response operations. The ALS responder should provide information on identified hazardous materials that require specific treatment or decontamination procedures.

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The ALS responder assigned to a hazardous materials team should inform local medical direction and medical control entities about potential physical stressors facing the hazardous materials team members to increase awareness of risk factors such as heat injury, dehydration, chemical exposure, thermal and chemical burns, and so on.

6.2.3.6 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall develop a list of the following health care facilities likely to receive injured or ill hazardous materials team members and the points of contact within those facilities:

(1) Trauma centers
(2) Emergency departments
(3) Burn centers
(4) Cardiovascular centers
(5) Stroke centers
(6) Hyperbaric centers

ALS responders assigned to a hazardous materials team should identify potential receiving facilities and points of contact (as indicated in 6.2.3.6) in their principal response areas to manage team member injury or illness more efficiently. Availability of specialty facilities such as burn centers and hyperbaric medicine centers may change daily; therefore, the ALS responder should connect with these facilities to be placed on availability notification lists as needed.

6.2.3.7 Given a list of health care facilities, the ALS responder assigned to a hazardous materials team shall describe how to establish and maintain the following:

(1) Capability and patient flow efficiency of decontamination facilities
(2) Standard inventory of antidotal pharmaceuticals

The ALS responder assigned to a hazardous materials team should identify receiving facilities that can perform patient decontamination and determine their patient flow efficiency (patients per hour, ambulatory and nonambulatory, etc.). The estimate should be based on data from exercises rather than planning estimates.

The ALS responder assigned to a hazardous materials team should work with receiving facilities to identify their standard inventories of antidotal pharmaceuticals, based on potential chemical hazards that may be encountered by the team. For example, a hazmat team covering an area with a large pesticide production facility may coordinate to obtain greater inventories of atropine, 2-PAM, and diazepam at potential receiving hospitals.

6.2.3.8* Given a listing of regional health care facilities with decontamination capabilities, the ALS responder assigned to a hazardous materials team shall demonstrate how to provide guidance for the health care facility in preparation for hazardous materials team member care.

A.6.2.3.8 The ALS responder should provide guidance, including assistance during Joint Commission and Local Emergency Planning Committee (LEPC) preparation exercises.

The ALS responder assigned to a hazardous materials team should work with health care facilities to guide and inform facility personnel about treatments of hazmat team members, such as format of patient condition information, chemical data, hazmat team liaison, and so on.

6.2.3.9 Given a list of regional EMS responders, the ALS responder assigned to a hazardous materials team shall establish and maintain a matrix of responder capabilities to include:

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(1) Patient decontamination capabilities
(2) Contaminated patient transportation capabilities
(3) Staff hazardous materials training levels
(4) Access to advanced hazardous materials medical interventions
(5) Personal protective equipment inventories

The ALS responder assigned to a hazardous materials team should contact EMS provider agencies in their regional response area and develop a matrix of capabilities to improve efficient operations during incidents. Data should be collected that includes the decontamination capability of EMS agencies, ability to transport contaminated patients, hazmat training levels of agency personnel, ability and authorization for personnel to perform advance clinical interventions such as antidotes, and types and quantities of personal protective equipment (PPE). Provision should be made to update the capabilities matrix on scheduled intervals at the discretion of the AHJ.

6.2.3.10 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall obtain and maintain medical equipment dedicated to supporting hazardous materials team operations.

The ALS responder assigned to a hazardous materials team should coordinate with the AHJ the acquisition of appropriate medical equipment to be dedicated to the hazmat team. Equipment such as cardiac monitors and defibrillators, laryngoscopes and other airway adjuncts, and other BLS and ALS equipment should be stored and maintained properly by the ALS responder assigned to the hazmat team. The presence of dedicated equipment will ensure availability for team members as needed without delay. Advanced equipment such as capnography and rainbow/masimo technologies can assist the ALS provider as well as in its use in daily EMS operations.

6.2.3.11 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall obtain and maintain patient rescue devices intended for affecting rescue of injured or ill hazardous materials team members from the hot zone.

The ALS responder assigned to a hazardous materials team should coordinate with the AHJ about the acquisition of appropriate rescue equipment to be dedicated to the hazmat team. Equipment such as rescue sleds, litters, and harness retrieval systems should be stored and maintained properly by the ALS responder assigned to the hazmat team. The presence of dedicated equipment will ensure availability for team members as needed without delay.

6.2.3.12 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall provide training on hot zone rescue techniques to the hazardous materials team members.

The ALS responder assigned to a hazardous materials team should coordinate training for hazardous materials team members on hot zone rescue techniques and the appropriate use of rescue equipment, as identified by the AHJ. The ALS responder should ensure that team rescue training evolutions include all phases of team member rescue, including retrieval, decontamination, and treatment procedures.

6.2.4 Competencies: Implementing the Planned Response.

6.2.4.1 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall verify that site medical surveillance is established in accordance with AHJ policies and that all team members complete medical surveillance prior to entry.

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The ALS responder assigned to a hazardous materials team should ensure that the AHJ policy for medical surveillance of entry team members is implemented to include establishment of medical unit functions. The decision to obtain pre-entry vital signs, whether at the beginning of the workday or immediately before entry, must be determined by the AHJ. The ALS responder should delegate the acquisition of vital signs to medical personnel on the scene, when possible, to focus on strategic team efforts.

6.2.4.2 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall ensure that the ICS 206 Medical Form or equivalent medical site survey form is completed and included as part of the incident action plan.

The ALS responder assigned to a hazardous materials team should ensure that a medical plan is developed in accordance with AHJ policy, including the information on a standard ICS 206 medical form. Items to be documented, at a minimum, include the following:

- Medical station locations and contact information
- Air or ground transportation unit locations and their contact information
- Closest hospital information including latitude/longitude, contact information, and travel time
- Closest trauma center information including latitude/longitude, contact information, and travel time
- Closest burn center information including latitude/longitude, contact information, and travel time
- Any special medical procedures

Additional information that may be beneficial is the air monitoring readings established at the scene of the event.

6.2.4.3 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall describe how to function as the hazardous materials team medical group supervisor during an exercise.

Δ **6.2.4.4** Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall describe how to coordinate support to the hazardous materials team from EMS ambulances and medical personnel assigned to support hazardous materials operations as defined in OSHA 29 CFR 1910.120(q).

During response operations, the ALS responder assigned to a hazardous materials team should act as a liaison for EMS units and personnel identified to support the hazardous materials incident. The ALS responder should communicate and delegate specific tasks as needed, such as establishment of rehabilitation and medical treatment areas, pre- and post-entry medical screening, and other functions.

6.2.4.5 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall demonstrate how to establish emergency decontamination for injured or ill hazardous materials team members, including removal from all personal protective equipment (PPE) provided by the AHJ.

6.2.4.6 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall describe how to coordinate with the decontamination group supervisor to ensure the following:

(1) Effectiveness of technical decontamination operations
(2) Recognition of team member medical concerns

6.2.4.7 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall describe how to coordinate the following:

(1) Preparation of a team rescue equipment cache near the technical decontamination line

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(2) Preparation of a backup team to affect a rescue in coordination with the hazardous materials safety officer

During response operations and in cooperation with the hazardous materials safety officer, the ALS responder assigned to a hazardous materials team should coordinate the movement of team rescue equipment to the area of technical decontamination in preparation for rapid intervention team (RIT) operations. The ALS responder should ensure that backup team personnel are familiar with the rescue equipment provided by the AHJ and are prepared to effect RIT operations as needed.

6.2.4.8 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall describe how to coordinate the rescue, medical treatment, and transportation of injured or ill hazardous materials team members in conjunction with the hazardous materials officer, hazardous materials safety officer, and EMS personnel assigned to the incident.

Δ **6.2.4.9** Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall describe the following:

(1) How to establish a hazardous materials rehabilitation group in accordance with NFPA 1584
(2) Procedures to ensure team member compliance with rehabilitation efforts

The ALS responder assigned to a hazardous materials team should ensure that rehabilitation is established to receive hazmat team members on exiting decontamination. The ALS responder should ensure that rehabilitation includes, at a minimum, medical evaluation, fluid replacement, shelter from environmental conditions, adequate areas for rest and recovery, and accountability.

The ALS responder should work with hazmat team leadership to develop a policy for mandatory personnel rehabilitation during operations and training evolutions.

6.2.4.10 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall describe the following procedures:

(1) Acting as a patient advocate for team members requiring transport to a health care facility for treatment
(2) Assisting health care responders as necessary with information regarding the patient's injury and/or illness

The ALS responder assigned to a hazardous materials team should be prepared to act as a patient advocate for injured or ill team members requiring transportation to a health care facility. The ALS responder should accompany the team member in the transport unit, have all the team member's medical information ready, ensure transport to the most appropriate facility, and provide a patient report to receiving medical personnel, including any physical stressors and any hazmat-related information.

Once the report at the health care facility is given, the ALS responder should remain with the team member to provide emotional support and answer questions from health care providers as the team member's care progresses. An established relationship with the health care facility will enhance efficient interaction between the ALS responder and health care facility personnel.

6.2.4.11 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall describe:

(1) Safety concerns when utilizing air medical transportation during hazardous materials incidents
(2) Methods to prevent air medical crew and aircraft from secondary contamination during incidents

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The ALS responder assigned to a hazardous materials team should be aware of the risks of transporting potentially contaminated patients in medical aircraft. The ALS responder should contact local airborne medical providers to discuss the safety risks during hazmat incidents, ascertain each provider's policy, and assist in the development of the AHJ's policy.

6.2.5 Competencies: Evaluating Progress. (Reserved)

6.2.6 Competencies: Terminating the Incident.

6.2.6.1 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to a hazardous materials team shall describe the importance of completing all team medical documentation required by the AHJ following incident responses.

6.2.6.2 Given the emergency response plan, existing guidance from the AHJ, and with guidance from the appropriate AHJ medical director, the ALS responder assigned to a hazardous materials team shall describe the process for coordinating morbidity and mortality review sessions for all medical personnel involved in patient care on hazardous materials team members during incidents.

6.3 Mission-Specific Competencies: Advanced Life Support (ALS) Responder Assigned to Provide Clinical Interventions at Hazardous Materials/WMD Incident.

6.3.1 General.

The intended audience of this competency is the ALS responder assigned to provide clinical interventions at hazardous materials/WMD incidents such as antidotes, antibiotics, chelating agents, advanced diagnostics, and treatment procedures.

This mission-specific competency is intended for the ALS provider who has been properly trained in the use of advanced clinical interventions with concurrence from their medical director and the AHJ.

6.3.1.1 Introduction.

6.3.1.1.1 The ALS responder assigned to provide clinical interventions at a hazardous materials/WMD incident shall be that person who is assigned to provide antidotes, antibiotics, and/or radiological countermeasures to persons contaminated by hazardous materials.

6.3.1.1.2 The ALS responder who is assigned to provide clinical interventions at a hazardous materials incident shall be trained to meet all competencies for NFPA 473, Chapter 4, "Competencies for Hazardous Materials/WMD Basic Life Support (BLS) Responder," and Chapter 5, "Competencies for Hazardous Materials/WMD Advanced Life Support (ALS) Responder," and the competencies in this section.

Δ **6.3.1.1.3** The ALS responder who is assigned to provide clinical interventions at a hazardous materials/WMD incident shall also be trained to meet all competencies at the NFPA 472 awareness level (Chapter 4) and operations level core (Chapter 5).

6.3.1.1.4 The ALS responder assigned to provide clinical interventions at a hazardous materials incident shall receive the additional training necessary to meet the specific needs of the AHJ.

6.3.1.1.5 The ALS responder assigned mission-specific responsibilities at hazardous materials/WMD incidents shall receive additional training to meet applicable governmental response and occupational health and safety regulations.

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6.3.1.1.6 The ALS responder assigned mission-specific responsibilities at hazardous materials/WMD incidents shall operate under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures.

6.3.1.1.7 The development of assigned mission-specific knowledge and skills shall be based on the tools, equipment, and procedures provided by the AHJ for the mission-specific responsibilities assigned.

6.3.1.2 Goal. The goal of the mission-specific competencies in this section shall be to provide the ALS responder assigned to provide clinical interventions at a hazardous materials incident with the knowledge and skills to perform the following tasks safely and effectively:

(1) Plan a response within the authority of the AHJ to provide advanced clinical interventions
(2) Implement the planned response consistent with the medical protocols of the AHJ to provide advanced clinical interventions

6.3.2 Competencies: Analyzing the Incident. (Reserved)

6.3.3 Competencies: Planning the Response.

6.3.3.1 Given the emergency response plan and existing guidance from the AHJ medical director, the ALS responder assigned to provide clinical interventions at a hazardous materials incident shall receive advanced training on pharmaceutical and clinical interventions.

The ALS responder assigned directly to provide clinical interventions at hazardous materials incidents should obtain competency with each clinical intervention approved by the AHJ.

6.3.3.2 Given the emergency response plan and existing guidance from the AHJ, the ALS responder assigned to provide clinical interventions at a hazardous materials incident shall identify potential sources of hazardous material exposure within the response area of the AHJ that may require clinical intervention skills and/or equipment.

The ALS responder assigned directly to provide clinical interventions at hazardous materials incidents should coordinate with hazardous materials teams to identify potential threats in the response area that may require clinical interventions. For example, a chemical facility with inventories of hydrogen fluoride in the response area may initiate development of a clinical intervention for the use of calcium gluconate.

6.3.4 Competencies: Implementing the Planned Response.

6.3.4.1* Given the emergency response plan and existing guidance from the AHJ medical director, the ALS responder assigned to provide clinical interventions at a hazardous materials incident shall identify the toxidromes for the following:

(1) Organophosphates

Refer to the cholinergic section of Table B.3 in Annex B.

(2) Carbamates

Refer to the cholinergic section of Table B.3 in Annex B.

(3) Military nerve agents

Refer to the cholinergic section of Table B.3 in Annex B.

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(4) Cyanides

Refer to the asphyxiant-systemic section of Table B.3 in Annex B.

(5) Chlorine and acid gases

Refer to the irritant gas–moderately water soluble section of Table B.3 in Annex B.

(6) Anhydrous ammonia

Refer to the irritant gas–highly water soluble section of Table B.3 in Annex B.

(7) Hydrogen fluoride
(8) Phenolic compounds
(9) Military vesicant agents
(10) Nitrogen containing compounds
(11) Hydrocarbons/hydrocarbon derivatives
(12) Bacteria
(13) Viruses
(14) Biologic toxins
(15) Riot control agents
(16) Phosgene

Refer to the irritant gas–slightly water soluble section of Table B.3 in Annex B.

(17) Ionizing radiation

A.6.3.4.1 Toxidromes of common toxicants are provided in Annex B, Table B.3; biodromes of common Category A bioterrorism agents are provided in Annex B, Table B.1; ASTM E2601, *Standard Practice for Radiological Emergency Response*, provides guidance on the first 24 hours of response to radiological incidents; CRCPD Publication 06-6, *Handbook for Responding to a Radiological Dispersal Device — First Responder's Guide — the First 12 Hours,* provides guidance on the first 12 hours of response to RDD incidents; Table 3 of the CRCPD Publication 06-6 provides "turn-back" exposure rates and dose guidelines.

6.3.4.2* Given the emergency response plan and existing guidance from the AHJ medical director, the ALS responder assigned to provide clinical interventions at a hazardous materials incident shall describe the clinical application and actions of the following pharmaceuticals based upon approval for clinical use by the AHJ:

This information is for general purposes only. The AHJ must determine the clinical use, protocols, and dosage for the pharmaceuticals listed.

(1) Atropine sulfate

A possible clinical application for this pharmaceutical is the treatment of organophosphate poisoning. Refer to Table B.2 in Annex B.

(2) Pralidoxime (2-PAM)

A possible clinical application for this pharmaceutical is the treatment of organophosphate poisoning. Refer to Table B.2 in Annex B.

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(3) Diazepam
(4) Calcium gluconate

A possible clinical application for this pharmaceutical is the treatment of hydrofluoric acid exposures. Refer to Table B.2 in Annex B.

(5) Amyl nitrite
(6) Sodium nitrite
(7) Sodium thiosulfate
(8) Hydroxocobalamin

A possible clinical application for this pharmaceutical is the treatment of exposure to cyanide. Refer to Table B.2 in Annex B.

(9) Methylene blue

A possible clinical application for this pharmaceutical is the treatment of methemoglobinemia. Refer to Table B.2 in Annex B.

(10) Sodium bicarbonate
(11) Naloxone
(12) Dimercaprol
(13) Polyethylene glycol
(14) Zinc EDTA
(15) Calcium EDTA
(16) Prussian blue
(17) Water
(18) Magnesium sulfate
(19) Prednisone
(20) Tetracaine (pontocaine)

A.6.3.4.2 Antidotes for common toxicants are provided in Table B.3; common bioagent mass casualty antidotes are provided in Table B.2; and Table A.1.3 of ASTM E2601, *Standard Practice for Radiological Emergency Response*, presents medical aspects of radiation injury (0 to 125 rem).

6.3.4.3 Given the emergency response plan and existing guidance from the AHJ medical director, the ALS responder assigned to provide clinical interventions at a hazardous materials incident shall demonstrate the ability to properly perform the following clinical skills using the equipment approved and provided for use by the AHJ:

(1) Nebulizer treatment
(2) Morgan lens insertion
(3) Monitor hemoglobin oxygenation levels
(4) Monitor carboxyhemoglobin levels
(5) Monitor end tidal carbon dioxide levels
(6) Monitor methemoglobin levels
(7) Administer square centimeter grid subcutaneous injections

6.3.5 Competencies: Evaluating Progress.

N **6.3.5.1** The following features of the rehabilitation process shall be evaluated:

(1) Rehabilitation area established in an area free of airborne contamination produced by the incident

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(2) Rehabilitation process activated, and personnel assigned to staff the area
(3) Responders assigned to rotate through the rehabilitation evaluated for fluid replenishment, medical monitoring, and heating/cooling measures if required
(4) Environmental conditions monitored in and around the rehabilitation area

This section is intended to serve as a reminder to the EMS provider that the nature of the work being done should be factored into any plans to render care to exposed responders.

(5) Process established for identifying responders who might not be medically fit to return to active duty at the incident or who might require more advanced medical evaluation

N **6.3.5.2** The following situations, which could require advanced medical evaluation or intervention, shall be described:

(1) Excessive work conditions, including heat or cold stress or significant physical activity
(2) PPE breech or failure resulting in physical injury to the responder
(3) Inhalation exposures to toxic by-products of combustion
(4) Other exposure scenarios that might adversely impact the responder

6.3.6 Competencies: Terminating the Incident. (Reserved)

6.4 Mission-Specific Competencies: Advanced Life Support (ALS) Responder Assigned to Treatment of Smoke Inhalation Victims.

6.4.1 General.

6.4.1.1 Introduction.

Δ **6.4.1.1.1** The ALS responder assigned to treatment of smoke inhalation victims shall be trained to meet at least the core competencies of the operations level responders as defined in Chapter 5 of NFPA 472 and all competencies of this section.

6.4.1.1.2 The ALS responder assigned to treatment of smoke inhalation victims at hazardous materials/WMD incidents, structural fires, or any other incident where smoke inhalation illness or injury is suspected shall operate under the medical control of a physician or designee providing direction for patient care activities in the prehospital setting.

6.4.1.2 Goal.

6.4.1.2.1 The goal of the competencies of this chapter shall be to provide the ALS responder with the knowledge and skills necessary to safely deliver care at hazardous materials/WMD incidents, structural fires, or any other incident where smoke inhalation illness or injury is suspected and to function within the established IMS/ICS as follows:

(1) Analyze the incident to determine the potential health risks to the ALS responder, other responders, and anticipated/actual patients by completing the following tasks:
    (a) Survey the incident to identify causes of suspected or confirmed illness or injury resulting from acute exposure to fire smoke

ALS responders called to the scene of any working fire should be aware of the potential for mild, moderate, or severe smoke exposures to emergency responders or civilians. In some cases, exposures may require little more than supportive care and observation. When victims or patients present with significant signs and symptoms such as cardiac arrhythmias, respiratory difficulty or arrest, or altered mental status, prehospital care providers should suspect the toxins in fire smoke as a possible cause. Not all toxins in fire smoke are acutely toxic at every fire scene. The levels of gaseous toxins such as hydrogen

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cyanide, carbon monoxide, and the various oxides of nitrogen or other gaseous by-products of combustion vary during the life cycle of the fire. Combustion chemistry depends on a number of factors, including the nature of the material involved in the fire and how poorly or well the fire is ventilated. During the overhaul phase, levels of some toxins such as carbon monoxide could reach levels that are higher than what might have been found during the time the fire was free burning. The point of this section is to remind care providers that treating a smoke inhalation patient is, in reality, treating a chemical exposure. That exposure is causing a series of complicated physiological responses to the human body.

(b) Collect information from on-scene emergency response personnel, civilians, or other knowledgeable persons to determine if victims have been rescued or otherwise removed from a closed space structure fire or any other situation indicating the potential for a smoke exposure

Prehospital care providers should attempt to identify the amount of time a victim may have been exposed to smoke and understand the setting in which the exposure occurred. This may not be possible, and would not likely change the need for treatment, but may help the care provider understand — anecdotally — the degree or severity of the exposure.

At the time this handbook is published, there is no test or device that a field level care provider can use to identify a patient's cyanide level in the field. Treatment for cyanide poisoning secondary to the smoke exposure must be done presumptively, based on the suggestive history of the illness and the signs and symptoms of the patient. Therefore, any cyanide antidote administered in the field must be safe to use in the setting of smoke inhalation.

(2) Plan to deliver ALS to smoke-exposed patients, within the scope of practice and training competencies established by the AHJ, including specific training on smoke exposures and antidotal therapy, by completing the following tasks:

(a) Identify the capabilities of the hospital network within the AHJ to accept patients with significant burns, trauma, or those patients that may be candidates for hyperbaric therapy

(b) Identify receiving hospitals with Food and Drug Administration (FDA) approved antidote(s) for suspected or confirmed cyanide poisoning resulting from a smoke exposure

Cyanide poisoning, secondary to a smoke exposure, has been identified as a possible cause of illness and death in smoke exposures. It is the only smoke toxicant that has an identified antidote. Keep in mind a cyanide antidote does not reverse or correct the entire exposure to smoke — it only addresses the hydrogen cyanide component of fire smoke. Also, keep in mind that an antidote should be safe and easy to administer in the prehospital care setting. Cyanide antidotes intended for occupational exposure may not be appropriate in the setting of smoke inhalation.

Not all emergency medical systems or hospitals stock or have access to the same cyanide antidotes. It is up to the prehospital care provider to know what is available and how those antidotes are accessed. Additionally, some current FDA-approved antidotes are suitable only for an occupational or intentional cyanide exposure, such as potassium or sodium cyanide, or hydrogen cyanide gas. These exposures are far different from a cyanide exposure in the setting of fire smoke and should be viewed differently. Any prehospital care provider must understand the indications and contraindications of each antidote and which antidotes are suitable to administer to smoke inhalation patients.

(3) Implement a prehospital treatment plan for smoke inhalation patients, within the scope of practice and training competencies established by the AHJ, by completing the following tasks:

(a) Perform a complete assessment of the smoke inhalation patient

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Patients exhibiting abnormal signs and symptoms from a smoke exposure are not exhibiting those signs and symptoms because of the smoke per se — their bodies are responding to the gases, heat, and/or particulates in the smoke. For example, dizziness, rapid respirations, and tachycardia are indications of exposures to cyanide or carbon monoxide. Smoke generated by almost any fire is a complex collection of chemical substances, and the patient is likely exposed to all of them to some degree. The patient exhibits the effects of those toxins. Heat is also present and at times a complicating factor as well. It is safe to say that a smoke inhalation patient is a complicated patient to manage.

(b) Determine the need for rapid field decontamination of the smoke inhalation patient including clothing removal

When appropriate, field decontamination will help protect care providers from secondary respiratory exposure from fire gases and particulates that are released from smoke-contaminated clothing. If time permits and the environmental conditions (mostly from cold weather) are not prohibitive, removing the patient's clothing is customary in significant trauma, and performing a quick field rinse with water may help reduce secondary exposures.

(c) Identify and treat any associated life-threatening injuries including burns or trauma within the scope of practice established by the AHJ

(d) Identify available and AHJ-approved field adjuncts to measure pulse oximetry, carbon monoxide levels and lactate levels

Several devices are on the market and several more are in development that may aid in the field assessment of hydrogen cyanide and carbon monoxide exposures. It is up to the AHJ to determine which device is appropriate for use. Keep in mind, however, that a device intended to determine levels of carbon monoxide in the body is good only for carbon monoxide — there is no straight-line correlation between carbon monoxide levels and hydrogen cyanide levels, or between carbon monoxide and the presence of any other toxicant that may be present in the smoke. These devices may be useful but should not replace an assessment of the entire patient presentation.

(e) Identify and treat any underlying medical conditions such as cardiac arrest, respiratory distress or arrest, seizures or altered level of consciousness, within the scope of practice established by the AHJ

Smoke exposures are not mysterious, they are complicated. Visible symptoms should be treated, and if an antidote for hydrogen cyanide is indicated, it should be administered with other drugs or clinical interventions. Prehospital care providers must treat patients in accordance with protocols and scope of practice.

(f) Determine the need to administer FDA-approved antidotes to affected patients within the scope of practice established by the AHJ

(g) Identify the most appropriate receiving hospital and provide for rapid transport

(4) Participate in the termination of the incident by reporting and documenting the actions taken by the ALS responder at the scene of the incident

6.4.2 Competencies: Analyzing the Incident.

6.4.2.1 Identifying General Hazards. Given examples of various types of fire scenes involving residential or commercial structure fires, vehicle fires, aircraft fires, and other hazardous materials/WMD incidents, the ALS responder shall describe the commonly found components

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of fire smoke, including carbon monoxide and hydrogen cyanide, and shall describe the general health hazards associated with those substances, including the following:

(1) Mechanism of toxicity
(2) Acute and delayed toxicological effects
(3) Dose-response relationship
(4) Signs and symptoms of mild, moderate, and severe exposures

Prehospital care providers must understand the basics of combustion chemistry to understand the variety of potential toxicants that can be found in fire smoke. Examples of the toxicants may include aldehydes (including formaldehyde, a known human carcinogen), sulfur compounds, hydrogen chloride gas, oxides of nitrogen, acrolein, carbon dioxide, ozone, and polyaromatic hydrocarbons.

6.4.2.2 Identifying Victims. Given examples of various types of fire scenes involving residential or commercial structure fires, vehicle fires, aircraft fires, and other hazardous materials/WMD incidents, the ALS responder shall describe the general health risks to patients exposed to fire smoke and shall identify those patients who might require clinical interventions, including antidotes for associated cyanide poisoning.

6.4.3 Competencies: Planning to Deliver ALS Patient Care.

6.4.3.1 Identifying Resources for Treating Acute Patients. Given examples of smoke inhalation patients, including circumstance of the exposure, signs and symptoms, underlying medical conditions (cardiac arrest, respiratory distress or arrest, seizure, or altered mental status), the ALS responder shall identify the methods and vehicles available to transport smoke inhalation patients and shall determine the location and potential routes of travel to the following appropriate local and regional hospitals, based on patient need:

(1) Adult trauma centers
(2) Pediatric trauma centers
(3) Adult burn centers
(4) Pediatric burn centers
(5) Hyperbaric chambers
(6) Field hospitals
(7) Hospitals or medical centers with FDA-approved cyanide antidotes

Not all receiving hospitals stock cyanide antidotes in the emergency department — some are stocked in the pharmacy or perhaps not at all. The ALS responder should find out what, if any, cyanide antidotes are available in the system. Additionally, not all cyanide antidotes are ideal for smoke inhalation patients. The ALS responder should take the time to understand the complexities of treating smoke exposures and fully understand the antidotes that may be approved for use in the system.

(8) Hospitals or medical centers with the capability of performing whole blood cyanide testing

There are relatively few laboratories that perform whole blood testing for cyanide. The ALS responder should check with the AHJ to determine where the nearest qualified laboratory is located and the procedures required for whole blood cyanide testing.

6.4.4 Competencies: Implementing a Prehospital Care Plan. Given examples of smoke inhalation patients including circumstance of the exposure, signs and symptoms, underlying medical conditions (cardiac arrest, respiratory distress or arrest, seizure, or altered mental status), the ALS responder shall demonstrate the ability to perform the critical BLS and ALS

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clinical interventions, including antidotes for known and suspected cyanide poisoning, within the scope of practice and training competencies established by the AHJ.

6.4.5 Competencies: Evaluating Progress. (Reserved)

6.4.6 Competencies: Terminating the Incident.

6.4.6.1 Reporting and Documenting the Incident. Given a scenario where treatment of a smoke inhalation patient occurred, the ALS responder shall demonstrate the ability to report and document all facets of patient care in accordance with the incident reporting system used within the AHJ.

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ANNEX

A

Explanatory Material

For the convenience of the readers of this handbook, the material contained in Annex A of the 2018 edition of NFPA 473 is interspersed throughout the text of Chapters 1 through 6 in Part II of this handbook, placed immediately after the mandatory text to which it applies. Therefore, it is not repeated here.

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ANNEX B

Toxicity Analysis and Antidote Tables

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

Δ **B.1** See Table B.1 for a list of hazardous materials biodromes.

Δ ***TABLE B.1*** *HazMat Biodromes — Category A Bioagents*

Bioterrorism Agent	*Exposure Routes*	*Incubation Period*	*Signs and Symptoms*	*Infective Dose*	*Precautions*
Anthrax (*Bacillus anthracis* — encapsulated, aerobic, gram-positive, spore-forming, rod-shaped bacterium)	Cutaneous anthrax — most common	Usually an immediate response up to 1 day	Local skin involvement after direct contact with spores or bacilli; localized itching followed by 1) papular lesion that turns vesicular and 2) subsequent development of black eschar within 7–10 days of initial lesion	Any direct exposure to vesicle secretions of cutaneous anthrax	Standard contact precautions; avoid direct contact with wound or wound drainage
	Inhalation anthrax — less common	Usually <1 week; may be prolonged for weeks up to 2 months	Nonspecific symptoms such as low-grade fever, nonproductive cough, malaise, fatigue, myalgias, profound sweats, chest discomfort (upper respiratory tract symptoms are rare)	<8,000 to 50,000 spores	Standard contact precautions; avoid direct contact with wound or wound drainage
	Gastrointestinal anthrax — less common	Usually 1–7 days	Nausea, anorexia, vomiting, and fever progressing to severe abdominal pain, hematemesis, and diarrhea that is almost always bloody; acute abdomen picture with rebound tenderness may develop		Standard contact precautions; avoid direct wcontact with wound or wound drainage
Botulism (*Clostridium botulinum* toxin produced by *Clostridium botulinum*, an encapsulated, anaerobe, gram-positive, spore-	Inhalation botulism (does not occur naturally, only as bioterrorism agent)	Foodborne botulism symptoms begin within 6–10 hours; inhalation botulism could be shorter	Symmetrical cranial neuropathies (difficulty swallowing or speaking, dry mouth, diplopia (double vision), blurred vision, dilated or nonreactive pupils, ptosis (drooping eyelids); symmetrical descending weakness respiratory dysfunction (requiring mechanical ventilation); descending flaccid paralysis; intact		Botulism is not transmissible from person-to-person; use standard precautions

(*Continues*)

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Δ *TABLE B.1 Continued*

Bioterrorism Agent	Exposure Routes	Incubation Period	Signs and Symptoms	Infective Dose	Precautions
forming, rod-shaped bacterium)			mental state; no sensory dysfunction; no fever; constipation more common in infant botulism		
Plague (*Yersinia pestis* — bacillus)	Pneumonic plague — airborne for exposure by inhalation	1 to 6 days	First signs of illness are fever, headache, weakness, and rapidly developing pneumonia with shortness of breath, chest pain, cough, and sometimes bloody or watery sputum	<100 organisms	Droplet precautions; surgical-type masks (N95); post-exposure prophylaxis (doxycycline 100 mg or ciprofloxacin 500 mg orally twice daily)
	Bubonic plague — most common form, when *Yersinia pestis* enters body through skin break		Enlarged, tender lymph nodes, fever, chills and prostration		
	Septicemic plague — when plague bacteria multiply in blood, usually a complication of pneumatic or bubonic		Fever, chills, prostration, abdominal pain, shock, and bleeding into skin and other organs		
Smallpox (variola major)	Direct and fairly prolonged face-to-face contact is required to spread smallpox from one person to another; Smallpox also can be spread through direct contact with infected bodily fluids or contaminated objects	Initial symptoms (prodrome — duration: 2 to 4 days) sometimes contagious; early rash (duration: about 4 days) most contagious	First symptoms of smallpox include fever, malaise, head and body aches, and sometimes vomiting; fever is usually high, in the range of 101 to 104 degrees Fahrenheit, at this time people are usually too sick to carry on their normal activities (called the *prodrome* phase and may last for 2 to 4 days); rash emerges first as small red spots on the tongue and in the mouth; spots develop into sores that break open and spread large amounts of the virus into the mouth and throat; at this point the person becomes most contagious; sores in mouth break down, a rash appears on the skin, starting on the face and spreading to the arms and legs and then to the hands and feet; usually rash spreads to all parts of the body within 24 hours; as rash appears, the fever usually falls and the person may start to feel better; by third day of the rash, the rash becomes raised bumps;	10–100 organisms with human-to-human transmission within 3 m	Airborne (N95 mask) and contact precautions; Smallpox vaccine, a live-virus vaccine made from vaccinia virus, is highly effective at inducing immunity against smallpox prior to exposure; if administered within 3 days after exposure to smallpox virus, it may prevent disease, or decrease the severity of disease and risk of death

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TABLE B.1 *Continued*

Bioterrorism Agent	*Exposure Routes*	*Incubation Period*	*Signs and Symptoms*	*Infective Dose*	*Precautions*
			by fourth day, the bumps fill with a thick, opaque fluid and often have a depression in the center that looks like a bellybutton (a major distinguishing characteristic of smallpox)		
Tularemia (*Francisella tularensis*)	Airborne for exposure by inhalation	Symptoms appear 3 to 5 days post-exposure, but can take as long as 14 days	Onset is usually abrupt with fever (38°C to 40°C), headache, chills, and rigors (violent shivering), generalized body aches often prominent in lower back), coryza (common cold symptoms), and sore throat; dry or slightly productive cough and substernal pain or tightness with or without signs of pneumonia; nausea, vomiting, and diarrhea may occur	10–50 organisms	Airborne (N95 mask) and contact precautions; a live attenuated vaccine derived from avirulent *Francisella tularensis* biovar palaearctica (type B) is under review by the Food and Drug Administration (has been used to protect laboratorians routinely working with the bacterium); post-exposure (before illness occurs) prophylactic treatment with doxycycline or ciprofloxacin
Viral hemorrhagic fevers [filoviruses (e.g., Ebola, Marburg) and arenaviruses (e.g., Lassa, Machupo)]	Inhalation or close contact with infected patient	5 to 10 days (may be as long as 3 weeks)	Overall the vascular system will be damaged, and the body's ability to regulate itself impaired; these symptoms are often accompanied by hemorrhage bleeding; initial signs and symptoms often include marked fever, fatigue, dizziness, muscle aches, loss of strength, and exhaustion; severe cases often show signs of bleeding under the skin, in internal organs, or from body orifices like the mouth, eyes, or ears. However, although they may bleed from many sites around the body, patients rarely die because of blood loss; severely ill patient cases may also show shock, nervous system malfunction, coma, delirium, and seizures; in some case renal (kidney) failure may occur	400 plaque-forming units by inhalation is fatal in 5 days	Airborne (N95 mask) and contact precautions; isolate infected patients; wear hard hygiene protective clothing (double gloves, impermeable gowns, leg/shoe covering, face shields/goggles

Source: CDC databases.

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B.2 See Table B.2 for a list of bioagent antidotes.

Δ *TABLE B.2 Bioagent Mass Casualty Antidotes*

Antidote	Bioagent	Common Adult Dose
Ciprofloxacin	Anthrax — Inhalation	500 mg po bid
Ciprofloxacin	Anthrax — Prophylaxis	500 mg po bid
Doxycycline	Plague	100 mg po bid
Ciprofloxacin	Plague	500 mg po bid
Doxycycline	Tularemia	100 mg po bid
Vaccinate	Smallpox	
Botulinum antitoxin	Botulinum	10 mL vial (most effective if administered within 24 hours)

Bid: two times a day.
IM: Intramuscular. IV: Intravenous. po: Oral.
Source: CDC databases.

Δ **B.3** See Table B.3 for a list of hazardous materials toxidromes.

Δ *TABLE B.3 HazMat Toxidromes*

Toxidrome	Typical Toxicants	Predominant Route of Exposure	Predominant Toxicodynamics	Predominant Target(s) of Toxicity
Irritant gas — highly water soluble	Ammonia (NH_3) Formaldehyde (HCHO) Hydrogen chloride (HCl) Sulfure dioxide (SO_2)	Inhalation	Irritant and corrosive local toxic effects, by readily dissolving in the water of exposed mucous membranes and the upper airway, forming a corrosive aqueous solution that causes inflammation, edema, and corrosion of the exposed mucous membranes and upper airway	Airway
Irritant gas — moderately water soluble	Chlorine (Cl_2)	Inhalation	Irritant and corrosive local toxic effects, by dissolving in the water of exposed mucous membranes and the upper airway and lower airways, forming a corrosive aqueous solution that causes inflammation, edema, and corrosion of the exposed upper and lower airways	Airway breathing
Irritant gas — slightly water soluble	Phosgene ($COCl_2$) Nitrogen dioxide (NO_2)	Inhalation	Irritant and corrosive local toxic effects, by slowly dissolving in the water of the alveolar-capillary membrane of the lung, forming a corrosive aqueous solution that causes delayed non-cardiogenic pulmonary edema	Breathing
Asphyxiant — simple	Carbon dioxide (CO_2) Methane (CH_4) Propane (CH_3, CH_2, CH_3)	Inhalation	Displacement of O_2 from the ambient atmosphere, decreasing the O_2 supply to the lungs	Cardiovascular disability (nervous system)
Asphyxiant — systemic (chemical)	Carbon monoxide (CO) Hydrogen cyanide (HCN) Hydrogen sulfide (H_2S) Hydrogen azide (HN_3) Isobutyl nitrite	Inhalation	Interference with O_2 transportation and/or utilization within the blood and/or other tissues	Cardiovascular disability (nervous system)

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Δ *TABLE B.3 Continued*

Toxidrome	*Typical Toxicants*	*Predominant Route of Exposure*	*Predominant Toxicodynamics*	*Predominant Target(s) of Toxicity*
Cholinergic	Organophosphate pesticides Carbamate insecticides	Skin and mucous membranes	Excess acetylcholine accumulation at both the muscarinic and nicotininc receptors in the CNS/PNS, due to inhibition of acetylcholinesterase, the enzyme that breaks down acetylcholine	Disability (nervous system)
Cholinergic	Organophosphate nerve agents	Inhalation and/or skin and mucous membranes	Excess acetylcholine accumulation at both the muscarinic and nicotininc receptors in the CNS/PNS, due to inhibition of acetylcholinesterase, the enzyme that breaks down acetylcholine	Disability (nervous system)
Corrosive	Acids (hydrochloric, nitric, sulfuric, etc.) Bases (sodium hydroxide, ammonium hydroxide, potassium hydroxide)	Skin and mucous membranes	Irritant and corrosive local toxic effects that cause chemical burns of the skin and mucous membranes that come into contact with the corrosive solutions	Airway cardiovascular
Hydrocarbon and halogenated hydrocarbon	Gasoline Propane Toluene Chloroform	Inhalation of gases or vapors	Inhalation can cause sleepiness to the point of narcosis (deep stupor and/or coma) and cardiac irritability because the heart is sensitized to catecholamines (epinephrine and norepinephrine)	Cardiovascular disability (nervous system)

Δ **B.4** See Table B.4 for a list of hazardous materials antidotes.

Δ *TABLE B.4 HazMat Antidotes*

Antidote	*Poisoning*	*Common Adult Dose*	*Common Pediatric Dose*
Atropine	Organophosphates carbamates nerve agents	1–2 mg IV bolus Titrate with repeated doses	0.02–0.04 mg/kg IV bolus Never less than .1 mg. Titrate with repeated doses
Calcium gluconate 10% slow IV bolus	Systemic hydrofluoric acid or fluoride poisoning	10–20 mL (1–2 amp) Repeat doses may be required	0.2–0.3 mL/kg Repeat doses may be required
Calcium gluconate 2.5% – 10% topical gel or solution	Hydrofluoric acid skin burns	Topical application	Topical application
Calcium chloride 10% slow IV bolus	Systemic hydrofluoric acid or fluoride poisoning	5–10 mL (0.5–1 amp) Repeat doses may be required	0.1–0.2 mL/kg 0.2 repeat doses may be required
USA cyanide antidote kit Amyl nitrite	Cyanides Nitriles Sulfides	By inhalation	By inhalation
USA cyanide antidote kit Sodium nitrite	Cyanides Nitriles Sulfides	10 mL (1 amp) slow IV bolus over 5 minutes	0.12–0.33 mL/kg slow IV bolus over 5 minutes, up to a maximum of 10 mL (1 amp)
USA cyanide antidote kit Sodium thiosulfate	Cyanides Nitriles Sulfides	50 mL (1 amp) slow IV bolus over 10 to 20 minutes	1.6 mL/kg slow IV bolus over 10 to 20 minutes, up to a maximum of 50 mL (1 amp)
Hydroxocobalamin	Cyanides	5 g IV	
Methylene blue	Methemoglobin forming compounds	1–2 mg/kg slow IV bolus over 5 minutes Repeat doses may be required	1–2 mg/kg slow IV bolus over 5 minutes Repeat doses may be required

(*Continues*)

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Δ *TABLE B.4 Continued*

Antidote	*Poisoning*	*Common Adult Dose*	*Common Pediatric Dose*
Oxygen	Simple asphyxiants Systemic asphyxiants Methemoglobin forming compounds Carbon monoxide Cyanides Azides and hydrozoic acid Hydrogen sulfide and sulfides	100% by inhalation	100% by inhalation
Pralidoxime (2-PAM)	Organophosphates Nerve agents	1–2 g slow IV infusion over 10 minutes, then 500 mg/hr continuous IV infusion	20–40 mg/kg slow IV infusion over 10 minutes, then 5–10 mg/kg/hr continuous IV infusion
Pyridoxine	Hydrazines	25 mg/kg IV	25 mg/kg IV

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ANNEX

C

Informational References

C.1 Referenced Publications.

The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

C.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2018 edition.

C.1.2 Other Publications.

C.1.2.1 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA, 19428-2959.

ASTM E2601, *Standard Practice for Radiological Emergency Response*, 2015.

C.1.2.2 CRCPD Publications. Conference of Radiation Control Program Directors, Inc., 1030 Burlington Lane, Suite 4B, Frankfort, KY, 40601.

CRCPD Publication 06-6, *Handbook for Responding to a Radiological Dispersal Device — First Responder's Guide — the First 12 Hours*, September 2006.

C.1.2.3 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 18, U.S. Code, Section 2332a, "Use of Weapons of Mass Destruction."

C.2 Informational References.

The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

C.2.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2016 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2015 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.

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NFPA 475, *Recommended Practice for Organizing, Managing, and Sustaining a Hazardous Materials/Weapons of Mass Destruction Response Program*, 2017 edition.

NFPA 1072, *Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications*, 2017 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety*, 2014 edition.

NFPA 1984, *Standard on Respirators for Wildland Fire-Fighting Operations*, 2016 edition.

NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies and CBRN Terrorism Incidents*, 2016 edition.

NFPA 1992, *Standard on Liquid Splash–Protective Ensembles and Clothing for Hazardous Materials Emergencies*, 2017 edition.

Hazardous Materials Response Handbook, 2013.

Wright, C. J., "Managing the Hazardous Materials Incident," *Fire Protection Handbook*, 20th edition, Quincy, MA: National Fire Protection Association, 2008.

C.2.2 Other Publications.

Δ **C.2.2.1 ACC Publications.** American Chemistry Council, 1300 Wilson Boulevard, Arlington, VA 22209.

Recommended Terms for Personal Protective Equipment, 1985.

C.2.2.2 API Publications. American Petroleum Institute, 1220 L Street, N.W., Washington, DC 20005-4070.

API 2021, *Guide for Fighting Fires in and Around Flammable and Combustible Liquid Atmospheric Petroleum Storage Tanks*, 2001, reaffirmed 2015.

API PUBL 2510A, *Fire Protection Considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities*, 1996, reaffirmed 2015.

C.2.2.3 NFA Publications. National Fire Academy, Federal Emergency Management Agency, Emmitsburg, MD 21727.

Hazardous Materials Incident Management, 2014.

C.2.2.4 NRT Publications. National Response Team, National Oil and Hazardous Substances Contingency Plan, Washington, DC 20593.

NRT-1, *Hazardous Materials Emergency Planning Guide*, 2001.

C.2.2.5 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Emergency Response Guidebook, U.S. Department of Transportation, 2016 edition.

Emergency Response, Command, and Planning Guidelines (various documents) for terrorist incidents involving chemical and biological agents. U. S. Army Research, Development, and Engineering Command (RDECOM), available through the Edgewood Chemical Biological Center, website http://www.ecbc.army.mil/hld.

EPA, Emergency Response Program publications, Washington, DC: Environmental Protection Agency, www.epa.gov.

National Toxicology Program, *Report on Carcinogens*, 12th edition, Washington, DC: U.S. Department of Health and Human Services, 2011.

NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, October 1985.

Title 29, Code of Federal Regulations, Parts 1910.119–1910.120.

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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.

Δ **C.2.2.6 Additional Publications.** Grey, G. L., et al., *Hazardous Materials/Waste Handling for the Emergency Responder*, New York: Fire Engineering Publications, 1989.

Maslansky, C. J., and S. P. Maslansky, *Air Monitoring Instrumentation*, New York: Van Nostrand Reinhold, 1993.

Noll, G. G., et al., *Hazardous Materials, Managing the Incident*, fourth edition, Jones and Bartlett, Burlington, MA 2013.

C.3 References for Extracts in Informational Sections.

NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2018 edition.

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PART III

NFPA® 475, *Recommended Practice for Organizing, Managing, and Sustaining a Hazardous Materials/Weapons of Mass Destruction Response Program*, 2017 Edition

Part III of this handbook presents the full text of NFPA 475, *Recommended Practice for Organizing, Managing, and Sustaining a Hazardous Materials/Weapons of Mass Destruction Response Program*.

Note that an asterisk (*) after a standard paragraph number indicates that advisory annex material pertaining to the requirement in that paragraph appears in Annex A. Paragraphs that begin with the letter A are extracted from Annex A of the standard. Although printed in black ink, this is nonmandatory material and purely explanatory in nature. For ease of use, this handbook places Annex A material immediately after the standard paragraph to which it refers.

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Administration

1

1.1 Scope.

This recommended practice provides the minimum criteria for organizing, managing, and sustaining a hazardous material response program (HMRP) based on the authority having jurisdiction's (AHJ) function and assessed level of risk.

1.1.1 A review of the laws, regulations, consensus standards, and guidance documents in addition to guidance for risk assessment, HMRP planning, resource management, staffing, training, health and medical issues, financial management, programs influences, and developing relationships are covered in this recommended practice.

1.2* Purpose.

The purpose of this document is to recommend the minimum program elements necessary for organizing, managing, and sustaining an HMRP to reduce or eliminate the hazardous materials/WMD risks within an organization/jurisdiction.

A.1.2 The committee believes that this document specifies the minimum job performance requirements for emergency response personnel to hazardous materials/weapons of mass destruction incidents given specific levels. The committee recognizes that emergency services organizations might have to invest considerable resources to provide the equipment and training needed to perform at hazardous materials/WMD incidents safely and efficiently. The committee does not mean to imply that organizations with limited resources cannot provide hazardous materials/WMD emergency response services, only that the individuals charged with performing hazardous materials/WMD responsibilities are qualified to specific levels according to this standard.

1.2.1 It is not the intent of this recommended practice to restrict any jurisdiction from using more stringent guidelines.

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2 Referenced Publications

2.1 General.

The documents or portions thereof listed in this chapter are referenced within this recommended practice and shall be considered part of the recommendations of this document.

2.2 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents,* 2013 edition.

NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents,* 2013 edition.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response,* 2017 edition.

NFPA 1072, *Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications,* 2017 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program,* 2013 edition.

NFPA 1521, *Standard for Fire Department Safety Officer Professional Qualifications,* 2015 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System,* 2014 edition.

NFPA 1582, *Standard on Comprehensive Occupational Medical Program for Fire Departments,* 2013 edition.

NFPA 1584, *Standard on the Rehabilitation Process for Members during Emergency Operations and Training Exercises,* 2015 edition.

NFPA 1851, *Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting,* 2014 edition.

NFPA 1852, *Standard on Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA),* 2013 edition.

NFPA 1951, *Standard on Protective Ensembles for Technical Rescue Incidents,* 2013 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services,* 2013 edition.

NFPA 1982, *Standard on Personal Alert Safety Systems (PASS),* 2013 edition.

NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies,* 2016 edition.

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NFPA 1992, *Standard on Liquid Splash–Protective Ensembles and Clothing for Hazardous Materials Emergencies,* 2017 edition.
NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents,* 2017 edition.

2.3 Other Publications.

2.3.1 ANSI Publications. American National Standards Institute, Inc., 25 West 43rd Street, 4th floor, New York, NY 10036.

ANSI Z88.2, *American National Standard Practices for Respiratory Protection*, 2015.
ANSI Z88.10, *Fit Test Method*, 2010.

2.3.2 API Publications. American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.

API 2021, *Management of Atmospheric Storage Tank Fires*, 2006.

2.3.3 ASTM Publications. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E2458, *Standard Practices for Bulk Sample Collection and Swab Sample Collection of Visible Powders Suspected of Being Biothreat Agents from Nonporous Surfaces*, 2010.
ASTM E2601, *Standard Practice for Radiological Emergency Response*, 2008.
ASTM E2770, *Standard Guide for Operational Guidelines for Initial Response to a Suspected Biothreat Agent*, 2010.
ASTM E2842, *Standard Guide for Credentialing for Access to a Disaster Scene*, 2014.
ASTM F1127, *Standard Guide for Containment of Hazardous Material Spill by Emergency Response Personnel*, 2013.

2.3.4 FEMA Publications. Federal Emergency Management Agency, U.S. Department of Homeland Security, 500 C Street, SW, Washington, DC 20472.

FEMA 508-1, *Typed Resource Definitions — Animal Health Resources*, 2005.
FEMA 508-4, *Typed Resource Definitions — Fire and Hazardous Materials Resources*, 2005.
FEMA NIMS Guide 0001, *National MIMS Resource Typing Criteria*, 2006.
FEMA NIMS Guide 0002, *National Credentialing Definition and Criteria*, 2007.
National Mutual Aid and Resource Management Initiative.

2.3.5 U.S. Government Publications. U.S. Government Publishing Office, Superintendent of Documents, Washington, DC 20402.

Emergency Planning and Community Right-to-Know Act, Public Law 99–499, 1986.
Emergency Response Guidebook, U.S. Department of Transportation, 2012 edition.
FBI Bomb Data Center, Special Technicians Bulletin 2010-1, A Model for Bomb Squad Standard Operating Procedures, July 22, 2011.
Title 6, Code of Federal Regulations, Part 27, "Chemical Facility Anti-Terrorism Standards."
Title 10, Code of Federal Regulations, Parts 1–199, "Nuclear Regulatory Commission."
Title 10, Code of Federal Regulations, Parts 1500–1508, "Council on Environmental Quality."
Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation."
Title 10, Code of Federal Regulations, Part 20.1201–1208, "Occupational Dose Limits."
Title 10, Code of Federal Regulations, Part 20.1301–1302, "Radiation Dose Limits for Individual Members of the Public."
Title 10, Code of Federal Regulations, Part 20.1601–1602, "Control of Exposure from External Sources in Restricted Areas."
Title 10, Code of Federal Regulations, Part 20.1901–1906, "Precautionary Procedures."

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Title 10, Code of Federal Regulations, Part 20 Appendix B, "Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage."
Title 10, Code of Federal Regulations, Part 20 Appendix G, "Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests."
Title 10, Code of Federal Regulations, Part 50, "Domestic Licensing of Production and Utilization Facilities."
Title 10, Code of Federal Regulations, Part 50.47, "Emergency Plans."
Title 10, Code of Federal Regulations, Part 50.54(q), "Evacuation Processes."
Title 10, Code of Federal Regulations, Part 50 Annex E, "Emergency Planning and Preparedness for Production and Utilization Facilities."
Title 18, U.S. Code, Section 2332a, "Use of Weapons of Mass Destruction."
Title 29, Code of Federal Regulations, Part 1910, "Occupational Safety and Health Standards."
Title 29, Code of Federal Regulations, Part 1910.120, "Hazardous Waste Operations and Emergency Response."
Title 29, Code of Federal Regulations, Part 1910.120(f), "Medical Surveillance."
Title 29, Code of Federal Regulations, Part 1910.120(q), "Emergency Response Program to Hazardous Substance Releases."
Title 29, Code of Federal Regulations, Part 1910.120, Appendix E, "Training Curriculum Guidelines — (Non-mandatory)."
Title 29, Code of Federal Regulations, Part 1910.134, "Respiratory Protection."
Title 29, Code of Federal Regulations, Part 1910.134(c), "Respiratory Protection Program."
Title 29, Code of Federal Regulations, Part 1910.146, "Permit-Required Confined Spaces."
Title 29, Code of Federal Regulations, Part 1910.147, "Control of Hazardous Energy."
Title 29, Code of Federal Regulations, Part 1910.151(c), "Medical Services and First Aid."
Title 29, Code of Federal Regulations, Part 1910.1020, "Access to Employee Exposure and Medical Records."
Title 29, Code of Federal Regulations, Part 1910.1020(d), "Preservation of Records."
Title 29, Code of Federal Regulations, Part 1910.1030, "Blood-Borne Pathogens."
Title 29, Code of Federal Regulations, Part 1910.1200, "Hazard Communications."
Title 29, Code of Federal Regulations, Part 1915, "Occupational Safety and Health Standards for Shipyard Employment."
Title 29, Code of Federal Regulations, Part 1926, "Occupational Safety and Health Standards for Construction."
Title 29, Code of Federal Regulations, Part 1926.65, "Hazardous Waste Operations and Emergency Response."
Title 29, Code of Federal Regulations, Part 1928, "Safety and Health Standards for Agriculture."
Title 33, Code of Federal Regulations, Part 104, "Maritime Security: Vessels."
Title 40, Code of Federal Regulations, "Protection of Environment."
Title 40, Code of Federal Regulations, Part 68, "Chemical Accident Prevention Provisions."
Title 40, Code of Federal Regulations, Part 110, "Discharge of Oil."
Title 40, Code of Federal Regulations, Part 112, "Oil Pollution Prevention."
Title 40, Code of Federal Regulations, Part 239–259, "Solid Wastes."
Title 40, Code of Federal Regulations, Part 239–282, "Waste Management."
Title 40, Code of Federal Regulations, Part 260–279, "Hazardous Waste Regulations."
Title 40, Code of Federal Regulations, Part 280, "Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)."
Title 40, Code of Federal Regulations, Part 300, "National Oil and Hazardous Substances Pollution Contingency Plan."
Title 40, Code of Federal Regulations, Part 310, "Reimbursement to Local Governments for Emergency Response to Hazardous Substance Releases."
Title 40, Code of Federal Regulations, Part 311, "Worker Protection."

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Title 40, Code of Federal Regulations, Part 311.2, "Definition of Employee."
Title 40, Code of Federal Regulations, Part 355, "Emergency Planning and Notification."
Title 40, Code of Federal Regulations, Part 355, Appendix A, "List of Extremely Hazardous Substances and Their Threshold Planning Quantities."
Title 40, Code of Federal Regulations, Part 370, "Hazardous Chemical Reporting: Community Right-to-Know."
Title 40, Code of Federal Regulations, Part 372, "Toxic Chemical Release Reporting: Community Right-to-Know."
Title 49, Code of Federal Regulations, Part 40, "Transportation."
Title 49, Code of Federal Regulations, Part Subpart B, "Oil Transportation."
Title 49, Code of Federal Regulations, Part 130, "Oil Spill Prevention and Response Plans."
Title 49, Code of Federal Regulations, Subpart C, "Hazardous Materials Regulations."
Title 49, Code of Federal Regulations, Part 171, "General Information, Regulations, and Definitions."
Title 49, Code of Federal Regulations, Part 172, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans."
Title 49, Code of Federal Regulations, Part 173, "General Requirements for Shipments and Packaging."
Title 49, Code of Federal Regulations, Part 174, "Carriage by Rail."
Title 49, Code of Federal Regulations, Part 175, "Carriage by Aircraft."
Title 49, Code of Federal Regulations, Part 176, "Carriage by Vessel."
Title 49, Code of Federal Regulations, Part 177, "Carriage by Public Highway."
Title 49, Code of Federal Regulations, Part 178, "Specifications for Packaging."
Title 49, Code of Federal Regulations, Part 179, "Specifications for Tank Cars."
Title 49, Code of Federal Regulations, Part 180, "Continuing Qualification and Maintenance of Packaging."
Title 49, Code of Federal Regulations, Subpart D, "Pipeline Safety."
Title 49, Code of Federal Regulations, Part 193, "Liquefied Natural Gas Facilities: Federal Safety Standards."
Title 49, Code of Federal Regulations, Part 194, "Response Plans for Onshore Oil Pipelines."
Title 49, Code of Federal Regulations, Part 195, "Transportation of Hazardous Liquids by Pipelines."

2.3.6 Other Publications. *Merriam-Webster's Collegiate Dictionary,* 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Recommended Sections. (Reserved)

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3 Definitions

3.1 General.

The definitions contained in this chapter apply to the terms used in this recommended practice. Where terms are not defined in this chapter or within another chapter, they should be defined using their ordinarily accepted meanings within the context in which they are used. Merriam-Webster's Collegiate Dictionary, 11th edition, should be used as the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

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 AHJ 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 AHJ 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.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

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 police chief, sheriff, 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.

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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.

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.

3.2.4 Recommended Practice. A document that is similar in content and structure to a code or standard but that contains only nonmandatory provisions using the word "should" to indicate recommendations in the body of the text.

3.2.5 Shall. Indicates a mandatory requirement.

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

3.2.7 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1* Allied Professional. That person who possesses the knowledge, skills, and technical competence to provide assistance in the selection, implementation, and evaluation of tasks at a hazardous materials/weapons of mass destruction (WMD) incident.

A.3.3.1 Allied Professional. Examples include certified safety professional (CSP), certified health physicist (CHP), certified industrial hygienist (CIH), radiation safety officer (RSO) or similar credentialed or competent individuals as determined by the authority having jurisdiction (AHJ). An allied professional can also be referred to as a technical specialist or subject matter expert (SME) in a mission-specific area.

3.3.2 Analyze. To identify a hazardous materials/weapons of mass destruction (WMD) problem and determine likely behavior and harm within the training and capabilities of the emergency responder.

3.3.3 Area of Specialization.

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

3.3.3.2 Organization's Area of Specialization. Any chemicals or containers used by the specialist employee's employer.

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

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3.3.5 CANUTEC. The Canadian Transport Emergency Centre, operated by Transport Canada, that provides emergency response information and assistance on a 24-hour basis for responders to hazardous materials/weapons of mass destruction (WMD) incidents.

3.3.6 CHEMTREC. A public service of the American Chemistry Council, that provides emergency response information and assistance on a 24-hour basis for responders to hazardous materials/weapons of mass destruction (WMD) incidents.

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

3.3.8* 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.

A.3.3.8 Confined Space. Additionally, a confined space is further defined as having one or more of the following characteristics:

(1) The area contains or has the potential to contain a hazardous atmosphere, including an oxygen-deficient atmosphere.
(2) The area contains a material with the 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.

3.3.9 Consensus Standard. A standard that has been adopted and promulgated by a nationally recognized standards-producing organization under procedures whereby it can be determined that persons interested and affected by the scope or provisions of the standard have reached substantial agreement on its adoption; was formulated in a manner that afforded an opportunity for diverse views to be considered; and has been designated as such.

3.3.10 Container. A receptacle, pipe, or pipeline used for storing or transporting material of any kind; synonymous with "packaging" in transportation.

3.3.11 Contaminant. A hazardous material, or the hazardous component of a weapon of mass destruction (WMD), 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.

3.3.12 Contamination. The process of transferring a hazardous material, or the hazardous component of a weapon of mass destruction (WMD), from its source to people, animals, the environment, or equipment which can act as a carrier.

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

3.3.13 Control. The procedures, techniques, and methods used in the mitigation of hazardous material/weapons of mass destruction (WMD) incidents, including containment, extinguishment, and confinement.

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

3.3.13.2 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).

3.3.13.3 Extinguishment. To cause to cease burning.

3.3.14* Control Zones. The areas at hazardous materials/weapons of mass destruction incidents within an established perimeter that are designated based upon safety and the degree of hazard.

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A.3.3.14 Control Zones. Law enforcement agencies might utilize different terminology for site control, for example, *inner* and *outer perimeters* as opposed to *hot* and *cold zones*. The operations level responder should be familiar with the terminology and procedures used by the authority having jurisdiction (AHJ) and coordinate on-scene site control operations with law enforcement.

Many terms are used to describe these control zones; however, for the purposes of this standard, zones are defined as the hot, warm, and cold zones.

3.3.14.1 Cold Zone. The control zone of hazardous materials/weapons of mass destruction incidents that contains the incident command post and such other support functions as are deemed necessary to control the incident.

3.3.14.2 Decontamination Corridor. The area usually located within the warm zone where decontamination is performed.

3.3.14.3 Hot Zone. The control zone immediately surrounding hazardous materials/weapons of mass destruction (WMD) incidents, which extends far enough to prevent adverse effects of hazards to personnel outside the zone and where only personnel who are trained, equipped, and authorized to do assigned work are permitted to enter.

3.3.14.4* Warm Zone. The control zone at hazardous materials/weapons of mass destruction (WMD) incidents where personnel and equipment decontamination and hot zone support takes place.

A.3.3.14.4 Warm Zone. The warm zone includes control points for the decontamination corridor, thus helping to reduce the spread of contamination. This support can include staging of backup personnel and equipment, staging of evidence, and personnel and equipment decontamination. Additionally, portions of this area can be used as a safe refuge for initial patient evacuation and triage.

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

3.3.16 Decision Point. A predefined circumstance in which the emergency responder is required to determine a path forward to maximize responder safety and public protection.

3.3.17* Decontamination. The physical and/or chemical process of reducing and preventing the spread of contaminants from people, animals, the environment, or equipment involved at hazardous materials/weapons of mass destruction (WMD) incidents.

A.3.3.17 Decontamination. There are three types of decontamination (also known as "decon") performed by emergency responders: emergency, mass, and technical.
Gross decontamination is performed on the following:

(1) Team members before their technical decontamination
(2) Emergency responders before leaving the incident scene
(3) Victims during emergency decontamination
(4) Persons requiring mass decontamination

3.3.17.1* 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.

A.3.3.17.1 Emergency Decontamination. This process can be as simple as removal of outer or all garments from the individual to washing down with water from a fire hose or emergency safety shower. The sole purpose is to quickly separate as much of the contaminant as possible from the individual to minimize exposure and injury.

3.3.17.2* Gross Decontamination. The phase of the decontamination process during which the amount of surface contaminants is significantly reduced.

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A.3.3.17.2 Gross Decontamination. Victims of a hazardous material release that is potentially life threatening due to continued exposure from contamination are initially put through a gross decontamination, which will significantly reduce the amount of additional exposure. This is usually accomplished by mechanical removal of the contaminant or initial rinsing from handheld hose lines, emergency showers, or other nearby sources of water. Responders operating in a contaminated zone in personal protective equipment (PPE) are put through gross decontamination, which will make it safer for them to remove the PPE without exposure and for members assisting them.

3.3.17.3* Mass Decontamination. The physical or chemical process of reducing, removing or neutralizing surface contaminants from large numbers of victims in potentially life-threatening situations in the fastest time possible.

A.3.3.17.3 Mass Decontamination. Mass decontamination is initiated where the number of victims and time constraints do not allow the establishment of an in-depth decontamination process. Mass decontamination should be established at once to reduce the harm being done to the victims by the contaminants. Initial operations are most often performed with handheld hose lines or master streams supplied from fire apparatus while a more formal process is being set up. A formal technical decontamination might be necessary if it is determined through detection, observation, or concern that the initial emergency decontamination was not effective. For example, this could be the case for victims exposed to a radiological dispersal device (RDD) or an aerosolized biological agent.

3.3.17.4* Technical Decontamination. The planned and systematic process of reducing contamination to a level that is as low as reasonably achievable.

A.3.3.17.4 Technical Decontamination. Technical decontamination is the process subsequent to gross decontamination designed to remove contaminants from responders, their equipment, and victims. It is intended to minimize the spread of contamination and ensure responder safety. Technical decontamination is normally established in support of emergency responder entry operations at a hazardous materials incident, with the scope and level of technical decontamination based on the type and properties of the contaminants involved. In non life-threatening contamination incidents, technical decontamination can also be used on victims of the initial release. Examples of technical decontamination methods are the following:

(1) Absorption
(2) Adsorption
(3) Chemical degradation
(4) Dilution
(5) Disinfecting
(6) Evaporation
(7) Isolation and disposal
(8) Neutralization
(9) Solidification
(10) Sterilization
(11) Vacuuming
(12) Washing

The specific decontamination procedure to be used at an incident is typically selected by a hazardous materials technician (*see 7.3.4 of NFPA 472*) and is subject to the approval of the incident commander.

3.3.18 Degradation. (1) A chemical action involving the molecular breakdown of a protective clothing material or equipment due to contact with a chemical. (2) The molecular breakdown of the spilled or released material to render it less hazardous during control operations.

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3.3.19* Demonstrate. To show by actual performance.

A.3.3.19 Demonstrate. This performance can be supplemented by simulation, explanation, illustration, or a combination of these.

3.3.20 Describe. To explain verbally or in writing using standard terms recognized by the hazardous materials/weapons of mass destruction (WMD) response community.

3.3.21 Detection and Monitoring Equipment. Instruments and devices used to detect, classify, or quantify materials.

3.3.22 Dispersal Device. Any weapon or combination of mechanical, electrical or pressurized components that is designed, intended or used to cause death or serious bodily injury through the release, dissemination or impact of toxic or poisonous chemicals or their precursors, biological agent, toxin or vector or radioactive material.

3.3.23 Emergency Response Guidebook (ERG). A reference book, written in plain language, to guide emergency responders in their initial actions at the incident scene, specifically the *Emergency Response Guidebook* from the U.S. Department of Transportation; Transport Canada; and the Secretariat of Transportation and Communications, Mexico.

3.3.24 Endangered Area. The actual or potential area of exposure associated with the release of a hazardous material/weapon of mass destruction (WMD).

3.3.25 Evaluate. The process of assessing or judging the effectiveness of a response operation or course of action within the training and capabilities of the emergency responder.

3.3.26 Example. An illustration of a problem serving to show the application of a rule, principle, or method (e.g., past incidents, simulated incidents, parameters, pictures, and diagrams).

3.3.27* Exposure. The process by which people, animals, the environment, and equipment are subjected to or come in contact with a hazardous material/weapon of mass destruction (WMD).

A.3.3.27 Exposure. The magnitude of exposure is dependent primarily on 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 can be external, internal, or both.

3.3.28 Exposures. The people, animals, environment, property, and equipment that might potentially become exposed at a hazardous materials/weapons of mass destruction (WMD) incident.

3.3.29* Fissile Material. Material whose atoms are capable of sustained nuclear fission (capable of being split).

A.3.3.29 Fissile Material. Department of Transportation (DOT) regulations define fissile material as plutonium-239, plutonium-242, uranium-233, uranium-235, or any combination of these radionuclides. This material is usually transported with additional shipping controls that limit the quantity of material in any one shipment. Packaging used for fissile material is designed and tested to prevent a fission reaction from occurring during normal transport conditions as well as hypothetical accident conditions.

3.3.30 Fusion Center. A focal point within the state and local environment for the receipt, analysis, gathering, and sharing of threat-related information between the federal government and state, local, tribal, territorial (SLTT), and private sector partners.

3.3.31 Harm. Adverse effect created by being exposed to a hazard.

3.3.32 Hazard. Capable of causing harm or posing an unreasonable risk to health, safety, or the environment.

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3.3.33* Hazardous Material. Matter (solid, liquid, or gas) or energy that when released is capable of creating harm to people, the environment, and property, including weapons of mass destruction (WMD) as defined in 18 U.S. Code, 2332a, as well as any other criminal use of hazardous materials, such as illicit labs, environmental crimes, or industrial sabotage.

A.3.3.33 Hazardous Material. In United Nations model codes and regulations, hazardous materials are called dangerous goods. [*See also 3.3.71 and A.3.3.71, Weapons of Mass Destruction (WMD)*].

3.3.34* Hazardous Materials Branch/Group. The function within an overall incident management system that deals with the mitigation and control of the hazardous materials/weapons of mass destruction (WMD) portion of an incident.

A.3.3.34 Hazardous Materials Branch/Group. This function is directed by a hazardous materials officer and deals principally with the technical aspects of the incident.

3.3.35* Hazardous Materials Officer. The person who is responsible for directing and coordinating all operations involving hazardous materials/weapons of mass destruction (WMD) as assigned by the incident commander (IC).

A.3.3.35 Hazardous Materials Officer. This individual might also serve as a technical specialist for incidents that involve hazardous materials/WMD. The National Incident Management System (NIMS) identifies this person as the Hazardous Materials Branch/Group Supervisor.

3.3.36 Hazardous Materials Response Program (HMRP). A program designed to manage emergency preparedness issues (i.e., planning, prevention, response, recovery) associated with hazardous materials/weapons of mass destruction (WMD) within a jurisdiction.

3.3.37* Hazardous Materials Response Team (HMRT). An organized group of trained response personnel operating under an emergency response plan and applicable standard operating procedures who perform hazardous material technician level skills at hazardous materials/weapons of mass destruction (WMD) incidents.

A.3.3.37 Hazardous Materials Response Team (HMRT). The team members respond to releases or potential releases of hazardous materials/WMD for the purpose of control or stabilization of the incident.

3.3.38* Hazardous Materials Safety Officer. The person who works within an incident management system (IMS) (specifically, the hazardous materials branch/group) to ensure that recognized hazardous materials/weapons of mass destruction (WMD) safe practices are followed at hazardous materials/WMD incidents.

A.3.3.38 Hazardous Materials Safety Officer. The hazardous materials safety officer will be called on to provide technical advice or assistance regarding safety issues to the hazardous materials officer and incident safety officer at a hazardous materials/WMD incident. The National Incident Management System (NIMS) identifies this person as the Hazardous Materials Branch/Group Supervisor.

3.3.39* Hazardous Materials Technician. Person who responds to hazardous materials/weapons of mass destruction (WMD) incidents using a risk-based response process by which they analyze a problem involving hazardous materials/WMD, plan a response to the problem, implement the planned response, evaluate progress of the planned response to the problem, and assist in terminating the incident.

A.3.3.39 Hazardous Materials Technician. These persons might have additional competencies that are specific to their response mission, expected tasks, and equipment and training as determined by the AHJ.

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

A.3.3.39.1 Hazardous Materials Technician with a Cargo Tank Specialty. The hazardous materials technicians are expected to use specialized chemical-protective clothing and specialized control equipment.

3.3.39.2 Hazardous Materials Technician with a Flammable Gases Bulk Storage Specialty. Person who, in incidents involving flammable gas bulk storage tanks, provide support to the hazardous materials technician and other personnel, provide strategic 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 resources.

3.3.39.3 Hazardous Materials Technician with a Flammable Liquids Bulk Storage Specialty. Person who, in incidents involving bulk flammable liquid storage tanks and related facilities, provides support to the hazardous materials technician and other personnel, provides strategic and tactical recommendations to the on-scene incident commander, provides oversight for fire control and product removal operations, and acts as a liaison between technicians, response personnel, and outside resources.

3.3.39.4 Hazardous Materials Technician with a Marine Tank and Non-tank Vessel Specialty. Person who provides technical support pertaining to marine tank and non-tank vessels, provides oversight for product removal and movement of damaged marine tank and non-tank vessels, and acts as a liaison between the hazardous materials technician and other outside resources.

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

A.3.3.39.5 Hazardous Materials Technician with an Intermodal Tank Specialty. See A.3.3.39.1.

3.3.39.6 Hazardous Materials Technician with a Radioactive Materials Specialty. Person who provides support to the hazardous materials technician and other personnel, uses radiation detection instruments, manages the control of radiation exposure, conducts hazards assessment, and acts as a liaison between hazardous materials technicians at incidents involving radioactive materials.

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

A.3.3.39.7 Hazardous Materials Technician with a Tank Car Specialty. See A.3.3.39.1.

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

3.3.41 Incident. An emergency involving the release or potential release of hazardous materials/weapons of mass destruction (WMD).

3.3.42* Incident Commander (IC). The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and the release of resources.

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A.3.3.42 Incident Commander (IC). This position is equivalent to the on-scene incident commander as defined in OSHA 1910.120(8), "Hazardous Waste Operations and Emergency Response." The IC has overall authority and responsibility for conducting incident operations and is responsible for the management of all incident operations at the incident site.

3.3.43 Incident Command System (ICS). A specific component of an incident management system (IMS) designed to enable effective and efficient on-scene incident management by integrating organizational functions, tactical operations, incident planning, incident logistics, and administrative tasks within a common organizational structure.

3.3.44* Incident Management System (IMS). A process 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 to include the incident command system (ICS), unified command, multi-agency coordination system, training, and management of resources.

A.3.3.44 Incident Management System (IMS). The IMS provides a consistent approach for all levels of government, private sector, and volunteer organizations to work effectively and efficiently together to prepare for, respond to, and recover from domestic incidents, regardless of cause, size, or complexity. An IMS provides for interoperability and compatibility among all capability levels of government, the private sector, and volunteer organizations. The IMS includes a core set of concepts, principles, terminology, and technologies covering the incident command system, multiagency coordination systems, training, and identification and management of resources.

3.3.45 Laws. Legislative action by governmental bodies such as Congress, individual states, and local government that provides broad goals and objectives, sets mandatory dates for compliance, and establishes penalties for noncompliance.

3.3.46 Match. To provide with a counterpart.

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

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.

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

3.3.50* Personal Protective Equipment (PPE). The protective clothing and respiratory protective equipment provided to shield or isolate a person from the hazards encountered at hazardous materials/weapons of mass destruction (WMD) incidents operations.

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.

3.3.51 Plan.

3.3.51.1* Emergency Response Plan. A plan developed by the authority having jurisdiction (AHJ) with the cooperation of all participating agencies and organizations, including a jurisdiction with emergency responsibilities and those outside jurisdictions who have entered into response/support agreements, that identifies goals and objectives for that emergency type, agency roles, and overall strategies.

A.3.3.51.1 Emergency Response Plan. Emergency response plans can be developed at organizational and governmental levels (agency, local, state, regional, provincial, territorial, tribal, and federal).

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3.3.51.2* Incident Action Plan. An oral or written plan approved by the incident commander containing general objectives reflecting the overall strategy for managing an incident.

A.3.3.51.2 Incident Action Plan. It can include the identification of operational resources and assignments. It can also include attachments that provide direction and important information for management of the incident during one or more operational periods.

3.3.51.3 Site Safety and Control Plan. A site-specific tactical document used by the hazardous materials branch under the incident command system (ICS) to organize information important to hazardous materials response operations.

3.3.52* Planned Response. The incident action plan, with the site safety and control plan, consistent with the emergency response plan and/or standard operating procedures for a specific hazardous material/weapon of mass destruction (WMD) incident.

A.3.3.52 Planned Response. The following site safety plan considerations are from the EPA's *Standard Operating Safety Guides*:

(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

3.3.53 Predict. The process of estimating or forecasting the future behavior of a hazardous materials/weapons of mass destruction (WMD) container and/or its contents within the training and capabilities of the emergency responder.

3.3.54 Productivity and Quality of Life. A multidimensional concept that includes domains related to physical, mental, emotional, and social functioning and focuses on the impact that health status has on quality of life.

3.3.55* Protective Clothing. Equipment designed to protect the wearer from thermal hazards, hazardous materials, or the hazardous component of a weapon of mass destruction (WMD) contacting the skin or eyes.

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

3.3.55.1 Ballistic Protective Clothing (BPC). An item of personal protective equipment (PPE) that provides protection against specific ballistic threats by helping to absorb the impact and reduce or prohibit penetration to the body from bullets and steel fragments from handheld weapons and exploding munitions.

3.3.55.2* Chemical-Protective Clothing (CPC). The ensemble elements (garment, gloves, and footwear) provided to shield or isolate a person from the hazards encountered during hazardous materials/WMD incident operations.

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A.3.3.55.2 Chemical-Protective Clothing. Chemical-protective clothing (garments) can be constructed as a single- or multi-piece 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.

3.3.55.2.1* Liquid Splash–Protective Ensemble. Multiple elements of compliant protective clothing and equipment that when worn together provide protection from some, but not all, risks of hazardous materials/WMD emergency incident operations involving liquids.

A.3.3.55.2.1 Liquid Splash–Protective Ensemble. This type of protective clothing is a component of EPA Level B chemical protection. Liquid splash–protective ensembles should meet the requirements of NFPA 1992.

3.3.55.2.2* Vapor-Protective Ensemble. Multiple elements of compliant protective clothing and equipment that when worn together provide protection from some, but not all, risks of vapor, liquid-splash, and particulate environments during hazardous materials/WMD incident operations.

A.3.3.55.2.2 Vapor-Protective Ensemble. This type of protective clothing is a component of EPA Level A chemical protection. Vapor-protective clothing should meet the requirements of NFPA 1991 or NFPA 1994.

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

A.3.3.55.3 High Temperature–Protective Clothing. This type of clothing is usually of limited use in dealing with chemical commodities.

3.3.55.4* Structural Fire-Fighting Protective Clothing. The fire-resistant protective clothing normally worn by fire fighters during structural fire-fighting operations, which includes a helmet, coat, pants, boots, gloves, PASS device, and a fire-resistant hood to cover parts of the head and neck not protected by the helmet and respirator facepiece.

A.3.3.55.4 Structural Fire-Fighting Protective Clothing. Structural fire-fighting protective clothing provides limited protection from heat but might not provide adequate protection from the harmful gases, vapors, liquids, or dusts that are encountered during hazardous materials/WMD incidents. The NFPA 1971 CBRN option is intended to add chemical protection to structural fire-fighting protective clothing.

3.3.56 Qualified. Having knowledge of the installation, construction, or operation of apparatus and the hazards involved.

3.3.57* Radioactive Materials Containers. Excepted packaging, industrial packaging, Type A, Type B, and Type C packaging for radioactive materials.

A.3.3.57 Radioactive Materials Containers. *Excepted packaging* is used to transport materials with extremely low levels of radioactivity that meet only general design requirements for any hazardous material. Excepted packaging ranges from a product's fiberboard box to a sturdy wooden or steel crate, and typical shipments include limited quantities of materials, instruments, and articles such as smoke detectors. Excepted packaging will contain non-life-endangering amounts of radioactive material.

Industrial packaging is used to transport materials that present limited hazard to the public and the environment. Examples of these materials are contaminated equipment and radioactive waste solidified in materials such as concrete. This packaging is grouped into three categories based on the strength of packaging: IP-1, IP-2, and IP-3. Industrial packaging will contain non-life-endangering amounts of radioactive material.

Type A packaging is used to transport radioactive materials with concentrations of radioactivity not exceeding the limits established in 49 CFR 173.431. Typically, Type A packaging

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has an inner containment vessel made of glass, plastic, or metal and packing material made of polyethylene, rubber, or vermiculite. Examples of materials shipped in Type A packaging include radiopharmaceuticals and low-level radioactive wastes. Type A packaging will contain non-life-endangering amounts of radioactive material.

Type B packaging is used to transport radioactive materials with radioactivity levels higher than those allowed in Type A packaging, such as spent fuel and high-level radioactive waste. Limits on activity contained in Type B packaging are provided in 49 CFR 173.431. Type B packaging ranges from small drums [55 gal (208 L)] to heavily shielded steel casks that sometimes weigh more than 138 tons (125 metric tons). Type B packaging can contain potentially life endangering amounts of radioactive material.

Type C packaging is used for consignments transported by aircraft of high-activity radioactive materials that have not been certified as "low dispersible radioactive material" (including plutonium). They are designed to withstand severe accident conditions associated with air transport without loss of containment or significant increase in external radiation levels. The Type C packaging performance requirements are significantly more stringent than those for Type B packaging. Type C packaging is not authorized for domestic use but can be authorized for international shipments of high-activity radioactive material consignments. Regulations require that both Type B and Type C packaging be marked with a trefoil symbol to ensure that the package can be positively identified as carrying radioactive material. The trefoil symbol must be resistant to the effects of both fire and water so that it is likely to survive a severe accident and serve as a warning to emergency responders.

The performance requirements for Type C packaging include those applicable to Type B packaging with enhancements on some tests that are significantly more stringent than those for Type B packaging. For example, a 200 mph (321.8 km/hr) impact onto an unyielding target is required instead of the 30 ft (9.1 m) drop test required for Type B packaging; a 60-minute fire test is required instead of the 30-minute test for Type B packaging; and a puncture/tearing test is required. These stringent tests are expected to result in packaging designs that will survive more severe aircraft accidents than Type B packaging designs.

3.3.58 Regulations. Official rules created by government agencies that detail how something should be done.

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

A.3.3.59 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

3.3.60* Response. That portion of incident management in which personnel are involved in controlling hazardous materials/weapons of mass destruction (WMD) incidents.

A.3.3.60 Response. The tasks in the response portion of a hazardous materials/WMD incident include analyzing the incident, planning the response, implementing the planned response, evaluating progress, and terminating the emergency phase of the incident.

3.3.61 Risk-Based Response Process. Systematic process by which responders analyze a problem involving hazardous materials/weapons of mass destruction (WMD), assess the hazards, evaluate the potential consequences, and determine appropriate response actions based upon facts, science, and the circumstances of the incident.

3.3.62* Safety Data Sheet (SDS). Formatted information provided by chemical manufacturers and distributors of hazardous products about chemical composition, physical and chemical properties, health and safety hazards, emergency response, and waste disposal of the material.

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A.3.3.62 Safety Data Sheet (SDS). SDS is a component of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) and replaces the term material safety data sheet (MSDS). GHS is an internationally agreed-upon system created by the United Nations beginning in 1992. It replaces the various classification and labeling standards used in different countries by using consistent criteria on a global level. It supersedes the relevant European Union (EU) system, which implemented the GHS into EU law as the Classification, Labelling and Packaging (CLP) Regulation, and United States Occupational Safety and Health Administration (OSHA) standards. The SDS requires more information than MSDS regulations and provides a standardized structure for presenting the required information.

3.3.63 Scenario. A sequence or synopsis of actual or imagined events used in the field or classroom to provide information necessary to meet student competencies; can be based upon threat assessment.

3.3.64 SETIQ. The Emergency Transportation System for the Chemical Industry in Mexico that provides emergency response information and assistance on a 24-hour basis for responders to emergencies involving hazardous materials/weapons of mass destruction (WMD).

3.3.65 Specialist Employees.

3.3.65.1* 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.

A.3.3.65.1 Specialist Employee A. Consistent with the organization's emergency response plan and/or standard operating procedures, the specialist employee A is able to analyze an incident involving chemicals within the 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. 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/WMD in their organization's area of specialization, they could be called on to provide technical advice or assistance to the incident commander relative to specific chemicals or containers for chemicals. Specialist employees should receive training or demonstrate competency in their area of specialization annually. Specialist employees also should receive additional training to meet applicable DOT, OSHA, EPA, and other appropriate state, local, or provincial occupational health and safety regulatory requirements. Specialist employees respond to hazardous materials/WMD incidents under differing 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 members of a hazardous materials response team or as specialist employees as outlined in this definition and in Chapter 9. When responding to incidents away from their assigned work area, specialist employees should be permitted to perform only at the response level at which they have been trained.

Persons responding to a hazardous materials/WMD 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 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.

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3.3.65.2* Specialist Employee B. That person who, in the course of his or her regular job duties, works with or is trained in the hazards of specific chemicals or containers within the individual's area of specialization.

A.3.3.65.2 Specialist Employee B. Because of the employee's education, training, or work experience, the specialist employee B can be called on to respond to incidents involving specific chemicals or containers. The 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/or standard operating procedures and the emergency response plan. *See 3.3.51.1.*

3.3.65.3* Specialist Employee C. That person who responds to emergencies involving chemicals and/or containers within the organization's area of specialization.

A.3.3.65.3 Specialist Employee C. Consistent with the organization's emergency response plan and/or standard operating procedures, the specialist employee C can be called on to gather and record information, provide technical advice, and/or arrange for technical assistance. A specialist employee C does not enter the hot or warm zone at an emergency. *See 3.3.14.*

3.3.66 Stabilization. The point in an incident when the adverse behavior of the hazardous material, or the hazardous component of a weapon of mass destruction (WMD), is controlled.

3.3.67 Standard Operating Guidelines (SOG). A written directive that establishes recommended strategies/concepts of emergency response to an incident.

3.3.68 Standard Operating Procedure (SOP). A written directive that establishes specific operational or administrative methods to be followed routinely for the performance of a task or for the use of equipment.

3.3.69* Termination. That portion of incident management after the cessation of tactical operations in which personnel are involved in documenting safety procedures, site operations, hazards faced, and lessons learned from the incident.

A.3.3.69 Termination. Termination is divided into three phases: debriefing the incident, post incident analysis, and critiquing the incident.

3.3.70* UN/NA Identification Number. The four-digit number assigned to a hazardous material/weapon of mass destruction (WMD), that is used to identify and cross-reference products in the transportation mode.

A.3.3.70 UN/NA Identification Number. United Nations (UN) numbers are four-digit numbers used in international commerce and transportation to identify hazardous chemicals or classes of hazardous materials. These numbers generally range between 0000 and 3500 and usually are preceded by the letters "UN" (e.g., "UN1005") to avoid confusion with number codes.

North American (NA) numbers are identical to UN numbers. If a material does not have a UN number, it might be assigned an NA number. These usually are preceded by "NA" followed by a four-digit number starting with 8 or 9.

3.3.71* Weapon of Mass Destruction (WMD). (1) Any destructive device, such as any explosive, incendiary, or poison gas bomb, grenade, rocket having a propellant charge of more than 4 oz (113 grams), missile having an explosive or incendiary charge of more than .25 oz (7 grams), mine, or similar device; (2) any weapon involving toxic or poisonous chemicals; (3) any weapon involving a disease organism; or (4) any weapon that is designed to release radiation or radioactivity at a level dangerous to human life.

A.3.3.71 Weapon of Mass Destruction (WMD). The source of this definition is 18 USC, 2332a. Weapons of mass destruction (WMD) are known by many different abbreviations and

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acronyms, the most common of which is CBRN, which is the acronym for chemical, biological, and radiological/nuclear, and explosives particulate agents that could be released as the result of a terrorist attack. CBRN agents are further categorized as follows:

(1) *Chemical terrorism agents* are materials used to inflict lethal or incapacitating casualties, generally on a civilian population, and include chemical warfare agents and toxic industrial chemicals:
   (a) *Chemical warfare agents* are solid, liquid, gaseous, and vapor agents, including, but not limited to, GB (Sarin), GD (Soman), HD (sulfur mustard), and VX.
   (b) *Toxic industrial chemicals* include chlorine and ammonia, which have been identified as mass casualty threats.
(2) *Biological terrorism agents* are liquid or particulate agents that can consist of a biologically derived toxin or pathogen to inflict lethal or incapacitating casualties, such as bacteria, viruses, or the toxins derived from biological material.
(3) *Radiological particulate terrorism agents* are particles that emit ionizing radiation in excess of normal background levels used to inflict lethal or incapacitating casualties, generally on a civilian population, as the result of a terrorist attack.

3.3.71.1* Radiological Weapons of Mass Destruction.

A.3.3.71.1 Radiological Weapons of Mass Destruction The intent of this annex material is to provide information on the different types of radiological/nuclear devices that can be used as a weapon by those with malicious intent.

3.3.71.1.1* Improvised Nuclear Device (IND). An illicit nuclear weapon that is bought, stolen, or otherwise obtained from a nuclear state (that is, a national government with nuclear weapons), or a weapon fabricated from fissile material that is capable of producing a nuclear explosion.

A.3.3.71.1.1 Improvised Nuclear Device (IND) The nuclear explosion from an IND produces extreme heat, powerful shockwaves, and prompt radiation that would be acutely lethal for a significant distance. It also produces potentially lethal radioactive fallout, which could spread and deposit over very large areas. It also produces potentially lethal radioactive fallout, which may spread and deposit over very large areas. A nuclear detonation in an urban area could result in over 100,000 fatalities (and many more injured), massive infrastructure damage, and thousands of square kilometers of contaminated land. If the IND fails to work correctly and does not create a nuclear explosion, then the detonation of the conventional explosives would likely disperse radioactive material like an explosive radiological dispersal device (RDD).

3.3.71.1.2* Radiation Exposure Device (RED). A device intended to cause harm by exposing people to radiation without spreading radioactive material.

A.3.3.71.1.2 Radiation Exposure Device (RED) An RED (used interchangeably with the terms *radiological exposure device* or *radiation emitting device*) is a device consisting of radioactive material, either as a sealed source or as material within some type of container or radiation-generating device that causes harm by exposure to ionizing radiation.

3.3.71.1.3* Radiological Dispersal Device (RDD). A device designed to spread radioactive material through a detonation of conventional explosives or other means.

A.3.3.71.1.3 Radiological Dispersal Device (RDD) An RDD is any device that intentionally spreads radioactive material across an area with the intent to cause harm, without a nuclear explosion occurring. An RDD that uses explosives for spreading or dispersing radioactive material is commonly referred to as a "dirty bomb" or "explosive RDD." Nonexplosive RDDs could spread radioactive material using common items such as pressurized containers, fans, building air-handling systems, sprayers, crop dusters, or even by hand.

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3.4 Operations-Level Responders Definitions.

3.4.1 Mission-Specific Competencies. The knowledge, skills, and judgment needed by operations level responders who have completed the operations level competencies and who are designated by the authority having jurisdiction to perform mission specific tasks, such as decontamination, victim/hostage rescue and recovery, evidence preservation, and sampling.

3.4.2* Operations-Level Responders. Persons who respond to hazardous materials/weapons of mass destruction (WMD) incidents for the purpose of implementing or supporting actions to protect nearby persons, the environment, or property from the effects of the release.

A.3.4.2 Operations Level Responders. The source of this definition is OSHA 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response." These responders can have additional competencies that are specific to their response mission, expected tasks, and equipment and training as determined by the AHJ.

3.4.3 Operations-Level Responders Assigned to Disablement/Disruption of Improvised Explosives Devices (IED), Improvised WMD Dispersal Devices, and Operations at Improvised Explosive Laboratories. Persons, competent at the operations level, who are assigned to interrupt the functioning of improvised explosive devices (IED) and improvised WMD dispersal devices and to conduct operations at improvised explosive laboratories.

3.4.4 Operations-Level Responders Assigned Responsibilities for Biological Response. Persons, competent at the operations level, who, at hazardous materials/weapons of mass destruction (WMD) incidents involving biological materials, are assigned to support the hazardous materials technician and other personnel, provide strategic and tactical recommendations to the on-scene incident commander, serve in a technical specialist capacity to provide technical oversight for operations, and act as a liaison between the hazardous materials technician, response personnel, and other outside resources regarding biological issues.

3.4.5 Operations-Level Responders Assigned Responsibilities for Chemical Response. Persons, competent at the operations level, who, at hazardous materials/weapons of mass destruction (WMD) incidents involving chemical materials, are assigned to support the hazardous materials technician and other personnel, provide strategic and tactical recommendations to the on-scene incident commander, serve in a technical specialist capacity to provide technical oversight for operations, and act as a liaison between the hazardous material technician, response personnel, and other outside resources regarding chemical issues.

3.4.6 Operations-Level Responders Assigned Responsibilities for Radioactive Material Response. Persons, competent at the operations level, who, at hazardous materials/weapons of mass destruction (WMD) incidents involving radioactive materials, are assigned to support the hazardous materials technician and other personnel, provide strategic and tactical recommendations to the on-scene incident commander, serve in a technical specialist capacity to provide technical oversight for operations, and act as a liaison between the hazardous material technician, response personnel, and other outside resources regarding radioactive material issues.

3.4.7 Operations-Level Responders Assigned to Perform Air Monitoring and Sampling. Persons, competent at the operations level, who are assigned to implement air monitoring and sampling operations at hazardous materials/weapons of mass destruction (WMD) incidents.

3.4.8 Operations-Level Responders Assigned to Perform Evidence Preservation and Sampling. Persons, competent at the operations level, who are assigned to preserve forensic evidence, take samples, and/or seize evidence at hazardous materials/weapons of

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mass destruction (WMD) incidents involving potential violations of criminal statutes or governmental regulations.

3.4.9 Operations-Level Responders Assigned to Perform Mass Decontamination. Persons, competent at the operations level, who are assigned to implement mass decontamination operations at hazardous materials/weapons of mass destruction (WMD) incidents.

3.4.10 Operations-Level Responders Assigned to Perform Product Control. Persons, competent at the operations level, who are assigned to implement product control measures at hazardous materials/weapons of mass destruction (WMD) incidents.

3.4.11 Operations-Level Responders Assigned to Perform Technical Decontamination. Persons, competent at the operations level, who are assigned to implement technical decontamination operations at hazardous materials/weapons of mass destruction (WMD) incidents.

3.4.12 Operations-Level Responders Assigned to Perform Victim Rescue/Recovery. Persons, competent at the operations level, who are assigned to rescue and/or recover exposed and contaminated victims at hazardous materials/weapons of mass destruction (WMD) incidents.

3.4.13 Operations-Level Responders Assigned to Respond to Illicit Laboratory Incidents. Persons, competent at the operations level, who, at hazardous materials/weapons of mass destruction (WMD) incidents involving potential violations of criminal statutes specific to the illegal manufacture of methamphetamines, other drugs, or weapons of mass destruction (WMD), are assigned to secure the scene, identify the laboratory/process, and preserve evidence.

3.4.14 Operations-Level Responders Assigned to Use Personal Protective Equipment. Persons, competent at the operations level, who are assigned to use of personal protective equipment at hazardous materials/weapons of mass destruction (WMD) incidents.

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Laws, Regulations, Consensus Standards, and Guidance Documents

4

4.1 Scope.

This chapter applies to those organizations and jurisdictions responsible for organizing, managing, and sustaining a hazardous materials/weapons of mass destruction (WMD) response program (HMRP) and provides information on applicable laws, regulations, consensus standards, and guidance documents that impact each program.

4.1.1 Laws are enacted by legislative action of governmental bodies such as Congress, individual states, and local government. Laws typically provide broad goals and objectives, set mandatory dates for compliance, and establish penalties for noncompliance.

4.1.2 Regulations are official rules created by government agencies that detail how something should be done.

4.1.3 A consensus standard is a standard that has been adopted and promulgated by a nationally recognized standards-producing organization under procedures whereby it can be determined that persons interested and affected by the scope or provisions of the standard have reached substantial agreement on its adoption; was formulated in a manner that afforded an opportunity for diverse views to be considered; and has been designated as such.

4.2 Purpose.

4.3 Laws.

4.3.1 General.

4.3.1.1 Laws are enacted by legislative action of governmental bodies such as Congress, individual states, and local government. Laws typically provide broad goals and objectives, set mandatory dates for compliance, and establish penalties for noncompliance. Subsections 4.3.2 through 4.3.11 provide a brief summary of the provisions of several laws that can impact an HMRP.

4.3.2 Resource Conservation and Recovery Act (RCRA). Passed by Congress in 1976, RCRA establishes a uniform national policy for proper management and disposal of all waste materials. It is intended to provide general oversight to state programs, which can

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be more stringent than RCRA but not less stringent. RCRA establishes the following four major programs:

(1) *Hazardous Waste Management.* Subtitle C establishes a program to manage hazardous waste from "cradle-to-grave" (i.e., from generation to disposal) to protect human health and the environment.
(2) *State and Regional Solid Waste Plans.* Subtitle D encourages states to develop comprehensive plans to manage nonhazardous industrial solid waste and municipal solid waste, sets criteria for municipal solid waste landfills and other solid waste disposal facilities, and prohibits the open dumping of solid waste.
(3) *Regulation of Underground Storage Tanks.* Subtitle I establishes a program for preventing leaks of petroleum products and hazardous substances from underground tanks to groundwater and for cleaning up past leakage. Standards for new tanks and regulations for leak detection and prevention are also addressed.
(4) *Standards for Tracking and Management of Medical Waste*. Subtitle J establishes a program to track medical waste from generation, to disposal.

4.3.3 Clean Air Act (CAA). Passed by Congress in 1970 and last amended in 1990, the CAA authorizes the development of comprehensive federal and state regulations to limit hazardous chemical emissions from both stationary (e.g., production, processing, and storage facilities) and mobile sources. The 1990 amendments established emergency response and planning activities at facilities using hazardous chemicals, a national permitting program, and mandates for making information available to the public.

4.3.3.1 Chemical Accident Prevention Provisions. Section 112(r) of the CAA requires owners and operators of stationary sources that produce, process, or store hazardous substances to identify all hazards associated with an accidental release, design and maintain a safe facility, minimize the consequences of an accidental release, and develop a risk management plan (RMP) to submit to the Environmental Protection Agency (EPA).

4.3.4 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Passed by Congress in 1980, the CERCLA, commonly known as the Superfund, authorizes the EPA to respond to actual or threatened releases of hazardous substances that could endanger public health, public welfare, or the environment; establishes prohibitions and requirements concerning closed and abandoned hazardous waste sites; provides for liability of persons responsible for releases of hazardous waste at these sites; establishes a trust fund to provide for cleanup where no responsible party can be identified; and enables the EPA to force parties responsible for environmental contamination to clean it up or to reimburse the Superfund for response or remediation costs incurred by the EPA.

4.3.5 Superfund Amendments and Reauthorization Act (SARA). Passed by Congress in 1986 to amend CERCLA, SARA revises various sections of CERCLA. SARA addresses hazardous material releases and cleanup of inactive hazardous waste disposal sites; requires National Response Center notification by parties responsible for releases above reportable quantity (RQ) levels; and requires development of safety standards for work groups that handle or respond to chemical emergencies. Key provisions of SARA include the following:

(1) *Provisions Relating Primarily to Response and Liability.* SARA Title I required OSHA to develop health and safety standards for worker groups that handle or respond to chemical emergencies and led to the development of 29 CFR 1910.120.
(2) *Emergency Planning and Community Right-to-Know Act (EPCRA).* SARA Title III, or EPCRA, is designed to improve community access to information about chemical hazards and to facilitate the development of chemical emergency response plans. EPCRA establishes emergency planning and community right-to-know reporting on hazard and toxic chemicals to help increase the public's knowledge and access to information at individual facilities, including information on the uses of any hazardous or toxic chemicals

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and any release of hazardous or toxic chemical into the environment. EPCRA led to the establishment of State Emergency Response Commissions (SERCs) and Local Emergency Planning Committees (LEPCs). Key provisions of EPCRA include the following:

(a) *Sections 301–303: Emergency Planning.* These sections require state and local governments to prepare chemical emergency response plans, review them annually, and establish SERCs and LEPCs to oversee and coordinate planning efforts.
(b) *Section 304: Emergency Release Notification.* This section requires notification by facilities that store, produce, or use a hazardous chemical (i.e., any chemical that is a physical or health hazard) of any release of an RQ of a substance contained in either of the following two tables published by the EPA in the Code of Federal Regulations:

i. List of extremely hazardous substances (EHS)
ii. List of CERCLA hazardous substances

(3) *Sections 311–312: Community Right-to-Know.* The data required by these sections increases public knowledge and allows first responders access to information on chemicals at individual facilitates. States and communities, working with individual facilities, can use this information to improve chemical safety and protect public health and the environment. These sections increase public knowledge of and make first responders aware of the hazards and chemical inventories present at individual facilities. The safety data sheets (SDSs), which are required by Section 311, and the annual chemical inventories, which are Tier II forms, are sent to the SERC, LEPC, and fire department with jurisdiction over the facility. First responders can use the information to guide their response. For example, the Tier II forms contain the name and phone number of the designated facility's "emergency contact," who could provide responders with first-hand knowledge of the facility.
(4) *Section 313: Toxic Chemical Release Inventory.* Under this section, the EPA is required to establish the toxic release inventory (TRI), which is an inventory of routine toxic chemical emissions from certain facilities. This report, commonly known as Form R, covers releases and transfers of toxic chemicals to various facilities and environmental media, and allows the EPA to compile the national TRI database. The TRI also includes information on source reduction, recycling, and treatment. The data gathered assists in research and development of regulations, guidelines, and standards.

4.3.6 Federal Water Pollution Control Act (FWPCA). Passed by Congress in 1972 and amended in 1977 to become the Clean Water Act, FWPCA requires the EPA and U.S. Coast Guard to regulate spills of oil and/or other hazardous substances that threaten coastal waters and inland waterways and to restore and maintain the chemical, physical, and biological integrity of the waters of the United States by preventing, reducing, and eliminating pollution.

4.3.7 Clean Water Act (CWA). Passed by Congress in 1977, the CWA establishes the basic structure (i.e., plans and permits) for regulating discharges of pollutants into the waters of the United States (e.g., navigable waterways, surface waters) and quality standards for surface waters.

4.3.7.1 The EPA's National Pollutant Discharge Elimination System (NPDES) permit program seeks to control discharges from industrial, municipal, and other facilities where such facilities discharge directly to surface waters.

4.3.8 Oil Pollution Act (OPA). Passed by Congress in 1990 to cover both facilities and carriers of oil and related liquid product, including deep-water marine terminals, marine vessels, pipelines, and railcars, the OPA requires development of emergency response plans, with regular training and exercise sessions; verification of spill resources and contractor capabilities; establishment of a national planning and response system on four levels: national, area, local, and facility; activation of the facility response plan (FRP) with other plans as needed;

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and owners or operators of a regulated facility to have a spill prevention, control, and countermeasure (SPCC) program.

4.3.8.1 Spill Prevention, Control, and Countermeasure Plans (SPCC). The OPA mandated the creation of SPCC plans for facilities engaged in drilling, producing, gathering, storing, processing, refining, transferring, distributing, or consuming oil and oil product where there is a risk of discharging oil in quantities that could be harmful if discharged into or on navigable waterways or adjoining shoreline, or on the water on the contiguous zone.

4.3.9 Hazardous Materials Transportation Act (HMTA). Passed by Congress in 1975 and reauthorized by the Hazardous Materials Transportation Safety and Security Reauthorization Act of 2005, HMTA protects against risks to life, property, and environment that are inherent in intrastate, interstate, and foreign transportation of hazardous material.

4.3.10 Robert T. Stafford Disaster Relief and Emergency Assistance Act (The Stafford Act). Passed by Congress in 1988, the Stafford Act designates the Federal Emergency Management Agency (FEMA) as the primary federal agency responsible for coordinating federal responses to disasters.

4.3.11 Maritime Transportation Security Act (MTSA). Passed by Congress in 2002, the MTSA addresses port and waterway security. It requires vessels and port facilities to conduct vulnerability assessments and develop security plans that could include passenger, vehicle, and baggage screening procedures; security patrols; establishing restricted areas; personnel identification procedures; access control measures; and/or installation of surveillance equipment.

4.4 Regulations by Agency.

4.4.1 General. Regulations are official rules created by government agencies that detail how something should be done. Section 4.4 contains a brief summary of the provisions of each regulation that can impact an HMRP.

4.4.2 Department of Homeland Security.

4.4.2.1 Chemical Facility Anti-Terrorism Standards (CFATS). CFATS, found in 6 CFR 27, addresses security regulations for high-risk chemical facilities, such as chemical plants, electrical generating facilities, refineries, and universities.

4.4.2.2 Area Maritime Security Committees (AMSC). AMSCs, established under MTSA I 33 CFR 104, are required in U.S. ports to coordinate the activities of port stakeholders, including other federal, local, and state agencies; industries; and the boating public to best deter, prevent and respond to terror threats.

4.4.3 U.S. Occupational Safety and Health Administration (OSHA).

4.4.3.1 OSHA regulations governing hazardous materials can be found in 29 CFR 1910. Several regulations of significance can be found in 4.4.3.1.1 through 4.4.3.1.6.

4.4.3.1.1 Hazardous Waste Operations and Emergency Response (HAZWOPER). Both 29 CFR 1910.120 and 29 CFR 1926.65 address emergency response operations for the release, or substantial threat of release, of hazardous substances without regard to the location of the hazard. Paragraph (q) of these parallel documents provides procedures for emergency response to hazardous substance releases pursuant to Section 303 of SARA.

4.4.3.1.2 Respiratory Protection. Title 29 CFR 1910.134 sets requirements to control occupational diseases caused by breathing contaminated air (e.g., harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors) by preventing atmospheric contamination through

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accepted engineering control measures (e.g., enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). Where effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to this section per 29 CFR 1910.134.

4.4.3.1.3 Permit-Required Confined Spaces. Title 29 CFR 1910.146 sets requirements for practices and procedures to protect general-industry employees from the hazards of entry into permit-required confined spaces. This section does not apply to agriculture, construction, or shipyard employment *(see 29 CFR 1928, 1926, and 1915, respectively).*

4.4.3.1.4 Control of Hazardous Energy (Lock Out/Tag Out). Title 29 CFR 1910.147 sets minimum performance requirements of servicing and maintaining machines and equipment from which unexpected starting, energizing, or release of stored energy could harm employees.

4.4.3.1.5 Blood-Borne Pathogens. Title 29 CFR 1910.1030 focuses on the creation of a written exposure control plan that describes how an employer will protect employees from all occupational exposure to blood or other potentially infectious materials.

4.4.3.1.6 Hazard Communication (HAZCOM). Title 29 CFR 1910.1200 establishes procedures to ensure that the hazards of all produced or imported chemicals are classified, and that information concerning the classified hazards is transmitted to employers and employees. The requirements of this section are intended to be consistent with the provisions of the United Nations' globally harmonized system of classification and labeling of chemicals (GHS). The transmittal of this information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, SDSs, and employee training.

4.4.4 U.S. Environmental Protection Agency (EPA).

4.4.4.1 EPA regulations governing hazardous materials can be found in 40 CFR. Several regulations of significance can be found in 4.4.4.1.1 through 4.4.4.1.7.

4.4.4.1.1 Chemical Accident Prevention Provisions. Title 40 CFR 68 sets forth risk management programs for accidental chemical release prevention activities, including hazard assessment, prevention programs, and emergency response considerations.

4.4.4.1.2 National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The NCP, addressed in 40 CFR 300, is the federal government's blueprint for responding to oil spills and hazardous substance releases. It develops a national response capability and promotes coordination among the hierarchy of responders and contingency plans. It establishes the National Response Team (NRT) and its roles and responsibilities in the national response system, which includes planning and coordinating responses, providing guidance to regional response teams, coordinating a national program of preparedness planning and response, and facilitating research to improve response activities.

4.4.4.1.3 Reimbursement to Local Governments for Emergency Response to Hazardous Substance Releases. Title 40 CFR 310 provides the procedures for seeking local government reimbursement for emergency responses to hazardous substance releases.

4.4.4.1.4 Worker Protection. Worker protection, addressed in 40 CFR 311, incorporates 29 CFR 1910.120 - requirements for states without OSHA-approved state plans.

4.4.4.1.5 Emergency Planning and Notification. Title 40 CFR 355 establishes requirements for a facility to provide information necessary for developing and implementing state and local chemical emergency response plans and requirements for emergency notification of chemical releases. This part also lists EHSs and threshold planning quantities (TPQs) in appendices A and B.

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4.4.4.1.6 Hazardous Chemical Reporting: Community Right-to-Know. Title 40 CFR 370 establishes reporting requirements for providing the public with important information on hazardous chemicals in their communities. Such reporting raises community awareness of chemical hazards and aids in the development of state and local emergency response plans. Reporting requirements include SDSs and inventory reporting to the SERC, LEPC, and local fire department.

4.4.4.1.7 Toxic Chemical Release Inventory. Title 40 CFR 372 requires facilities to complete and submit a toxic chemical release inventory form (i.e., Form R) annually. A Form R must be submitted for each of the over 600 TRI chemicals that are manufactured or otherwise used above the applicable threshold quantities.

4.4.4.2 Discharge of Oil. Title 40 CFR 110 requires federal agencies to report discharges of oil from vessels or facilities under their jurisdiction or control to the National Response Center (NRC).

4.4.4.3 Oil Pollution Prevention. Title 40 CFR 112 establishes procedures, methods, equipment, and other requirements to prevent the discharge of oil from non-transportation-related onshore and offshore facilities into or on the navigable waters of the United States or adjoining shorelines.

4.4.4.4 Solid Wastes. Title 40 CFR 238–282 contains waste management regulations in support of the RCRA. CFRs 239 through 259 contain the regulations for solid waste. CFRs 260 through 279 pertain to hazardous waste regulations and also contains the definitions for characteristic and listed hazardous wastes. CFR 280 contains requirements for underground storage tanks.

4.4.5 U.S. Department of Transportation (DOT). DOT regulations governing the transportation of hazardous materials/dangerous goods in commerce (e.g., highway, rail, air, and water) are found in 49 CFR. Where spills occur while the hazardous material is on the vehicle or otherwise "in transportation," OSHA's 29 CFR 1910.120(q) HAZWOPER regulations apply to emergency response personnel who respond to the incident. Several regulations of significance can be found in 4.4.5.1 through 4.4.5.3.

4.4.5.1 Subchapter B Hazardous Materials and Oil Transportation.

4.4.5.1.1 Oil Spill Prevention and Response Plans. Title 49 CFR 130 contains prevention, containment, and response planning requirements applicable to the transportation of oil by motor vehicles and rolling stock.

4.4.5.2 Subchapter C Hazardous Materials Regulations (Parts 171–180). The following is a breakdown of the regulations in Subchapter C:

(1) 49 CFR 171 — General Information Regulations and Definitions
(2) 49 CFR 172 — Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans
(3) 49 CFR Part 173 — General Requirements for Shipments and Packagings
(4) 49 CFR Part 174 — Carriage by Rail
(5) 49 CFR Part 175 — Carriage by Aircraft
(6) 49 CFR Part 176 — Carriage by Vessel
(7) 49 CFR Part 177 — Carriage by Public Highway
(8) 49 CFR Part 178 — Specifications for Packaging
(9) 49 CFR Part 179 — Specifications for Tank Cars
(10) 49 CFR Part 180 — Continuing Qualification and Maintenance of Packagings

4.4.5.3 Subchapter D - Pipeline Safety (Parts 193–195) The following is a breakdown of the regulations in Subchapter D:

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(1) 49 CFR 193 — Liquefied Natural Gas Facilities: Federal Safety Standards
(2) 49 CFR 194 — Response Plans for Onshore Oil Pipelines
(3) 49 CFR 195 — Transportation of Hazardous Liquids by Pipelines

4.4.6 U.S. Department of Energy (DOE). DOE regulations governing hazardous materials are found in 10 CFR. Several regulations of significance can be found in 4.4.6.1 through 4.4.6.1.2.

4.4.6.1 Nuclear Regulatory Commission. Parts 1–199 establish procedures for transportation and storage of nuclear materials; use of radioactive materials at nuclear power plants, research and test reactors, uranium recovery facilities, waste repositories, and other nuclear facilities; and use of nuclear materials for medical, industrial, and academic purposes. Subpart C establishes the requirements for the DOE to comply with Section 102(2) of the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA *(see 40 CFR 1500–1508)*. Parts 1500–1508 supplement, and are to be used in conjunction with, the CEQ regulations.

4.4.6.1.1 Standards for Protection Against Radiation. Part 20 establishes standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the Nuclear Regulatory Commission. The following regulations were issued under the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974, as amended:

(1) 10 CFR 20.1201–1208 — Occupational Dose Limits
(2) 10 CFR 20.1301–1302 — Radiation Dose Limits for Individual Members of the Public
(3) 10 CFR 20.1601–1602 — Control of Exposure from External Sources in Restricted Areas
(4) 10 CFR 20.1901–1906 — Precautionary Procedures
(5) 10 CFR 20 Appendix B — Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage
(6) 10 CFR 20 Appendix G — Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests

4.4.6.1.2 Domestic Licensing of Production and Utilization Facilities. Title 10 CFR 50 provides for the licensing of production and utilization facilities (i.e., nuclear reactors). The following regulations can be found in 10 CFR 50:

(1) 10 CFR 50.47 includes the 16 planning standards of 10 CFR 50.47(b) and the "realism rule" in 10 CFR 50.47(c), which recognizes that state and local government officials do their best to protect public health and safety.
(2) 10 CFR 50.54(q) contains requirements for following and maintaining in-effect emergency plans.
(3) 10 CFR Appendix E to 10 CFR 50, describes information needed to demonstrate compliance with emergency preparedness requirements in Section IV of this appendix.

4.5 Consensus Standards by Organization.

4.5.1 General.

4.5.1.1 A consensus standard is a standard that has been adopted and promulgated by a nationally recognized standards-producing organization under procedures whereby it can be determined that persons interested and affected by the scope or provisions of the standard have reached substantial agreement on its adoption; was formulated in a manner that afforded an opportunity for diverse views to be considered; and has been designated as such.

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4.5.1.2 The documents or portions thereof listed in Section 4.5 are referenced within this recommended practice and should be considered part of the recommendations of this document.

4.5.2 NFPA Standards. This subsection contains a partial list of NFPA standards. To determine if other NFPA standards apply, review the complete list of NFPA standards at nfpa.org/codes-and-standards.

4.5.2.1 NFPA 472 provides a framework by which an organization can meet the requirements of the OSHA HAZWHOPER regulation. By meeting this standard, compliance with OSHA 1910.120 is met or exceeded.

4.5.2.2 NFPA 473 identifies the levels of competence required of emergency medical services (EMS) personnel who respond to incidents involving hazardous materials or WMD.

4.5.2.3 NFPA 1072 identifies the minimum job performance requirements (JPRs) for personnel at the scene of a hazardous materials/WMD incident at the following levels: awareness, operations, operations mission-specific, hazardous materials technician, and incident commander.

4.5.2.4 NFPA 1500 contains minimum requirements for a fire service–related safety and health program. Items covered include personal protective equipment (PPE), staffing, medical requirements, and physical requirements.

4.5.2.5 NFPA 1521 contains minimum requirements for the assignment, duties, and responsibilities of a health and safety officer (HSO) and an incident safety officer (ISO) for a fire department.

4.5.2.6 NFPA 1582 provides guidance on annual physicals for fire fighters and members of hazardous materials response teams.

4.5.2.7 NFPA 1584 establishes the minimum criteria for developing and implementing a rehabilitation process for fire department members at incident scene operations and training exercises.

4.5.2.8 NFPA 1951 specifies the minimum design, performance, testing, and certification requirements for utility technical rescue; rescue and recovery technical rescue; and chemical, biological, radiological, and nuclear (CBRN) technical rescue and protective ensembles for use by emergency services personnel during technical rescue incidents.

4.5.2.9 NFPA 1981 specifies certification, labeling, design requirements, performance requirements, and test methods that apply to all open-circuit self-contained breathing apparatus (SCBA) and combination SCBA/supplied air respirator (SAR) used during firefighting, rescue, hazardous materials incidents, terrorist incidents, and similar operations where responders could encounter confined spaces, atmospheres that are unknown, atmospheres that are or could become immediately dangerous to life and health (IDLH), or atmospheres that are or could become oxygen deficient.

4.5.2.10 NFPA 1982 specifies cover design, performance, testing, and certification of PASS that monitor an emergency responder's motion and automatically emit an audible signal to summon aid in the event the user becomes incapacitated or needs assistance.

4.5.2.11 NFPA 1991 contains requirements for protection for emergency responders against adverse vapor environments during hazardous materials incidents, and from specified chemical, biological, or radiological terrorism agents during chemical and biological terrorism incidents.

4.5.2.12 NFPA 1992 provides requirements for protection for emergency responders against adverse liquid-splash environments during hazardous materials emergency incidents.

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4.5.2.13 NFPA 1994 establishes requirements for protective ensembles and ensemble elements to safeguard emergency first responder personnel from CBRN terrorism agents.

4.5.3 American Society for Testing and Materials (ASTM) Standards. This subsection contains a partial list of ASTM standards. To determine if other ASTM standards apply, review the complete list of ASTM standards at astm.org/standards.

4.5.3.1 ASTM F1127, *Standard Guide for Containment of Hazardous Material Spill by Emergency Response Personnel*, is the standard of care for hazardous materials response personnel.

4.5.3.2 ASTM E2458, *Standard Practices for Bulk Sample Collection and Swab Sample Collection of Visible Powders Suspected of Being Biothreat Agents from Nonporous Surfaces,* covers bulk and onsite sampling.

4.5.3.3 ASTM E2601, *Standard Practice for Radiological Emergency Response*, provides decision-making considerations for response to incidents that involve radioactive materials. It provides information and guidance for what to include in response planning and what activities to conduct during a response.

4.5.3.4 ASTM E2770, *Standard Guide for Operational Guidelines for Initial Response to a Suspected Biothreat Agent*, provides considerations for decision-makers where responding to incidents that could involve biothreats.

4.5.4 American National Standards Institute (ANSI) Standards. This subsection contains a partial list of ANSI standards. To determine if any other ANSI standards apply, review the complete list of ANSI standards at ansi.org.

4.5.4.1 ANSI Z88.2, *American National Standard Practices for Respiratory Protection*, sets forth accepted practices for respirator users; provides information and guidance on the proper selection, use, and care of respirators; and contains requirements for establishing and regulating respirator programs.

4.5.4.2 ANSI Z88.10, *Fit Test Method*, provides guidance on how to conduct fit testing of tight-fitting respirators and appropriate methods to be used.

4.5.5 American Petroleum Institute (API) Standards. This subsection contains a partial list of API standards. To determine if any other API standards apply, review the complete list of API standards at api.org/standards/.

4.5.5.1 API 2021, *Management of Atmospheric Storage Tank Fires*, provides information to enhance the understanding of fires in atmospheric storage tanks containing flammable and combustible materials. It presents a systematic management approach that can assist tank fire prevention and helps responders optimize fire suppression techniques to reduce the severity of an incident.

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4.6 Guidance Documents.

4.6.1 General. Guidance documents are publications typically prepared by regulatory agencies, that provide instructions to establish the agencies expectations.

4.6.2 National Response Framework (NRF). The NRF is a comprehensive how-to guide that spells out how the nation should conduct an all-hazard response. It is intended to capture all levels of government and all incident levels. Local plans feed into state plans, which feed into the NRF. Its use during a federally declared disaster is required by the Stafford Act.

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4.6.2.1 Resource typing is the categorization and description of resources that are exchanged in disasters via mutual aid, by capacity and/or capability, for the purpose of ordering and tracking resources.

4.6.3 Presidential Directives.

4.6.3.1 Homeland Security Presidential Directive 5 (HSPD 5) — Management of Domestic Incidents. HSPD 5, issued on Feb. 28, 2003, enhances the ability of the United States to manage domestic incidents by establishing a single, comprehensive national incident management system.

4.6.3.2 Homeland Security Presidential Directive 8 (HSPD 8) — National Preparedness. HSPD 8 was issued to strengthen the security and resilience of the United States through systematic preparation for the threats that pose the greatest risk to national security, including acts of terrorism, cyber-attacks, pandemics, and catastrophic natural disasters. National preparedness is the shared responsibility of all levels of government, the private and nonprofit sectors, and individual citizens. As such, while this directive is intended to galvanize action by the federal government, it is also aimed at facilitating an integrated, all-of-nation, capabilities-based approach to preparedness using the following:

(1) *National Preparedness Vision.* A concise statement of the core preparedness goal for the nation.
(2) *National Planning Scenarios.* A diverse set of high-consequence threat scenarios of potential terrorist attacks and natural disasters.
(3) *Universal Task List.* A menu of some 1600 unique tasks that can facilitate efforts to prevent, protect against, respond to, and recover from the events represented by the national planning scenarios.
(4) *Core Capabilities List.* A list divided into five mission areas, including prevention, protection, mitigation, response, and recovery that agencies and jurisdictions can use to identify mission deficiencies and take corrective actions. The target capabilities list has been merged into the core capabilities list.

4.6.3.3 Homeland Security Presidential Directive 12 (HSPD 12) — Policy for a Common Identification Standard for Federal Employees and Contractors. HSPD 12 was issued to eliminate variations in quality and security of identification used to gain access to secure facilities where there is potential for terrorist attacks, and to enhance security, increase government efficiency, reduce identity fraud, and protect personal privacy. HSPD 12 established a mandatory, government-wide standard for secure and reliable forms of identification issued by federal government employees and contractors, including contractor employees.

4.6.3.4 National Security Presidential Directive 33 (NSPD 33). — Biodefense for the Twenty-First Century. NSPD 33 covers response planning, mass casualty care, risk communication, medical countermeasures, and decontamination. These initiatives strengthen the government's ability to provide mass casualty care and to decontaminate the site of an attack.

4.6.4 Additional Resources. The following resources might be helpful to HMRP in becoming familiar with laws, regulations, consensus standards, and guidance documents:

(1) U.S. Chemical Safety Board, www.csb.gov
(2) National Transportation Safety Board, www.ntsb.gov
(3) Lessons Learned Information Sharing, www.llis.dhs.gov
(4) FEMA's National Training and Education Division, www.firstrespondertraining.gov
(5) The National Fire Fighter Near-Miss Reporting System, www.firefighternearmiss.com
(6) U.S. Coast Guard, www.nrc.uscg.mil
(7) Interagency Board, www.iab.gov

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5 Risk Assessment

5.1 Scope.

This chapter applies to those organizations and jurisdictions responsible for organizing, managing, and sustaining a hazardous materials/weapons of mass destruction (WMD) response program (HMRP) and provides guidance for assessing an organization's/jurisdiction's risk of being affected by hazardous materials or a WMD.

5.2* Purpose.

This chapter provides processes for conducting a risk assessment, including hazard identification, vulnerability assessment, consequence identification, and risk analysis within the organization/jurisdiction.

A.5.2 Risk assessment is a process used to determine the probability of a hazardous materials/WMD incident within the organization/jurisdiction along with the associated impact. Risk assessment considers various factors, including severity, frequency, causes, and location and the organization's/jurisdiction's vulnerability to the threat. Assessing risk includes examining local response history and comparing it to regional, state, and national historical data. In addition, the following factors should be examined:

(1) The HMRP manager should examine previous events in their local area. DOT, OSHA, and NIOSH accident data involving the most common hazardous materials/WMD can be valuable in conducting local risk assessments. Where a catastrophic event occurs in some other area and the AHJ has a comparable facility in their area, the local HMRP manager should ensure that its response plans and training programs include information about that type of facility.
(2) The HMRP manager should maintain a list of the Tier 2 facilities, including those facilities that have EHS and the ones that are covered by EPA RMP regulations. Response plans should be developed and reviewed with both the facility and the nearby community. The review should identify vulnerable populations such as schools, day cares, retirement centers, assisted living/nursing homes, hospitals, and other facilities that cannot be quickly evacuated and might have to shelter in place. Response plans should include atmospheric air monitoring and protection strategies for vulnerable populations. Outreach efforts between the facility and the vulnerable populations should be conducted on a regular basis so that all parties are aware of emergency response plans prior to a release.
(3) Fuel stations, liquefied gas (i.e., LPG/LNG) facilities, and their respective storage present a likely risk in many communities. The number, frequency, and method of delivery make

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incidents at these locations a likely scenario. Conducting a commodity flow study that identifies the delivery routes can assist in the development of pre-incident plans.

(4) The transportation system should be analyzed for potential threats. The railroad that operates in the AHJ can be contacted for information concerning the number and frequency of hazardous cargo shipments. The Port Authority can be contacted to determine the number and frequency of maritime shipments. The DOT Pipeline and Hazardous Materials Safety Administration (PHMSA) pipeline mapping system can be researched to determine what pipelines are located in the AHJ's area of responsibility. For highway transportation one method of determining the potential threat is to conduct a community flow study where HMRP personnel track the number of truck shipments in their area along with the type and quantity of materials being shipped. Peek truck traffic can vary greatly, so a community flow study should encompass a variety of times and should be done over a period of days to reveal trends. If a weigh station is present, law enforcement agencies that conduct truck inspections can help identify cargos by examining the shipping papers.

(5) The impact of natural events and their interaction with at-risk facilities should be considered. Where natural events occur, the HMRP manager should identify comparable facilities within their region and plan for the possibility of a similar event. Examining historical weather data can determine the frequency of unusual weather-related events.

(6) Emergency response plans should include expected accidental releases, including the frequency and impact. Events can be categorized as frequent or infrequent and have a low or high impact. The impact to the local community should be considered as well as the potential impact to adjacent facilities. Fixed facilities should have safety systems in place with redundant backups to prevent accidental releases.

(7) Intentional releases are criminal in nature and could be an attempted terrorist attack. Although both acts are criminal, it is the purpose and intent of the release that makes the difference. Releases at fixed facilities should be considered criminal acts until proven otherwise. While it can be difficult to determine whether a release is accidental or intentional, the HMRP personnel along with trained investigators should try to determine the root cause. In cases where terrorism is suspected, the appropriate law enforcement officials should be notified.

(8) Explosions also require an investigation, including the root cause. The bomb squad can be used to determine the cause of an explosion. The HMRP personnel should be used to determine if there are flammable gases or other hazardous materials present.

5.2.1 A risk assessment characterizes the impact and danger associated with hazardous materials/WMD within an organization/jurisdiction.

5.2.2 Risk assessment methods can vary but should involve the characterization of risk within the organization/jurisdiction.

5.2.3 Risk assessment influences all elements of an HMRP — prevention, preparedness, response, and recovery.

5.3 Identifying Hazardous Materials/WMD Within an Organization/Jurisdiction.

5.3.1 Identifying hazardous materials/WMD, which is the first step in risk assessment, is a process of collecting information regarding the locations and types of hazardous materials/WMD within the organization/jurisdiction.

5.3.2* Identifying hazardous materials/WMD locations should include any facilities within the organization/jurisdiction that manufacture/produce, store, transport, use, treat, or dispose of hazardous materials.

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A.5.3.2 Special attention should be given to facilities that could have a profound human health, or economic impact on the community, should a major release or loss occur. The majority of the population within any given area could be either directly or indirectly employed by a facility that manufactures, stores, or ships certain regulated materials. Some could be employed by the stricken facility itself while others could work for companies that support or depend on those facilities.

5.3.3 Hazardous materials/WMD identification should include all materials at the identified locations within the organization/ jurisdiction that are capable of causing death, injury, property or environmental damage, and system disruptions where there is an accidental or intentional release.

5.3.3.1* For each identified location, the following information should be collected:

(1) List of all materials found categorized by name or other manner that allows identification to assess potential characteristics, behavior, and hazards of the materials
(2) Quantity and concentration of material that could be involved in a release
(3) Type and design of container used for the materials
(4) Conditions found at the location, such as storage configuration, protection features, protection systems, safety devices, cleanliness, and so on
(5) Transportation facilities and routes used by various transport modes
(6) Properties of the material, including safety data sheets (SDSs) and other product-specific facility documents
(7) Potential hazards associated with spills or releases
(8) Surrounding conditions and circumstances adjacent to the potential incident site, including the following:

  (a) Number and types of people, including facility employees, neighborhood residents, vulnerable populations, and other groups in the area.
  (b) Private and public property, including critical facilities (e.g., homes, schools, hospitals, businesses, and offices), critical infrastructures (e.g., water, food, power, communication, and medical), and transportation facilities and corridors. Special attention should be given to facilities that could have a significant economic impact on an organization/jurisdiction should a major release or loss occur.
  (c) Environmentally sensitive areas, including waterways, estuaries, parks, floodplains, wetlands, or adjacent facilities as well as areas containing endangered species.

A.5.3.3.1 Threshold planning quantities (TPQs) have been established under the Emergency Planning and Community Right-to-Know Act (EPCRA). The TPQ for ammonia is 500 lb (227 kg). Ammonia, however, can be found in an anhydrous or aqueous (i.e., mixed with water) state. The potential impact from a release of anhydrous and aqueous ammonia can be very different. If a fixed facility stores more than 500 lb (227 kg) of ammonia it is considered an EHS facility. Some materials that are not considered EHSs could create situations where there is substantial risk to the facility and the public.

5.3.4 Information about hazardous materials/WMD locations and types can be found from the following sources:

(1) State emergency planning commissions (SERC)
(2) Local emergency planning councils (LEPC)
(3) Local emergency management agency personnel
(4) Local pre-emergency planning activities
(5) Scientific community
(6) Industrial community
(7) Governmental agencies [i.e., Department of Defense (DOD), Department of Transportation (DOT), and Environmental Protection Agency (EPA)]

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(8) Maritime community
(9) Historical records

5.4 Analyzing the Consequences of a Release.

Analyzing the consequences of a release of hazardous materials/WMD found at each location within the organization/jurisdiction is the process of evaluating the likely behavior of a container and its contents to determine the hazards associated with the release and the likely outcomes (e.g., deaths and injuries, environmental and property damage, system disruptions) associated with that release.

5.4.1 Predicting Behavior. Using data collected during the hazardous materials/WMD consequence analysis, the likely behavior of a material and its container as well as the resultant hazards associated with a release of the material should be identified.

5.4.1.1 Factors that can contribute to the behavior of a container and its contents include the following:

(1) Type of container — pressure, nonpressure or cryogenic
(2) Type of stress — thermal, mechanical, chemical, or radiological
(3) Type of breach — disintegration, linear cracking, closure opening up, puncture, split, or tear
(4) Type of release — detonation, violent rupture, rapid relief, spill, or leak) — also provides indication of the rate of release
(5) Type of release — matter or energy
(6) Form released — solid, liquid, or gas
(7) Type of dispersion pattern — considers type of breach, cause of movement, or path of movement
(8) Type of impingement — short term, medium term, or long term
(9) Type of harm — thermal, chemical, biological, radiological, asphyxiant, or mechanical

5.4.2 Estimating Outcomes. The analysis process should estimate the impact to the organization/jurisdiction, or the region, state, and/or nation in terms of potential deaths and injuries, cost of environmental and property damage, and impact of system disruptions, including land, equipment, infrastructure, and key resources that might have to be repaired, decontaminated, or replaced.

5.4.2.1 Surrounding conditions and circumstances adjacent to the potential incident site that could be impacted by the release of hazardous materials/WMD. *[See 5.3.3.1(8).]*

5.4.2.2 Estimated outcomes should include the following:

(1) Likely dimensions of the endangered area based on the likely dispersion of the hazardous materials/WMD
(2) Likely number and types of exposures within the endangered area (e.g., people, environment, property, systems)
(3) Likely concentrations of the hazardous materials/WMD within the endangered area (i.e., dispersion modeling)
(4) Likely physical, health, and safety hazards within the endangered area, including acute, delayed, and/or chronic health effects
(5) Likely areas of harm within the endangered area
(6) Likely outcomes within the endangered area - based on exposures within the areas of harm

5.4.2.3 Estimated outcomes should be based on realistic worst-case scenarios — especially for high-frequency events.

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5.5 Analyzing the Risk.

Risk analysis is a judgment of the likelihood or probability of a release occurring coupled with the severity of outcomes, based on hazardous materials/WMD found within the organization/jurisdiction and an estimate of the likely outcomes associated with their release within the organization/jurisdiction.

5.5.1* Probability. Probability is the likelihood that a hazardous materials/WMD incident could occur.

A.5.5.1 Assessing risks combines the potential for an incident to happen, an estimation of the probability of an event, and the potential impact to life and property should an incident occur. The AHJ's vulnerability should be assessed from an accidental and intentional release perspective.

5.5.1.1 Probability estimates the potential for an incident to take place. Where estimating probability, the following should be taken into account:

(1) Types of incidents within the organization and/ jurisdiction.
(2) Frequency of incidents, which is determined by how often hazardous materials/WMD incidents occur in your AHJ, the state, or the region.

5.5.2 Frequency. Frequency is the process of determining how often hazardous material/WMD incidents occur in your AHJ, the state, or the region. Frequency can be determined by asking the following questions:

(1) Has a hazardous materials/WMD incident ever occurred in your AHJ?
(2) Have similar types of incidents ever occurred within your AHJ?
(3) What was the magnitude of the incidents that occurred?
(4) How did the event impact the jurisdiction in terms of loss of life, injuries, property and environmental damage, and disruption of infrastructure or the economy? Criteria to consider includes the following:

    (a) Types of materials involved
    (b)* Analysis of the history of current conditions and controls at the location, including engineering controls to minimize release potential; plans to control a release; the organization's and jurisdiction's response capabilities

A.5.5.2(4)(b) The ability of a fixed facility to prevent, detect, and mitigate a potential release is an important part of a threat assessment. The HMRP's capability to detect, control, and mitigate a potential release is a vital part of the threat assessment process. In the event of a terrorist attack there is potential for the terrorist to try and exploit weaknesses in the system for maximum impact.

    (c) Any unusual environmental conditions
    (d)* Possibility of simultaneous incidents

A.5.5.2(4)(d) Simultaneous incident types are categorized as either natural or man-made. Man-made incidents can include accidental and intentional or deliberate acts. Naturally occurring incidents have the potential to cause hazardous materials/WMD releases. Unforeseen hazards from naturally occurring incidents can hamper response efforts. The AHJ could be faced with difficult decisions such as determining alternate routes for access and egress, designating specialized equipment needed to support the response, and allocating specialized resources to overcome obstacles encountered. Naturally occurring incidents that could affect a response include the following:

(1) Floods
(2) Hurricanes

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(3) Earthquakes
(4) Tsunamis
(5) Tornadoes
(6) Wildfires
(7) Landslides
(8) Winter storms
(9) Drought
(10) Lightning
(11) Plough (i.e., shear) winds
(12) Hail
(13) Tidal forces (e.g., spring tides can complicate spill response due to large tidal range)
(14) Space weather (e.g., solar storms that can disrupt space-based communications systems)
(15) Temperature extremes

Man-made incidents have the potential to cause hazardous materials/WMD releases. During day-to-day operations, personnel can cause accidental releases by their actions or lack thereof. Man-made releases that are more common than naturally occurring incidents can be classified into two categories — accidental or intentional. The cause of the release can change the response. Intentional releases could involve a crime and require investigative assistance from law enforcement agencies. Although the protection of life and the environment are paramount, steps should be taken to preserve evidence. Intentional man-made releases also imply other complications to response, such as the location (e.g., intentional releases are generally caused in areas that will have the greatest impact) and/or the potential for secondary devices/releases designed to cause harm to responders. Causes of man-made hazardous materials/WMD releases include the following:

(1) Poor maintenance of equipment, faulty engineering and design, human error, or mechanical failure
(2) Transportation incidents
(3) Terrorist activities
(4) Fire or explosion
(5) Sabotage or intentional releases
(6) Cascading within the incident
(7) Intelligence about specific threats

5.5.3 Severity. For severity of consequences of human injury that might occur (e.g., acute, delayed, and/or chronic health effects), see Section 5.4.

5.5.4 Resources for Risk Analysis. National databases can be consulted to determine the most common types of hazardous materials/WMD involved in other incidents. This data can then be compared to the hazardous materials/WMD identified within the AHJ to determine if there is a high or low probability of an incident occurring. Probability can also be determined through the use of mathematics and models that measure the ratio of the favorable cases to the whole number of cases possible.

5.5.4.1 Geographic-Based Analysis. Geographic threat assessments utilize geographic information systems (GIS) that allow the user to better visualize, question, analyze, interpret, and understand interdependencies, patterns, and trends. A GIS provides layers of information that can be used to map locations and assess potential impact. This allows planners to identify the relationships between the hazards, predict outcomes, visualize scenarios, and plan strategies.

5.5.4.2 Computer-Based Modeling Analysis. Computer-based assessments use a variety of computer-based modeling to determine the potential impact of a hazardous materials release. Computer models are designed to evaluate specific issues such as hazardous substances

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releases, migrating toxic gas plumes, oil spill migration, blast effects, and weather. Where computer data is combined with GIS data, the consolidation of information can give planners a clearer picture of the potential vulnerabilities within the organization/jurisdiction, region, or state.

5.5.5 Ranking the Risks. Once risk assessment is completed, the organization/jurisdiction should be ranked by risk level.

5.5.6 Cascading Incidents. Cascading incidents can compound the stresses placed on the response system as a whole. A single man-made incident occurring at the same time as a natural disaster can compound the intensity by virtue of the sheer magnitude. A natural disaster such as an earthquake can cause multiple incidents at multiple locations that can spiral out of control and have secondary or tertiary impacts to life safety, public health, or the environment. Where evaluating cascading incident potential, each location should be viewed as an individual incident within the context of a larger disaster complex.

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Planning

6

6.1 Scope.

This chapter applies to those organizations and jurisdictions responsible for organizing, managing, and sustaining a hazardous materials/weapons of mass destruction (WMD) response program (HMRP) and provides guidance for the planning process.

6.2 Purpose.

This chapter addresses emergency operations plans (EOPs), standard operating procedures (SOPs), and standard operating guidelines (SOGs) where developing plans for the safe, effective response to hazardous materials/WMD incidents.

6.2.1 It is not the intent of this document to restrict any authority having jurisdiction (AHJ) from exceeding these minimum recommended practices.

6.3 Plan Development.

A planning team should be established for plan development. The plan should address the findings of the jurisdictional risk assessment process, other related plans, mutual-aid agreements and memorandums of understanding (MOU). Plans are not a scripting process to dictate specific actions. They should provide a starting point for operations, be flexible, and be adjusted as circumstances change. Plans should be organized in a logical framework of functions and topics. HMRP managers should establish formal management systems to ensure that plans are developed, maintained, and enforced along a four-step process: a needs or gap assessment, plan development, implementation, and evaluation. The planning team should also perform a needs or gap assessment of any equipment, supplies and resources needed to meet the mission identified in the plan.

6.3.1 A planning team should be established for plan development with processes in place to insure the plan remains current and is implemented as designed.

6.3.2 Plans should be based on the results of a risk assessment and an analysis of the current capabilities of the HMRP in relation to the risk. This analysis should include the following:

(1) Identifying the required HMRP capabilities
(2) Current capabilities, including other plans and mutual-aid agreements already in place
(3) Gaps between required and current capabilities
(4) Capabilities required to bridge the gaps

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6.3.3 Plans should address formal management activities, such as resource management, staffing, training, health and medical issues, financial management, and developing relationships as well as operational activities and emergency operations. Plans should provide a starting point for operations and be flexible, so that they can be adjusted as circumstances change.

6.3.4 Plans should be organized in a logical framework of functions and topics.

6.4 Emergency Operations Plan (EOP).

Every state has an EOP that complements the National Response Framework (NRF) and that works in concert with the FEMA — Robert T. Stafford Act for disaster relief and emergency assistance. Many states require local jurisdictions to have a basic emergency operations plan supported by functional annexes with guidance for mitigation, preparedness, response, and recovery. Plans can mirror the national response framework and use emergency support functions (ESFs) in lieu of annexes.

6.4.1 Hazardous Materials/WMD Annex. Tactical planning guidance and recommendations for a Hazardous Materials/WMD annex should be based on a risk-based response process and use decision points.

6.5 Standard Operating Procedure (SOP)/Standard Operating Guideline (SOG) Planning Components.

The following template can be used as a guide to develop SOGs and SOPs and to provide necessary information for an emergency response in a standardized format:

(1) Introduction
(2) Scope
(3) Purpose
(4) Health and safety
(5) Response information
(6) Operations
(7) Annex
(8) Glossary
(9) Equipment
(10) Documentation
(11) Site specific information
(12) Product specific information

6.6 SOPs.

HMRP managers need a system to communicate operational procedures to personnel and ensure compliance with laws, regulations and standards. SOPs provide a mechanism to identify job requirements and expectations in an applicable format. SOPs are written directives that describe in detail what is required of personnel in specific situations or how to use equipment. The result is improved operational performance and safety and reduced liability.

6.6.1 Termination and Postincident Procedures. An HMRP should have procedures for specific processes that should be followed after a hazardous material/WMD incident. Procedural steps should be designed to assess and document actions, restore capabilities, address problems, and improve future results. The procedures should include the following:

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(1) Postincident analysis, including the following:
   (a) Demobilization
   (b) Debriefing
   (c) Critique and after-action report
(2) Postincident recovery
(3) Incident record keeping and reporting
(4) Injury/exposure reporting
(5) Behavioral and mental health considerations

6.6.2 Incident Management. An HMRP should have an incident command procedure that is in full compliance with the National Incident Management System (NIMS). This is as an essential part of any emergency response plan (ERP). For an ERP to be compliant, it should require the use of an incident management system/incident command system (IMS/ICS).

6.6.3 Respiratory Protection. An HMRP should have a respiratory protection program that meets the requirements of 29 CFR 1910.134, NFPA 1500, and NFPA 1852.

6.6.4 Medical Surveillance. An HMRP should have a medical surveillance program that meets the requirements set forth in 29 CFR 1910.120 (h), NFPA 1500, and NFPA 1582.

6.6.5 Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting. An HMRP should have an SOP for the selection, care, and maintenance of firefighter turnout gear that meets the requirements of NFPA 1851.

6.6.6 Personnel Credentialing. An HMRP should have a procedure designed to assess the capabilities of personnel and establish a credentialing system. The credentialing process entails objective evaluation and documentation of an individual's current certification, license, or degree; training and experience; and competence or proficiency to meet nationally accepted standards, provide particular services and/or functions, or perform specific tasks under specific conditions during an incident. According to NIMS, credentialing is the administrative process for validating personnel qualifications and providing authorization to respond/deploy, to perform specific functions, and to have specific access to an incident. Personnel credentialing is covered in greater detail in Chapter 7.

6.7 SOGs.

SOGs enable HMRP personnel to operate at a hazardous materials/WMD incident where hazards are identified, risk are assessed, and response options are chosen based on the AHJ's concept of operations, available resources and capabilities and the responder's level of training. SOGs should be built around Core Capabilities as identified by the national preparedness goals. The advantages of SOGs include the following:

(1) Enhances personnel safety
(2) Provides response consistency
(3) Serves as a guide for response actions
(4) Enhances the decision process
(5) Allows for better coordination and interoperability with other agencies and departments

6.7.1 Chemical Response Guideline. Guidelines for response to an incident involving chemicals should be based on available resources, personnel, and capabilities necessary to perform assigned tasks. Whether the event is accidental or intentional, HMRP personnel should identify all hazards associated with the incident and take appropriate actions, based on the greatest harm and danger. It is possible that additional present hazards could be more dangerous than exposure to the chemicals. The SOG should address the following:

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(1) SOG implemented during the emergency phase of an incident
(2) SOG used for determining the feasibility of rescue and recovery operations
(3) SOG safety and incident response considerations for the rescue of victims in the following situations:
   (a) Line-of-sight with ambulatory victims
   (b) Line-of-sight with nonambulatory victims
   (c) Non-line-of-sight with ambulatory victims
   (d) Non-line-of-sight with nonambulatory victims
   (e) Rescue operations versus victim recovery
(4) SOG for a risk-based response approach
(5) SOG considerations for possible decontamination

6.7.2 Biological Response Guideline. Guideline for response to an incident involving biological materials should be based on available resources, personnel, and capabilities necessary to perform assigned tasks. Whether the event is accidental or intentional, HMRP personnel should identify all hazards associated with the incident and take appropriate actions, based on the greatest harm and danger. It is possible that additional present hazards could be more dangerous than exposure to the biological material. The SOG should address the following:

(1) SOG safety and incident response considerations for the rescue of victims in the following situations:
(2) Potential public health emergency
(3) Known point-source
(4) Potential area dissemination
(5) SOG for a risk-based response approach
(6) SOG considerations for possible decontamination

6.7.2.1 ASTM E2458, Standard Practices for Bulk Sample Collection and Swab Sample Collection of Visible Powders Suspected of Being Biothreat Agents from Nonporous Surfaces. ASTM E2458 addresses the collection of visible powders that are suspected biothreat agents from solid nonporous surfaces using a bulk collection method that employs a dry swab and laminated card followed by a swab sampling method using a sterile moistened swab. Bulk powder samples are collected and packaged in a manner that permits the maximum amount of the sample to be safely transported to a reference laboratory within the Centers for Disease Control and Prevention (CDC) national laboratory response network (LRN) for identification and safe storage.

6.7.2.2 ASTM E2770, Standard Guide for Operational Guidelines for Initial Response to a Suspected Biothreat Agent. ASTM E2770 provides considerations where responding to incidents that could involve biothreats. This guide contains information and recommendations for response planning and on activities to conduct during an initial response to an incident involving suspected biothreat agents.

6.7.3 Radiological Response Guideline. Guidelines for response to an incident involving radiological materials should be based on available resources, personnel, and capabilities necessary to perform assigned tasks. Whether the event is accidental or intentional, HMRP personnel should identify all hazards associated with the incident and take appropriate actions, based on the greatest harm and danger. It is possible that additional present hazards could be more dangerous than exposure to the radiological material.

6.7.3.1 ASTM E2601, Standard Practice for Radiological Emergency Response. ASTM E2601 contains recommended practices that can be incorporated into the development, planning, training, and implementation of a radiological response plan. It also provides choices for responses to an accidental or intentional release of radiological materials. The standard applies to the emergency phase of an incident and incorporates a risk-based response approach.

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6.7.4 Explosives Response Guideline. Guidelines for response to an incident involving explosive materials should be based on available resources, personnel, and capabilities necessary to perform assigned tasks. Whether the event is accidental or intentional, HMRP personnel should identify all hazards associated with the incident and take appropriate actions, based on the greatest harm and danger. It is possible that additional present hazards could be more dangerous than the harms associated with explosive materials. The SOG should address the following:

(1) SOG for the emergency phase of an emergency
(2) SOG safety and incident response considerations for the following situations:
  (a) Life threatening
  (b) Non–life threatening
  (c) No threat to life or property
(3) SOG for a risk-based response

6.7.5 WMD Response Guideline. Older emergency response plans were based on accepted procedures and safe work practices. The new hazardous materials/WMD mission includes concerns that are specific to an intentional release that is designed to kill, injure or cause mass destruction of property, infrastructure, or the environment. Guidelines for response to an incident involving a WMD should be based on available resources, personnel, and capabilities necessary to perform assigned tasks. Because the incident is intentional, the associated criminal activity could affect the decisions of HMRP personnel. HMRP personnel could find themselves in a situation and become targets themselves. The SOG should include safety and incident response considerations to address the following:

(1) Immediate notification of on-scene and responding personnel
(2) Deployment of law enforcement personnel for scene security and criminal investigation
(3) SOG considerations for identification and preservation of evidence, chain of custody, and documentation issues
(4) SOG considerations for information and intelligence exchange with other organizations or jurisdictions
(5) SOG considerations for possible decontamination
(6) SOG considerations for deployment of personnel for force protection
(7) SOG considerations for awareness of the potential for secondary threats

6.7.6 Significant Incident Response Guideline. As part of the ERP, the AHJ should develop guidelines that outline such things as strategic objectives, tactical considerations, resource needs, dispatching and notification procedures, pre-determined mutual-aid requests and emergency operation center activation trigger points for an all-hazards approach to a significant incident. Procedures should include; guidelines for response, shelter-in-place, and personnel recall. The guidelines should focus on ensuring that a jurisdiction can respond to any threat or hazard, including those with cascading effects. Emphasis should be on saving and sustaining lives. Procedures should include: incident stabilization, meeting basic human needs, restoring basic services and functionality, establishing a safe and secure environment, and supporting the transition to recovery. Significant incidents demand a much broader set of atypical partners to meet the demands of the incident.

6.7.7 Public Planning Guideline. The AHJ should develop a guideline for public use that provides guidance for recognizing hazards and appropriate self-protective actions. Public involvement is vital to provide additional support to response personnel and can often be the primary source of response in the first hours or days after a catastrophic event. As such, the public should be encouraged to train, exercise, and partner with each other and emergency management officials.

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6.8* Operational Security.

SOGs, SOPs, ERPs and other response program documents can contain critical and sensitive information that can be used by adversaries against emergency responders. Operation Security (OPSEC) should be an integral element of the organization/jurisdiction preparedness program.

A.6.8 OPSEC includes safeguarding sensitive information that an adversary could use to their advantage.

While all hazmat response programs should consider OPSEC, HMR teams should develop an OPSEC plan if their team's area of responsibility includes any of the following:

(1) CBRNE response or consequence management
(2) Assisting with law enforcement operations, including illicit lab or bomb squad responses
(3) Providing hazmat/WMD response assistance with regard to dignitary protection
(4) Special event planning or participating in joint hazard assessment teams (JHATs)

The OPSEC planning process should include the following steps:

(1) Identify sensitive information
(2) Analyze threat
(3) Analyze vulnerability
(4) Assess risk
(5) Apply countermeasures

Examples of sensitive information that an HM program might need to protect include the following:

(1) Current and future operations
(2) Information about law enforcement investigations
(3) Official access or identification cards
(4) User names and passwords
(5) Team capabilities and limitations
(6) Entry/exit or checkpoint security procedures
(7) IAPs for special events
(8) Critical communications via phone or radio
(9) Facility pre-plans or hazardous materials storage information
(10) Proprietary industrial information

Examples of HMR program vulnerabilities that adversaries might exploit include the following:

(1) Unsecured e-mails accounts
(2) Use of home e-mail for official business
(3) User names or password reminders in public view
(4) Sensitive documents left in vehicles
(5) Information shared on websites and social media
(6) Information discussed in public forums
(7) Disposed un-shredded documents
(8) Lost electronic devices such as smart phones, computers, or flash drives

6.9 Information and Intelligence Sharing.

The HMRP should develop, and maintain, relationships that help facilitate intelligence and information sharing, including formal relationships with government fusion centers.

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6.9.1 The HMRP should gather intelligence from fusion centers, such as officer safety bulletins, threats against chemical facilities, or missing/stolen hazardous materials.

6.9.2 The HMRP should contribute or produce intelligence products for fusion centers by providing technical analyses, hazardous materials/WMD threat assessments, or hazardous materials/WMD–focused bulletins on emerging trends or hazards.

6.9.3 The HMRP should enroll and participate in Department of Homeland Security online intelligence portals and the International Association of Fire Chiefs' (IAFC) hazmat fusion center to receive and share Hazardous Materials/WMD best practices, case studies, and additional information.

6.9.4 Hazardous materials/WMD responders should maintain a wide professional network of other hazardous materials/WMD professionals to exchange best practices, response options, training information, and technical advice.

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7 Resource Management

7.1 Scope.

This chapter applies to those organizations and jurisdictions responsible for organizing, managing, and sustaining a hazardous materials/weapons of mass destruction (WMD) response program (HMRP) and provides guidance for developing a comprehensive resource management plan to ensure that all required resources are available to meet program objectives.

7.2 Purpose.

This chapter addresses the identification, acquisition, and management of personnel, equipment, and supplies to support HMRP activities.

7.3 Personnel.

Quality personnel is a critical aspect of HMRP management. Program success is dependent on proper recruitment, effective retention, and appropriate maintenance of personnel.

7.4* HMRP Types.

HMRPs can vary in size and complexity based on the mission and objectives. Programs can be single or multijurisdictional, public or private industry, or any combination thereof and based on available personnel and resources.

A.7.4 Based on the type of HMRP, staffing capabilities, regulatory requirements, budget considerations, and other factors, HMRP managers should develop a deployment model. The model should be published in HMRP procedural documents and team members should be familiar with their personal responsibilities within the deployment model. Deployment models should be evaluated and include the following:

(1) Staffing requirements for the mission.
(2) Staffing options, which can include, but are not limited to, the following:
    (a) Dedicated teams
    (b) Cross-staffed teams, which include personnel assigned to more than one unit at a single location (e.g., personnel assigned to other response apparatus and a designated

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hazardous materials response team at the same time). The nature of the response dictates staffing. This model provides greater flexibility in staffing; however, this model can negatively impact training and a member's ability to maintain proficiency and competency in all required job duties if assigned multiple responsibilities.

(c) Regional response teams are composed of several organizations that respond to a specified geographic area, or a single organization with responsibilities for a particular geographic area. Teams are made up of members from multiple organizations that can respond to an assembly point to gather tools, equipment, personnel, and apparatus prior to response. Training and competency assessment for this model can be challenging due to interagency dynamics.

(d) Satellite teams have personnel and resources assigned to a central location (e.g., fire stations, deployment centers, and so forth) that are supplemented by other responders at nearby locations. This deployment model places initial hazardous materials response personnel on scene quickly to size up and control the scene, and allows additional time to determine if additional resources are needed.

(e) Mutual aid allows agencies that provide or receive assistance from each other to respond together to mitigate or manage hazardous materials/WMD incidents.

(f) Contracting allows private and public agencies to utilize outside contracts and contractors to augment existing response capabilities or mitigate the incident on behalf of the HMRP.

7.4.1 Hazardous Materials/WMD Response Teams (HMRTs). A unit whose primary mission is to respond to hazardous materials/WMD incidents.

7.4.2 Types of HMRTs. Due to the professional competencies and job performance requirements (JPRs) of personnel needed to manage hazardous materials/WMD incidents, the training requirements needed to achieve and maintain these competencies and JPRs, and the specialized equipment and practices used in responding to such hazardous materials/WMD incidents, most HMRPs maintain a team of dedicated personnel. HMRTs are configured in various ways, including the following:

(1) *Single jurisdiction/single agency or organization:* HMRT members are recruited and maintained from personnel within the specific agency, jurisdiction, or organization that is maintaining the HMRP.
(2) *Private/industrial sector:* HMRT members are employees of a private business or industry that maintains hazardous materials response capabilities for other business operations and responds to offsite incidents that involve the company's products or services.
(3) *Multijurisdictional/multiagency:* HMRT members are recruited and maintained from a pool of personnel from two or more agencies, jurisdictions, and organizations that cover a single or multijurisdictional geographic area. Often referred to as regional teams, this type of HMRT often pools personnel, equipment, funding, and other necessary resources into a single team to mitigate hazardous materials/WMD incidents.
(4) *Combination teams:* HMRTs members are recruited and maintained from both public agencies and private industry, to form a combined team.

7.4.3 Resource Typing. Resource typing can have an impact on daily staffing, deployment, program sustainability, and team member recruitment and retention. Team typing categories describe resources by capacity and capability and include measurable standards that are intended to produce an identifiable response to a hazardous materials/WMD incident. Resource typing should provide the HMRP manager and on-scene incident management with the following:

(1) Enhanced emergency readiness
(2) Guidance for equipment purchasing and subsequent training
(3) Ease in identifying, requesting, and tracking resources by type

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7.4.4 Specialty Personnel. HMRP managers should be aware of other agencies that are capable of providing additional resources to the hazardous materials/WMD incident, such as personnel and/or specialized equipment, or that could be otherwise available to the authority having jurisdiction (AHJ). These resources could come from many sources, including private-industry response teams, military units such as civil support teams or the United States Coast Guard National Strike Force, railroad response teams, pipeline experts, airline experts, and so forth. This pool of resources can change due to funding and/or other influences, so HMRP managers should be aware of resource availability. Chapter 9 of NFPA 472 offers detailed information on specialty employees and the conditions under which they could be utilized at hazardous materials/WMD incidents.

7.4.5* Core Capabilities (Team). Per the HMRP's mission, a specific set of core team capabilities should be developed based on available personnel, resources, and funding. Each responder within the HMRT should be trained and equipped to perform their assigned task in a safe and effective manner. A specific set of core team capabilities should be developed based on NFPA 472.

A.7.4.5 The national preparedness goal identifies core capabilities. These are the critical elements needed to achieve the goal. These capabilities are referenced in many national preparedness efforts, including the national planning frameworks. The goal groups the capabilities into five mission areas based on where they best fit. Some capabilities fall into only one mission area, while others apply to several mission areas.

7.4.5.1 Various internal and external influences shape the mission of HMRPs. HMRP managers should assess these influences to determine the mission and scope of team operations and develop a plan for staffing the HMRP based on these factors.

7.4.5.2 Community support is an important influence on the HMRP's overall mission and, by relation, affects HMRP personnel recruitment and retention decisions.

7.4.5.3 Funding has direct and indirect effects on team personnel decisions. Reimbursement for team activities might be one of the largest line items in an HMRP budget. Planning is required to match available funding to personnel resources and the overall HMRP mission.

7.4.6 Competencies (Members). Title 29 CFR 1910.120 dictates personnel management and training requirements for HMRP personnel. Under this regulation, HMRP managers have legal requirements where training and maintaining their team members.

7.4.6.1 NFPA 472, NFPA 473, and NFPA 1072 all provide competencies and JPRs for personnel assigned to respond to hazardous materials/WMD incidents. HMRP managers should use these documents as guides where developing competencies for HMRP personnel.

7.4.6.1.1 HMRP managers can recruit and maintain subject matter experts (SMEs) to assist them with specialized aspects of team responses and training. The SME might or might not be a trained and qualified team member and can only be used for specific purposes. One common example is the use of a chemist to assist with research and planning during responses.

7.4.6.1.2 By definition and practice, personnel are considered to be HMRP resources. In 2005, the United States Department of Homeland Security developed and published the *National Mutual Aid and Resource Management Initiative*, which was designed to support the National Incident Management System (NIMS) by establishing a comprehensive, integrated, national mutual-aid and resource management system that provides the basis to type, order, and track all federal, state, and local response assets. Resource typing for hazmat entry team personnel is defined within DHS Resource Typing Documents FEMA 508-1, *Typed Resource Definitions — Animal Health Resources,* and FEMA 508-4, *Typed Resource Definitions — Fire and Hazardous Materials Resources*.

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7.4.6.1.3 Personnel credentialing is defined within DHS NIMS Guide NG0002, *National Credentialing Definition and Criteria*, which provides credentialing requirements for personnel ordered as single resources or appointed to teams assigned to equipment listed within the Tier 1 NIMS national resource typing definitions. Personnel credentialing is a voluntary process and only relates to deployable resources for interstate mutual-aid responses. It is recommended that HMRP managers be familiar with NIMS credentialing requirements within ASTM E2842, *Standard Guide for Credentialing for Access to a Disaster Scene*. ASTM E2842 was developed with the Federal Emergency Management Agency (FEMA) National Integration Center (NIC) to identify essential elements from FEMA guidance on credentialing at a disaster scene.

7.4.6.1.4 Various federal regulations, guidance documents, voluntary standards, and recommended practices provide criteria for the recruitment, development, and training of HMRP personnel. Team personnel should be assigned specific roles and responsibilities based on their training specialties, experience, and capabilities. HMRP managers should be familiar with these documents and use them in making personnel management decisions.

7.4.7 Deployment. As influenced by the HMRP mission, responsibilities, geographic coverage area, regulations, and other various factors, HMRP managers should anticipate and prepare for team deployments. HMRP deployments vary in length and complexity and necessitate that HMRP managers perform appropriate predeployment planning. Staffing solutions are complex, with benefits and limitations for each staffing option. Response to a hazardous materials/WMD event demands familiarity with all resources (e.g., personnel, supplies, and equipment) including those from other jurisdictions or organizations. Deployment of these resources should take into consideration community risk assessment, response times, financial constraints, standard operating procedures/guidelines, automatic and mutual-aid agreements, and other policies and procedures of the AHJ. Long-term plans for retention and recruitment should also be considered. Deployment models should be developed based on the findings of the risk assessment process and the best interest of the organizations or jurisdictions.

7.4.7.1* Depending on the type and size of the HMRP, deployments can present an HMRP manager with staffing challenges. Title 29 CFR 1910.120 requires that personnel with specific training and competencies be present during emergency responses. It is the HMRP manager's responsibility to ensure that the correct number of trained and qualified personnel are present to meet this federal regulation.

A.7.4.7.1 Title 29 CFR 1910.120(q) requires jurisdictions to have an ERP if they have an emergency response program to hazardous substances. An ERP should include the following:

(1) Pre-emergency planning and coordination with outside parties
(2) Personnel roles, lines of authority, and coordination with outside parties
(3) Emergency recognition and identification
(4) Notification protocols
(5) Safe distances and places of refuge
(6) Site security and control
(7) Evacuation routes and procedures
(8) Decontamination
(9) Emergency medical treatment and first aid
(10) Emergency alerting and response procedures
(11) Critiques or response and follow-up
(12) PPE and emergency equipment

7.4.7.2 Depending on the type and size of hazardous materials/WMD incident, HMRP managers should be prepared to sustain incident operations over long periods. Relief of on-scene personnel for incidents that are to be sustained for greater than one operational period should be anticipated by the HMRP manager.

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7.4.7.2.1 The first choice for HMRP managers should be to relieve team personnel with other team members. Personnel rotations should be anticipated far in advance, and HMRP managers should have systems in place to recall off-duty personnel.

7.4.7.2.2 Mutual-aid resources are another source of relief for on-scene personnel. HMRP managers should be familiar with existing mutual-aid systems and available resources prior to calling for these resources to sustain operations at an existing emergency incident. Some mutual-aid relationships might require advance agreements outlining the provision and sharing of services prior to deploying to incidents.

7.4.7.2.3 Local and regional resources can be another source of personnel to sustain or enhance incident operations. These can include other emergency services agencies, private hazardous materials teams, military units proficient in hazardous materials response, and other like resources. HMRP managers should be familiar with these types of resources prior to requiring assistance from such services.

7.4.7.2.4 The Emergency Management Assistance Compact (EMAC) was established by Congress in 1996 and serves as a national state-to-state mutual-aid system. HMRP are subject to EMAC requests and can be requested to deploy to large-scale events of national significance. HMRP managers should be familiar with the EMAC system and seek guidance from their superiors as to whether their team can be deployed within this compact.

7.4.7.3 HMRP managers should develop and maintain demobilization plans as part of their team practices and documentation.

7.4.7.3.1 Record keeping is an important part of HMRP deployments. Based on the type, length, and complexity of the incident, team members might have to produce documentation after the incident, including, but not limited to, incident action plans (IAP), entry and medical records, payroll records, maintenance records, and so forth. HMRP managers should develop record-keeping requirements and systems prior to team deployments and maintain a system for the collection and review of such documentation following deployments.

7.4.7.3.2 HMRP managers should develop a process to conduct a postincident analysis following deployment to emergency incidents. A postincident analysis can provide an opportunity to review incident information and operations and to improve future team operations.

7.4.8 Compensation and Benefits. Where applicable, HMRP personnel management should include provisions for compensating team members and providing for their assigned benefits. HMRP managers should develop budget information on the compensation and benefit requirements of team members. Budgeting for compensation should include anticipating the deployment of team members and any associated overtime costs.

7.4.8.1 HMRP members can work under collective bargaining agreements that outline compensation and benefit requirements, including overtime provisions and working conditions. HMRP managers who have personnel working within collective bargaining agreements should be familiar with the provisions contained in these agreements and their associated responsibilities in managing such personnel.

7.4.8.2 Some team members might be subject to nonmonetary compensation for team activities. These can include compensation time and/or a variable work schedule.

7.4.8.3 Many HMRP members are covered under workers compensation regulations. If a team member suffers a duty-related injury, the HMRP manager or his or her designee might be responsible for filing initial reporting documentation and managing the worker's compensation case to a conclusion.

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7.4.9 Member Maintenance. Responses to hazardous materials/WMD incidents should include provisions to ensure the well-being of responders before, during, and after their designated actions are executed. Member maintenance incorporates a number of subcategories that in aggregate are designed to address the legal requirements set forth in applicable standards, but beyond the letter of the law are designed to ensure the well-being of personnel. Incorporated in this topic are 29 CFR1910.120, 29 CFR1910.134, and 29 CFR1910.1020, as well as any employer's internal standards regarding the subject.

7.4.9.1 Respiratory Protection Program. Title 29 CFR 1910.134(c) requires that an employer develop and implement a written respiratory protection program where workplace conditions necessitate the use of a respirator to protect the health of the employee — hazmat teams also fall under this requirement. The respiratory protection program should be administered by trained and experienced individuals and should address respirator selection; annual fit-testing procedures; breathing-air quality; procedures for use, care, and cleaning of respirators; employee training; evaluation of program effectiveness; and medical evaluations to determine the employees' ability to don the required respirator.

7.4.9.1.1 It should be noted that the requirements in 29 CFR 1910.134(c) for use of a respirator do not require the employee to receive an annual medical examination. However, the Occupational Safety and Health Administration (OSHA) places the responsibility on the employer and the examining health care professional to determine the frequency and content of medical evaluations for each employee. Type and content of medical evaluations depend on the strenuousness of the work being performed, the type and frequency of respirator use, and the physical and medical condition of the employee as determined by the evaluating physician, as well as any physical and medical issues reported by the employee.

7.4.9.2 Medical Surveillance. Title 29 CFR 1910.120 (a)(1)(i) through (a)(1)(iv) defines the operational arenas in which employees fall under the routine medical surveillance program. Section (q)(9) incorporates hazmat team members and mandates the minimum requirements for an organization's/employer's medical surveillance program. It should be noted that the type of medical surveillance is based on roles filled during a response. Not all personnel have to have the same type of medical surveillance. However, this is a nonissue where all members of the team are trained to the same level [e.g., use of personal protective equipment (PPE)]. Medical surveillance is an annual requirement per Section (q)(9), unless the attending physician believes a longer interval is acceptable. In no case can the period between physicals exceed 2 years.

7.4.9.2.1 OSHA requires anyone who leaves the HMRP for any reason to have a physical examination on departure, unless an annual or biennial physical was conducted within 6 months of exiting, in which case it can be used to fulfill the requirement.

7.4.9.2.2 Medical examinations, including what might be in existence in an employee's file, should be conducted with detailed emphasis related to the handling of hazardous materials and their accompanying health hazards, as well as fitness for duty, including the ability to wear any PPE that might be required.

7.4.9.3 Record Keeping. Record keeping is addressed in 29 CFR 1910.120(f)(8), and retention periods specified in 29 CFR 1910.1020(d)(1)(i) and (d)(1)(ii) require that medical records and exposure records be retained for 30 years beyond termination of employment.

7.4.9.3.1 Medical and exposure records should include, at a minimum, the following:

(1) Employee name and social security number
(2) Physician's written opinions, recommended limitations, and results of examinations and tests
(3) Any employee medical complaints related to exposure to hazardous substances
(4) A copy of the information provided to the examining physician by the employee

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7.4.9.4 Personnel Exposures. Employers should, upon notification that an employee is experiencing signs or symptoms of exposure, provide the employee access to additional medical surveillance.

7.4.9.5 Treatment. Employees who undergo treatment for an exposure or injury should receive said treatment at no cost to them, with no loss of pay. Treatment should be performed by or under the supervision of a licensed physician at a reasonable time and place.

7.4.9.6 Follow-up. Follow-up medical surveillance and treatment by the examining physician should be provided as necessary. Additional medical surveillance could also be required under 29 CFR 1910 Subpart Z depending on the nature and extent of the exposure.

7.5 Supply Management.

Supplies are defined as nonequipment, expendable related resources (e.g., pH paper or colorimetric tubes) that an HMRP could need to complete its mission.

7.5.1 The acquisition and maintenance of supplies is a key aspect of managing an HMRP. The amount of HMRP supplies can be significant in scope, number, and size, depending on the HMRP's mission. It is important that HMRPs are stocked with needed supplies and that these supplies be maintained in various locations, including at the same location as response units, on response vehicles, at vendor warehouses, and/or in storage buildings. Some supplies might have a defined shelf life that should be identified and handled according to a defined process for their management and restocking.

7.5.2 Supplies related to hazardous materials/WMD incident responses might be of a specialized nature with a limited number of vendors for such items. HMRP managers should ensure that vendor relationships are established to provide quick and efficient restocking of expended supplies. HMRP managers and personnel assigned to manage team supplies should be familiar with specific purchasing oversight requirements related to purchasing any supplies that are subject to municipal and/or organizational purchasing laws, regulations, and/or processes. They should be familiar with advance prequalification and approval requirements per government regulations and industry purchasing practices. Where required by these regulations and practices, standing purchasing agreements need to be developed and maintained with approved vendors. Some might involve competitive bidding activities and require formal, contractual relationships with vendors.

7.5.3 HMRP managers should develop internal processes to ensure that team supplies are identified, maintained, and restocked. Mission-critical supplies should be noted as such in an inventory system and processes for rapid restocking should be developed.

7.5.4 Proper documentation of inventory and use is an important aspect of supply management. A thorough and complete record-keeping system should be established and maintained by HMRP managers to ensure that supply management is documented.

7.5.5 5 Supplies should be stored and maintained in suitable facilities. Many HMRPs maintain the supplies at the same location as response units to facilitate restocking after responses, exercises, or training. Regardless of location, supply storage facilities should be secure and appropriate for the type and amount of supplies being maintained. Some supplies require climate-controlled storage and all should be stored and maintained in suitable facilities, which should be secure and appropriate for the type and quantity maintained. HMRP managers should anticipate the needs related to emergency and routine transportation from remote storage. Plans to manage all such circumstances should be developed.

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7.6* National Incident Management System (NIMS) and Resource Management.

A.7.6 When a request for mutual aid is received by a jurisdiction, the potential supporting department or agency evaluates its capacity to absorb the anticipated loss of resources that would be deployed. The assisting agency should not compromise their own mission. For example, can a fire department allow 20 percent of its equipment and personnel to be deployed to another jurisdiction for 30 days and still meet its own community's needs?

If the assisting department or agency determines that it can accommodate the request for resources, it must next identify specific personnel who will be deployed. The assisting department or agency should then select members for deployment. Some states have an authorized accrediting agency that will verify the responder's credentials and clear those who can provide mutual aid. The accrediting agency evaluates each person's credentials and determines whether the applicant meets the established criteria for the positions required by the mission. For responders that are approved by the authorized accrediting agency, the following steps are taken:

(1) The applicant's department or agency is notified.
(2) A record is created on the individual in the official credentialing database.
(3) An identification card or other credential is issued to the individual-the identification card or credential should include an expiration date and be reissued as appropriate.
(4) Information on the applicant is uploaded to the incident management infrastructure.

Figure A.7.6 illustrates the recommended credentialing process.

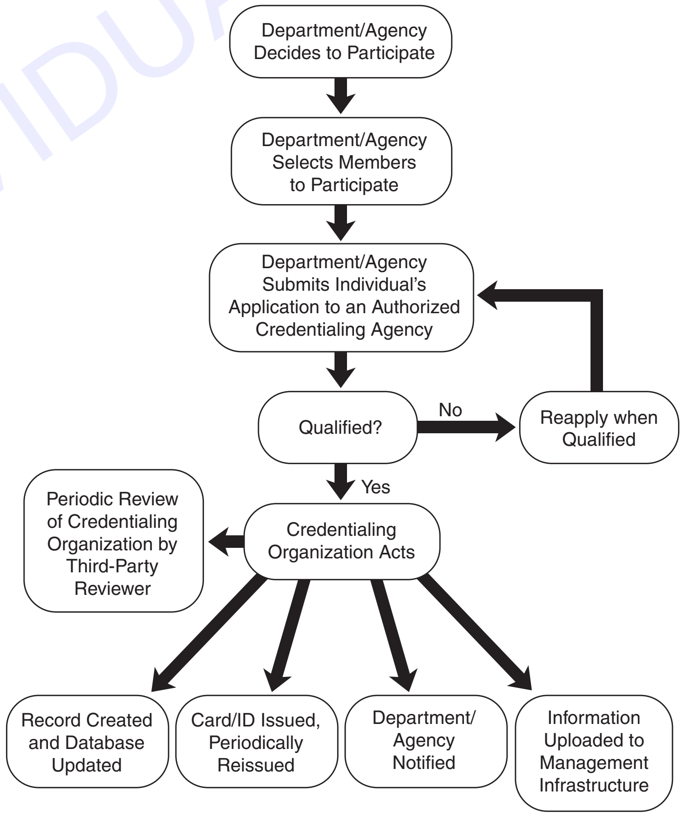

***FIGURE A.7.6** An Illustration of the Recommended Credentialing Process.*

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7.6.1 NIMS. The NIMS command and management component stresses effective and efficient incident management and coordination via a flexible, standardized incident management structure. This structure should include the incident command system, multiagency coordination systems, and public information.

7.6.2 NIMS Resource Management. NIMS also emphasizes that careful resource management is essential before, during, and after incidents. NIMS emphasizes standardized resource management practices such as typing, inventory control, organizing, and tracking to allow for effective sharing and integration of critical resources across organizations/jurisdictions.

7.6.3 Preparedness and Response. In accordance with NIMS, the resource management process can be separated into two parts: resource management as an element of preparedness and resource management during an incident. The preparedness activities (e.g., resource typing, credentialing, and inventorying) are conducted on a continual basis to help ensure that resources are ready to be mobilized if called to an incident.

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8

Staffing

8.1 Scope.

This chapter applies to those organizations or jurisdictions responsible for organizing, managing, and sustaining a hazardous materials/weapons of mass destruction (WMD) response program (HMRP) and provides guidance to evaluate personnel resources required to staff the program.

8.2 Purpose.

This chapter addresses the various deployment options, team typing, and recommendations for specialty personnel or allied professionals.

8.3 Deployment of Personnel.

Each staffing solution has benefits and limitations. Deployment of personnel should take into account jurisdictional risk assessment, response times, financial considerations, program capabilities, automatic and mutual-aid agreements, and policies and procedures of the authority having jurisdiction (AHJ). Deployment models include the following:

(1) *Response model.* In this model, daily staffing levels should be based on a jurisdictional risk analysis relative to hazardous materials/WMD incidents.
(2) *Staffing model.* The HMRP should determine the staffing model that best meets the needs and resources of the organization/jurisdiction. Staffing model types include the following:
    (a) *Dedicated staffing model.* In this model, personnel are assigned to a unit with a primary mission to respond to hazardous materials/WMD incidents. Personnel in this model have a specialized mission with specific training requirements instead of other response tasks, but this could include additional staffing to cover areas of specialty, which can increase program costs.
    (b) *Cross-trained staffing model.* Cross-trained personnel can be assigned to more than one type of response unit in a single location and have multiple response duties. The nature of the incident drives staffing decisions. This model might allow for more flexibility in staffing but adds multiple responsibilities that can impact training and the ability to maintain proficiency. Other benefits might include reduced staffing levels, greater flexibility, increased capabilities, and program cost savings; however, maintaining the proficiency of personnel to multiple response tasks could be an issue, as well as unstaffed units or delayed response.

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(c) *Regional response staffing model.* In this model, personnel from multiple agencies or organizations staff an HMRP to respond to an incident within a given or designated geographic area. With the regional response model, personnel from multiple agencies or organizations respond to an assembly point to gather supplies, equipment, and other necessary resources to respond to an incident. This model offers greater flexibility, increased capabilities, access to personnel with varied experience and specialties, and program cost savings. However, it might prove difficult to maintain the proficiency of personnel from multiple agencies and organizations due to interagency dynamics and logistics. Also, personnel with multiple response task(s) might not be available, which could result in understaffed units or delayed response.

(d) *Mission-specific or augmented staffing model.* Mission-specific response personnel or units are trained to supplement or augment any model. This model can allow for expanded capabilities at the operations level, additional staffing, maintaining proficiency, and program cost savings. Some limitations of this model include the logistics needed to train and supply more units and personnel, additional command and control elements, and coordinating operations.

(e) *Mutual-aid staffing model.* In this model, agencies provide or receive assistance from other organizations or jurisdictions for hazardous materials/WMD incidents. This staffing model should require written mutual-aid agreements that specify types of assistance and cost reimbursement considerations. Mutual-aid benefits include increased flexibility and expanded capabilities, and program cost savings. However, some limitations of this model include “availability-only” mutual-aid based on jurisdictional requirements or needs, and varying levels of training, experience, and competence.

(f) *Contract service staffing model.* Here, personnel from outside contractors are utilized to augment the staffing and response capabilities of an HMRP. This model can provide reduced staffing costs, greater flexibility, increased capabilities, and program cost savings. However, this model might also include extra liability because contracted personnel might not be trained and equipped for the incident, insured, or bonded, and a delay in response is possible because of availability of resources.

8.4 Resource Typing and Specialty Personnel or Allied Professionals.

8.4.1 Resource Typing Categories. Resource typing categorizes and describes the capacity and capability of a specific resource. Resource typing can impact staffing levels, deployment of personnel, program sustainability, and recruitment and retention where trying to maintain a specific level of resource for an HMRP.

8.4.2 Resource Typing Staffing Levels. Resource typing can assist HMRP managers and enhance emergency response readiness through consistent staffing levels, a standard equipment list, and recommended levels of training for personnel. Where available during a hazardous materials/WMD incident, command and control can identify and track resources by type and kind.

8.4.3 Specialty Personnel or Allied Professionals. HMRP managers should be aware of the capabilities of other HMRPs. Capabilities might include specialized resources and personnel that could be deployed. Specialty personnel can come from private industry, the Department of Defense (DOD), and other sources. Staffing levels can vary due to funding or other influences. HMRP managers should be aware of the availability of such resources. Chapter 9 of NFPA 472 offers detailed information on specialty employees and the conditions under which they could be utilized at a hazardous materials/WMD incident.

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9 Training

9.1 Scope.

This chapter applies to those organizations and jurisdictions responsible for organizing, managing, and sustaining a hazardous materials/weapons of mass destruction (WMD) response program (HMRP) and provides guidance for the development of a comprehensive training program.

9.1.1* A training program should serve as the source of personnel training and should include a means for evaluating personnel competence as required by Occupational Safety and Health Administration (OSHA) regulations and NFPA standards.

A.9.1.1 NFPA 1041 is one resource for instructional practices and associated competencies.

9.1.2 A training program should provide accurate, relevant, and engaging training that is challenging and worthwhile to HMRP personnel.

9.2 Purpose.

This chapter addresses training levels, competencies, and refresher training; training program development; instructional design; training delivery models and methodologies; training facilities, equipment, and props; selecting competent instructors; training and exercise safety; and training records management in support of an HMRP.

9.3 Levels of Hazardous Materials Training.

HMRP managers determine the level of training needed for the program and its support elements. Training should be based on risks assessed by the authority having jurisdiction (AHJ), tasks to be performed time available for training, and financial commitment from the AHJ.

9.3.1 Hazardous Materials Training Standards and Regulations.

9.3.1.1 There are three sources for determining hazardous materials training levels: OSHA, the Environmental Protection Agency (EPA), and NFPA. Title 29 CFR 1910.120 and 40 CFR 311 are laws and NFPA 472 and NFPA 1072 are voluntary consensus standards for hazardous materials emergency response. Hazardous materials personnel that train to the competencies set forth in NFPA exceed those established by OSHA or EPA regulations.

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9.3.1.2 Title 29 CFR 1910.120 is a regulation enforced by OSHA. Violations can result in fines against the AHJ and/or individuals within the AHJ. Title 29 CFR 1910.120 defines the levels of training for hazardous materials emergency responders in paragraph (q)(6). Promulgated in 1990, the regulation recognizes 5 levels of training: first responder awareness level, first responder operations level, hazardous materials technician, hazardous materials specialist, and on-scene incident commander.

9.3.1.3 Title 40 CFR 311 is a mirror of 29 CFR 1910.120 and applies to all employees in states that do not have a state-specific OSHA plan. Title 40 CFR 311.2 defines an employee as either a compensated or noncompensated worker controlled by a state or local government, which includes volunteer public safety agencies. Title 40 CFR 311 incorporates 29 CFR 1910. Further references to 29 CFR 1910.120 in this document include 40 CFR 311.

9.3.1.4 NFPA 472 is a voluntary consensus standard that defines minimum competencies for personnel responding to hazardous materials/WMD incidents.

9.3.2 Awareness Level.

9.3.2.1 Awareness-Level Personnel. Awareness-level personnel are personnel who, in the course of normal duties, could encounter an emergency involving hazardous materials/WMD and who are expected to recognize the presence of the hazardous materials/WMD, protect themselves, call for trained personnel, and secure the scene. *(See also NFPA 472 and NFPA 1072.)*

9.3.2.2 First Responder Awareness Level. First responders at the awareness level are individuals who are likely to witness or discover a hazardous substance release and who have been trained to initiate an emergency response by notifying authorities of the release and taking no further action. First responders at the awareness level should have sufficient training or experience to demonstrate competency in the following areas *[see also 29 CFR 1910.120(q)(6)]*:

(1) An understanding of what hazardous substances are and the risks associated with them in an incident
(2) An understanding of potential outcomes associated with an emergency where hazardous substances are present
(3) The ability to recognize the presence of hazardous substances in an emergency
(4) The ability to identify a hazardous substance, if possible
(5) An understanding of the role of first responder at the awareness level in an employer's emergency response plan (ERP), including site security and control, and the U.S. Department of Transportation's (DOT) *Emergency Response Guidebook*
(6) The ability to recognize the need for additional resources and to notify the communications center

9.3.2.3* Delivery of Awareness-Level Training. Awareness-level personnel are not emergency responders but could encounter hazardous materials as part of their assigned duties. OSHA, NFPA 472, and NFPA 1072 do not state that awareness-level training is necessary for anyone expected to respond to and deliver emergency response services at a hazardous materials/WMD incident.

A.9.3.2.3 Awareness-trained personnel can include the following:
(1) Administrative staff
(2) Custodial staff
(3) Maintenance staff
(4) Agency officials (e.g., mayor's staff)
(5) News media

9.3.2.3.1* Neither OSHA nor NFPA place a time factor on awareness-level training. The expectation is that upon the completion of training, personnel should have an understanding

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of the hazards associated with hazardous materials/WMD and know how to contact the appropriate response agency to deal with the situation. The HMRP manager should design an evaluation process for personnel. The instruction time varies based on a gap analysis and the number of personnel in class.

A.9.3.2.3.1 Because awareness-level personnel are not part of the response and do not don personal protective clothing or enter the exclusion zone, there is very little equipment needed for this training. Awareness-level training equipment can include the following:

(1) Classroom
(2) Data projector
(3) DOT emergency response guidebooks
(4) Pens/pencils
(5) Notebook paper

9.3.2.3.2 Title 29 CFR 1910.120 Appendix E(C)(b)(1)(F) states first responder awareness-level personnel should know the first responder awareness-level competencies covered in NFPA 472.

9.3.3 Operations Level.

9.3.3.1 Operations-Level Responders. Operations-level responders are personnel who respond to hazardous materials/WMD incidents to implement or support actions to protect nearby persons, the environment, or property from effects of a release. *(See also NFPA 472 and NFPA 1072.)*

9.3.3.2 Operations-Level Mission-Specific Competencies. Operations-level mission-specific competencies are the knowledge, skills, and judgment needed by operations-level responders designated by the AHJ to perform mission-specific tasks, such as decontamination, victim/hostage rescue and recovery, evidence preservation, and sampling.*(See also NFPA 472 and NFPA 1072.)*

9.3.3.3 First Responder Operations Level. First responders at the operations level are personnel who are part of the initial response to the site of releases or potential releases of hazardous substances to help protect people, property, or the environment from the effects of the release. They are trained to respond in a defensive fashion without trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures. First responders at the operations level should have at least 8 hours of training or sufficient experience to demonstrate competency in the following areas, in addition to those at the awareness level *[see also 29 CFR1910.120(q)(6)]*:

(1) Basic hazard and risk assessment techniques
(2) How to select and use personal protective equipment (PPE) at the first responder operations level
(3) Basic hazardous material terms
(4) How to perform basic control, containment, and/or confinement operations with available resources and PPE
(5) How to implement basic decontamination procedures
(6) Relevant standard operating procedures (SOPs) and termination procedures

9.3.3.4* Delivery of Operations-Level Responder Training. Operations-level training is defined in NFPA 472 and includes personnel who respond to hazardous materials incidents. If personnel are sent to a hazardous materials incident, they need to be trained at or above the operations level. Personnel trained to the operations level can perform defensive actions at a hazardous materials/WMD incident. NFPA 472 and NFPA 1072 state that operations-level personnel respond to hazardous materials/WMD incidents to protect people, property, or the

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environment from the effects of the release. NFPA 472 and NFPA 1072 divide operations-level personnel into the following two categories:

(1) Competencies for operations-level responders apply to all operations-level responders. *(See Chapter 5 of NFPA 472 and Chapter 5 of NFPA 1072.)*
(2) Competencies for operations-level responders assigned mission-specific competencies apply to operations-level responders wearing PPE, performing decontamination, or conducting other mission-specific tasks at hazardous materials incidents. *(See Chapter 6 of NFPA 472 and Chapter 6 of NFPA 1072.)*

A.9.3.3.4 Personnel who should be trained to operations-level responder competencies include the following:

(1) Firefighters assigned to suppression or rescue duties
(2) Industrial brigade personnel assigned to suppression or rescue duties
(3) Law enforcement officers assigned to patrol duties
(4) Emergency medical service personnel
(5) Health department response personnel
(6) Public works department response personnel
(7) Emergency management agency response personnel
(8) Other response personnel

9.3.3.4.1 Title 29 CFR 1910.120 places a minimum time requirement on first responder operations-level training. OSHA requires that first responder operations personnel complete at least 8 hours of training or have enough experience to demonstrate competency in the identified areas.

9.3.3.4.2 The HMRP manager should design an evaluation process to track the progress of personnel in operations-level training. Operations-level training that meets the competencies in Chapter 5 of NFPA 472 also meets the OSHA first responder operations level as defined in 29 CFR 1910.120(q)(6)(ii). To meet the NFPA 472 competencies of an operations-level responder, additional training could be required beyond the 8 hours referenced in 29 CFR 1910.120.

9.3.3.4.3 Title 29 CFR 1910.120 Appendix E, (C)(b)(2)(H) states that first responder operations-level personnel should be aware of and know the first responder operations-level competencies covered in NFPA 472.

9.3.4 Operations-Level Responder with Mission-Specific Competencies (MSCs).

9.3.4.1* Delivery of Operations-Level Responder Mission-Specific Training. In NFPA 472 and NFPA 1072, operations-level MSCs are designed to provide operations-level responders with the knowledge and skills to perform mission-specific responsibilities in a safe and effective manner. Any personnel expected to perform defensive actions in a hot zone or any action in a warm zone should receive operations-level responder training and any requisite MSCs. The AHJ determines the appropriate MSC based on the mission of the emergency responder. Personnel that need MSC training should achieve all the competencies listed in Chapters 4 and 5 of NFPA 472 prior to being trained in the MSCs. The mission-specific competencies set forth in NFPA 472 are based on the operations competencies and any competencies based on the specific mission and tasks of the HMRP. OSHA does not have an equivalency to the NFPA 472 mission-specific competencies; however, they are covered in 29 CFR 1910.120(q)(6)(ii).

A.9.3.4.1 Table A.9.3.4.1 is designed to assist HMRP managers and training program personnel in choosing the appropriate MSCs for team members. The matrix in Table A.9.3.4.1 is a guide. The AHJ makes the final determination on MSCs appropriate for the team.

9.3.4.2 MSCs — PPE. The operations-level responder assigned to use PPE should be competent at the operations-level use of PPE at hazardous materials/WMD incidents. This MSC is necessary for any responder as all MSC levels use PPE.

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***TABLE A.9.3.4.1** NFPA 472 Operations-Level Mission-Specific Responder Matrix.*

	Competencies						
Responders	***Use PPE***	***Perform Technical or Mass Decontamination****	***Perform Product Control***	***Perform Air Monitoring***	***Perform Victim Rescue and Removal***	***Preserve Evidence and Perform Sampling***	***Respond to Illicit Lab Incident***
Fire fighters expected to perform basic defensive product control measures	X	X	X	—	—	—	—
Emergency responders assigned to a decontamination company or decontamination strike force	X	X	—	—	—	—	—
Emergency responders assigned to a unit tasked with providing rapid rescue and extraction from a contaminated environment	X	X	—	X	X	—	—
Emergency responders assigned to provide staffing or support to a hazardous materials response team	X	X	X	X	X	—	—
Law enforcement personnel involved in investigation of criminal events where hazardous materials are present	X	X	—	X	—	X	X
Law enforcement personnel involved in investigation of incidents involving illicit laboratories	X	X	—	X	—	X	X
Public health personnel involved in the investigation of public health emergencies	X	X	—	—	—	X	—
Environmental health and safety professionals who provide air monitoring support	X	X	—	X	—	—	—

*The scope of the decontamination competencies would be based on whether the mission involves the responder being the "customer" of the decontamination services being provided or is part of those responders who are responsible for the set-up and implementation of the decontamination operation.

9.3.4.3 MSCs — Mass Decontamination. The operations-level responder assigned to perform mass decontamination at hazardous materials/WMD incidents should be competent at operations-level mass decontamination operations at hazardous materials/WMD incidents.

9.3.4.4 MSCs — Technical Decontamination. The operations-level responder assigned to perform technical decontamination at hazardous materials/WMD incidents should be competent at operations-level technical decontamination operations at hazardous materials/WMD

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incidents. Technical decontamination is contamination removal to a level that is as low as reasonably achievable (ALARA) on responders wearing PPE.

9.3.4.5 MSCs — Evidence Preservation and Sampling. The operations-level responder assigned to perform evidence preservation and public safety sampling should be competent at operations-level forensic evidence preservation, sample collection, and/or evidence seizure at hazardous materials/WMD incidents involving potential violations of criminal statutes or governmental regulations. Evidence collection is performed by a law enforcement responder or under the guidance of law enforcement. Public safety samples can be collected by any responder authorized by the AHJ to assess incidents for potential threats to public safety.

9.3.4.6 MSCs — Product Control. The operations-level responder assigned to perform product control should be competent at operations-level implementation of product control measures at hazardous materials/WMD incidents. This MSC is only designed for defensive actions, such as damming or diking, and the application of Class B foams. Advanced product control, such as the application of patching kits, falls under the skill set of hazardous materials technicians.

9.3.4.7 MSCs — Air Monitoring and Sampling. The operations-level responder assigned to perform air monitoring and sampling should be competent at operations-level air monitoring and sampling operations at hazardous materials/WMD incidents. This MSC applies to air monitoring and detection devices that do not need direct contact with hazardous substances.

9.3.4.8 MSCs — Victim Rescue and Recovery. The operations-level responder assigned to perform victim rescue and recovery should be competent at operations-level rescue and recovery of exposed and contaminated victims at hazardous materials/WMD incidents.

9.3.4.9 MSCs — Response to Illicit Laboratory Incidents. The operations-level responder assigned to respond to illicit laboratory incidents should be competent at operations-level secureness at hazardous materials/WMD incidents involving potential violations of criminal statutes specific to the illegal manufacture of methamphetamines, other drugs, or WMD, as well as identifying the laboratory or process, and preserving evidence.

9.3.4.10 MSCs — Improvised WMD Dispersal Device Disablement/Disruption and Operations at Improvised Explosive Laboratories. The operations-level responder assigned to interrupt the functioning of an improvised WMD dispersal device or conduct mitigation procedures on energetic materials should be competent at operations-level disablement and/or disruption procedures on improvised explosive devices (IEDs) or WMD dispersal devices. This MSC is designed for a responder certified as a hazardous devices technician through the Federal Bureau of Investigation's (FBI) hazardous devices school or the Department of Defense (DOD).

9.3.4.11* Competency Evaluation. The HMRP manager should design an evaluation process to track the progress of personnel in operations-level training. Instruction time varies based on a gap analysis and the number of personnel in the class. NFPA 472 operations-level responder mission-specific competency training requires additional training time beyond the 8 hours referenced in 29 CFR1910.120.

A.9.3.4.11 PPE and other equipment can include the following:

(1) Self-contained breathing apparatus (SCBA) and spare cylinders
(2) Air-purifying respirators
(3) Powered air-purifying respirators
(4) Liquid splash chemical protective clothing
(5) Vapor chemical protective clothing
(6) Thermal/flammable protective clothing
(7) Other protective clothing (e.g., MOPP gear, multithreat tactical gear, bomb disposal suit)

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(8) Chemical-resistant boots
(9) Chemical-resistant gloves
(10) Detection and monitoring equipment
(11) Reagent papers
(12) Advanced detection equipment
(13) Product control equipment
(14) Decontamination equipment
(15) Rescue and recovery equipment
(16) Illicit laboratory equipment
(17) Evidence preservation and sampling equipment
(18) Field screening tools

Electronic simulation devices can include the following:

(1) Air-monitoring and detection simulators
(2) Incident simulators
(3) Virtual reality simulators

9.3.5 Technician Level.

9.3.5.1 Hazardous Materials Technician. A hazardous materials technician responds to hazardous materials/WMD incidents using a risk-based response process to analyze problems involving hazardous materials/WMD, select decontamination procedures, and control a release using specialized PPE. *(See also NFPA 472.)*

9.3.5.2 Hazardous Materials Technician. Hazardous materials technicians respond to releases or potential releases to stop the release. They assume a more aggressive role than an operations-level first responder in that they approach the point of release to plug, patch, or otherwise stop the release of a hazardous substance. Hazardous materials technicians should have at least 24 hours of training equal to the first responder operations level and competency in the following areas *[see also 29 CFR 1910.120(q)(6)]*:

(1) How to implement the employer's ERP
(2) How to classify, identify, and verify known and unknown materials using field survey instruments and equipment
(3) How to function within an assigned role in the incident command system (ICS)
(4) How to select and use proper specialized chemical PPE
(5) Hazard and risk assessment techniques
(6) How to perform advanced control, containment, and/or confinement operations with available resources and PPE
(7) How to implement decontamination procedures
(8) Termination procedures
(9) Basic chemical and toxicological terminology and behaviors

9.3.5.3 Delivery of Hazardous Materials Technician Training. Personnel expected to perform offensive actions at a hazardous materials/WMD incident should meet the requirements of hazardous materials technician-level training in 29 CFR 1910.120(q)(6)(iii). Such personnel can include the following:

(1) Hazmat team members tasked to perform product control
(2) Responders who perform advanced risk assessment and presumptive identification on hazardous materials within hazardous environments
(3) Bomb squad members tasked to perform render-safe actions that can affect container integrity or change the stability of hazardous materials
(4) Members of railroad, trucking, or other related industries performing product control or transfer at emergency incidents
(5) Fire brigade members tasked to perform product control

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9.3.5.3.1* The HMRP manager should design an evaluation process to track the progress of personnel in technician-level training. Title 29 CFR 1910.120 places a minimum time requirement on technician-level training by requiring OSHA hazardous materials technicians to complete at least 24 hours at a level equal to OSHA first responder operations level.

A.9.3.5.3.1 Technician-level training should include practical skills and training evolutions. Training props and equipment should be integrated into this training. Technician training equipment can include the following:

(1) Pressurized and nonpressurized nonbulk containers
(2) Cargo tank truck leak and/or fire prop
(3) Railroad tank car valve props
(4) Pipe leak trees

9.3.5.3.2 Title 29 CFR 1910.120 Appendix E, (C)(b)(3)(H) states that hazardous materials technicians should be aware of and know the hazardous materials technician-level competencies covered in NFPA 472.

9.3.6 Specialist Employees. Chapter 9 of NFPA 472 defines the role of specialist employees as subject matter experts (SMEs) within an organization. NFPA 472 defines three levels of specialist employee. Personnel should have documented demonstration of competency in their specific area of expertise.

9.3.6.1 Specialist Employee A. Specialist employee A is trained to handle incidents involving chemicals or chemical containers used in an organization and who can analyze an incident involving any or all such chemicals. The specialist employee A is trained to the specialist employee C and hazardous materials technician level. The specialist employee A can plan a response to an incident, operate under the incident management system/incident command system (IMS/ICS) to implement the planned response, and evaluate the results within the capabilities of the available resources consistent with ERPs and/or SOPs.

9.3.6.2 Specialist Employee B. Specialist employee B is trained in the hazards of specific chemicals or chemical containers and who responds to incidents involving these chemicals or chemical containers. The specialist employee B can gather and record information, provide technical advice, provide technical assistance for the technical decontamination process, employ federal or provincial regulations, develop an incident action plan (IAP), and perform assigned actions consist with ERPs and/or SOPs.

9.3.6.3 Specialist Employee C. Specialist employee C is trained to respond to emergencies involving hazardous materials/WMD and/or hazardous materials/WMD containers in an organization and can gather and record information, provide technical advice, and arrange for technical assistance.

9.3.6.4 Specialist Employee. Specialist employees, in the course of their regular job duties, work with and are trained in the hazards of specific hazardous substances, and can provide technical advice or assistance at a hazardous substance release incident. Specialist employees should receive training required by 29 CFR 1910.120(q)(5) and not 29 CFR 1910.120(q)(6), and should demonstrate their competency annually. *[See also 29 CFR 1910.120(q)(5).]*

9.3.7 Hazardous Materials Technician with Specialty. The following are examples of hazardous materials technician specialties *(see also NFPA 472)*:

(1) Hazardous materials technician with a tank car specialty
(2) Hazardous materials technician with a cargo tank specialty
(3) Hazardous materials technician with an intermodal tank specialty
(4) Hazardous materials technician with a marine tank and non–tank vessel specialty
(5) Hazardous materials technician with a flammable liquids bulk storage specialty
(6) Hazardous materials technician with a flammable gases bulk storage specialty
(7) Hazardous materials technician with a radioactive materials specialty

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9.3.7.1* Hazardous Materials Specialist. Hazardous materials specialists respond with and support hazardous materials technicians. Their duties parallel those of hazardous materials technicians; however, the duties of a technician require a more direct or specific knowledge of the substances they can be called on to contain. A hazardous materials specialist also acts as the site liaison with federal, state, local and other government authorities with regards to site activities. Hazardous materials specialists should have at least 24 hours of technician-level training and be competent in the following areas *[see also 29 CFR 1910.120(q)(6)]*:

(1) How to implement the local ERP
(2) How to classify, identify, and verify known and unknown materials using survey instruments and equipment
(3) The state ERP
(4) How to select and use specialized chemical PPE
(5) In-depth hazard and risk techniques
(6) How to perform specialized control, containment, and/or confinement operations with available resources and PPE
(7) How to determine and implement decontamination procedures
(8) How to develop a site safety and control plan
(9) Chemical, radiological, and toxicological terminology and behaviors

A.9.3.7.1 NFPA does not have competencies equivalent to an OSHA hazardous materials specialist; however, NFPA 472 does specify competencies for hazardous materials technicians with specialties.

9.3.8 Incident Commanders. Chapter 8 of NFPA 472 defines incident commander as the person responsible for all incident activities, including strategies and tactics, and resources as designated by the AHJ. *(See also NFPA 472.)*

9.3.8.1 On-Scene Incident Commander. Incident commanders who assume control of an incident scene beyond the first responder awareness level should have at least 24 hours of first responder operations-level training and show competency in the following areas *[see also 29 CFR 1910.120(q)(6)(v)]*:

(1) How to implement an employer's ICS
(2) How to implement an employer's ERP
(3) The hazards and risks associated with working in chemical protective clothing
(4) How to implement the local ERP
(5) The state ERP and the federal regional response team
(6) Decontamination procedures

9.3.9 Hazardous Materials Officer. The hazardous materials officer, or, according to the National Incident Management System (NIMS), the hazardous materials branch director/group supervisor, is responsible for directing and coordinating all operations involving hazardous materials/WMD as assigned by the incident commander. Hazardous materials officers should show competency for awareness level, operations-level responder, hazardous materials technician, and hazardous materials officers as defined in NFPA 472.

9.3.9.1 OSHA does not have an equivalent competencies for a hazardous materials officer.

9.3.10 Hazardous Materials Safety Officer. The hazardous materials safety officer, or, according to NIMS, the assistant safety officer — hazardous material, works within an incident management system (IMS), specifically, the hazardous material branch/group, to ensure that recognized hazardous materials/WMD safe practices are followed at hazardous materials/WMD incidents. Chapter 11 of NFPA 472 defines the competencies of a hazardous materials safety officer.

9.3.10.1 OSHA does not have equivalent competencies for a hazardous materials safety officer.

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9.4* Establishing Training Level.

HMRP managers determine the level of training needed for a program. An objective assessment should be made based on the expected mission and assigned tasks of personnel. The HMRP manager should understand the commitment necessary to train and maintain competency at the hazardous materials technician level.

A.9.4 Table A.9.4 is a decision matrix designed to assist HMRP managers determine training levels. It is based on the expected job tasks for team personnel. HMRP managers should assess each unique situation to determine levels of training.

9.4.1 Other Hazardous Materials/WMD Position Training. NFPA 472 defines several other hazardous materials/WMD responder positions for personnel assigned to an HMRP. Each position carries additional mandates for training and competency demonstration. The AHJ should assess organizational needs for these positions and identify the best method for competency demonstrations.

9.5 Annual Competencies and Refresher Training.

The HMRP manager should ensure that personnel retain knowledge and show competency on an annual basis.

9.5.1* OSHA Requirements for Refresher Training. Title 29 CFR 1910.120(q)(8) states that employees are required to receive training that is of sufficient content and length to maintain or demonstrate competency in the area of certification on at least an annual basis. Refresher training should include knowledge-based and competency training consistent with a job task analysis for the employee.

A.9.5.1 At the conclusion of annual refresher training, each trainee should be evaluated on his or her ability to perform the tasks assigned by the AHJ. Training drills, workshops, and exercises should be developed with a mechanism to measure competency.

9.5.2 NFPA Requirements for Refresher Training. NFPA 472 does not specify a refresher/training requirement. NFPA 472 identifies the objectives and abilities required for a responder to be considered competent. NFPA 472 defines competence as possessing knowledge, skills, and judgment needed to perform indicated objectives and assigned tasks.

9.6 Training Program Development.

Training development programs should be based on the needs of the organization. HMRP managers should ensure that training programs meet all regulatory requirements and operational needs of the team. External, internal, or electronic programs, or any combination thereof, can be used to deliver training programs.

9.6.1* External Training Programs. External training programs are programs developed and delivered by agencies or individuals outside of the AHJ.

A.9.6.1 External training programs offer several advantages for HMRPs. The curriculum development process is borne by the external provider, and external instructors can provide a fresh insight and perspective to course topics. External instruction is often preferred where introducing new equipment or procedures. External training programs where personnel travel to a remote location adds additional advantages. The remote location can include training equipment not available in the local jurisdiction. A physical separation from the normal workplace also reduces distractions associated with normal work activities such as administrative

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TABLE A.9.4 *Decision Matrix for Hazardous Materials WMD Training Levels*

Mission Expectation	***Level of Training***
Administrative worker: could encounter hazardous materials incidents in workplace	OSHA first responder awareness level NFPA awareness-level personnel
Responder: could be sent to hazardous materials incidents, not intended to don PPE	OSHA first responder operations level NFPA operations-level responder
Responder: could be sent to hazardous materials incidents, intended to perform rescue of victims from hazardous environments	OSHA first responder operations level NFPA operations-level responder NFPA for PPE and victim recovery
Responder: will be sent to hazardous materials incidents, intended to perform decontamination and/or defensive product control	OSHA first responder operations level NFPA operations-level responder NFPA MSCs for PPE and MSCs for mass decontamination and technical decontamination, and for product control, as needed
Responder: will be sent to hazardous materials incidents, intended to enter the exclusion zone to assess the situation and assist in determining a plan of action	OSHA first responder operations level NFPA operations level responder NFPA MSCs for PPE, evidence preservation and sampling, illicit labs, air monitoring and sampling
Emergency medical technician: will be sent to hazardous materials incidents, intended to receive only decontaminated patients	OSHA first responder operations level NFPA operations-level responder
Emergency medical technician: will be sent to hazardous materials incidents, intended to perform decontamination and/or patient care for contaminated patients	OSHA first responder operations level NFPA operations level responder NFPA MSCs for PPE, technical and mass decontamination NFPA 473 for BLS/ALS providers as appropriate
Emergency medical technician — advanced provider: will be sent to hazardous materials incidents, intended for assignment to the hazardous materials team for overall team medical care	OSHA hazardous materials technician NFPA operations level NFPA MSCs for PPE, technical decontamination, air monitoring and sampling NFPA 473 BLS/ALS provider recommended — NFPA hazardous materials technician
Bomb technician: will be sent to hazardous materials incidents, intended to assess and render-safe suspected explosive devices and assess explosives laboratories	OSHA hazardous materials technician* NFPA operations-level responder NFPA MSCs for PPE, evidence preservation and sampling, illicit labs, air monitoring and sampling, WMD dispersal device disablement/disruption
Law enforcement: will be sent to hazardous materials incidents, intended to conduct activities outside of exclusion zone (e.g., traffic control)	OSHA first responder operations level NFPA operations-level responder
Law enforcement: will be sent to hazardous materials incidents, intended to assess and collect items of evidence from within the exclusion zone	OSHA first responder operations level NFPA operations level responder NFPA MSCs for PPE, evidence preservation and sampling, illicit labs
Law enforcement tactical: will be sent to hazardous materials incidents, intended to make tactical law enforcement entry into exclusion zone	OSHA first responder operations level NFPA operations level responder NFPA MSCs for PPE, illicit labs, air monitoring and sampling
Hazardous materials technician: will be sent to hazardous materials incidents, intended to make an entry into the exclusion zone to perform offensive actions for product control	OSHA hazardous materials technician NFPA hazardous materials technician

*Responders must be certified as an OSHA hazardous materials technician prior to attending the FBI/DOD hazardous devices school.

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tasks and on-call duties. External training programs come with challenges. Costs incurred by bringing in outside instructors, outside course development, locating training with sufficient expertise, personnel travel, course fees, and backfilling personnel to replace trainees all have to be factored in. The costs and reliance on external training are significant, and HMRP managers and personnel should consider internal training programs as an alternative.

9.6.2* Internal Training Programs. Internal training programs are programs or instructional curricula developed and delivered by individuals within the AHJ.

A.9.6.2 Internal training programs offer several advantages including efficient use of training funds, training products that are site specific to the AHJ, administrative control over course content, convenient access to the training program by HMRP personnel, professional development of personnel or staff utilized to develop and deliver training, and consistency of course materials. The primary challenges of internal training programs revolve around curriculum development, course materials, training equipment, facilities, instructors, and evaluation of learning. These are the responsibilities of the HMRP manager and should be monitored. HMRP managers should understand that the delivery of training in the classroom is only a small component of the curriculum process. The analysis, design, development, and evaluation of training takes a great deal of time and effort compared to the actual delivery of the training itself. Encouraging HMRP personnel to take over training duties can enhance instruction and increase the knowledge of the guest instructor as they prepare to deliver the course. The utilization of third-party evaluators is one way to mitigate potential issues.

9.7 Instructional Design.

Proper training curricula is the cornerstone of a successful training program. Training should focus on the transfer of skills and knowledge and that education is a professional process.

9.7.1* Training curricula should follow a consistent instructional design process that meets the needs of the AHJ and can withstand scrutiny for regulatory and accreditation purposes.

A.9.7.1 A common example used in adult learning is the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model. The ADDIE model has been adopted and further enhanced by FEMA's responder training development center by adding a "planning" phase, turning ADDIE into PADDIE. The use of the curriculum development tool on the responder training development center's website can assist course developers through the instructional design process and ensure that the course development is in line with DHS standards. (*See FEMA training development center: https://www.firstrespondertraining.gov/rtdc/state/*)

9.7.1.1 Planning. The planning phase looks at training from a strategic level, assessing the needs of the AHJ, the training scope, developmental resource needs, scheduling, and budgets. HMRP managers should weigh the benefits of internal development against available financial, staffing, and logistical resources.

9.7.1.2 Analysis. Every training project should contain an analysis of the factors that can impact course development. The analysis should concentrate on identifying gaps in the AHJ's response capabilities; the current relevant and available instruction; and the knowledge, skills, and abilities of trainees. Examples of analysis factors include the following:

(1) *Audience analysis:* An analysis of which personnel should attend training and any challenges in getting personnel to the training event
(2) *Job task, or work, analysis:* An analysis of job tasks and how the training applies to the trainee's job

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(3) *Learner, or learner gap, analysis:* An analysis of the trainee's current knowledge, skills, and abilities with regard to the training subject

9.7.1.2.1 Analysis review can be accomplished using a variety of tools, including surveys, interviews, group sessions, and other similar techniques. It is often beneficial to include agency stakeholders (e.g., supervisors, administrators, external peers, and so forth) where performing learner and job task analysis. Where performing t analysis, the curriculum designer should ensure that a sufficient number of trainees are included in the discussion.

9.7.1.3 Design. Once the analysis tools are complete, the training product design can begin. During the design phase, decisions are made regarding training components and delivery methods to bridge any gaps discovered during the analysis phase. Often, the design phase is captured in a design document. Design document elements can include the following:

(1) The training goal
(2) Training objectives
(3) Performance targets
(4) Results of all analysis tools
(5) Statutory and regulatory requirements
(6) Training prerequisites
(7) A list of course materials (e.g., visuals, handouts, evaluation tools)
(8) Instructional strategies and models (e.g., classroom, practical sessions, group sessions, e-learning)
(9) Evaluation strategies
(10) Plan to implement the training

9.7.1.3.1 The design phase is complete when the curriculum development team understands how the training product looks, who should attend, how to deliver the training, and how transfer of skills and knowledge is measured.

9.7.1.4 Development. Once the design phase is complete, development of the training product can begin. During the development phase, course materials are researched and written, visual aids are created, practical skill sessions are developed, training aids and props are built, evaluation tools are written and validated, student and instructor handbooks are designed, and any courses for computer or web-based delivery are loaded into an electronic format.

9.7.1.4.1 An instruction or lesson plan should be developed to deliver the course, including goals and objectives, materials needed, and instructor guidance. The lesson plan should be written so that any instructor knowledgeable in the topic can deliver the course. As the development phase proceeds, the curriculum development team should reference elements of the design phase.

9.7.1.5 Implementation. Once the course materials are developed, the implementation phase begins. The curriculum development team might decide to offer a pilot course to evaluate the course. A pilot course provides an opportunity to ensure the quality and consistency of the course material, visual aids, practical sessions, evaluation tools, and overall flow of the material.

9.7.1.5.1 Delivery of the training course should be coordinated so that HMRP personnel can attend and participate in all classroom and practical sessions. The instructional team should ensure that all tools and materials identified during the design and development phases are available for implementation. The trainee should be given all course materials to review after delivery. Instructors should measure the trainee-to-instructor ratio to maintain control of the learning environment.

9.7.1.6 Evaluation. Once the training program is implemented, the evaluation phase can begin. HMRP managers should determine the appropriate methodology to measure competency. During the design phase, the curriculum development team should have identified the level of evaluation needed to assess transfer of skills and knowledge.

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9.8* Training Delivery Models.

During the design phase, the curriculum development team should determine the best model of delivery for the training program. Although each method of delivery has its advantages, successful training programs often use a blended format of several different models to offer a variety to the trainee. The following are the most common types of delivery models:

(1) *Instructor-led classroom lecture:* This model is suited for large-group delivery of technical material. However, it is not useful for evaluating competency.
(2) *Instructor-facilitated discussion:* This model is suited for large-group delivery of technical material where immediate feedback is desired. However, it is not efficient for evaluating competency.
(3) *Instructor-led demonstration:* This model is suited for large-group demonstrations of visual concepts, such as chemical and physical property demonstrations. However, it is not useful for evaluating competency.
(4) *Self-paced learning:* This model is suited for research-type work. This model can be used for competency skills evaluation.
(5) *Small-group lecture:* This model is suited for delivery of technical information where a smaller instructor-to-trainee ratio is desired. However, it is not efficient for evaluating competency.
(6) *Small-group demonstration:* This model is suited for equipment demonstrations where trainees need to be in close proximity of the instructor. This model can be used as an evaluation tool.
(7) *Practical skill sessions:* This model is suited for hands-on experience and can be used for competency evaluation if planned by the instructor team.
(8) *Web-based or computer-based e-learning:* This model is suited for individual delivery of written material and can be used for evaluation of written competency.
(9) *Simulation:* This model is suited for individual or group training and uses electronic aids to present unique problem-solving and critical-thinking exercises.
(10) *Scenario-based practical sessions:* This model is suited for maximum transfer of skills and knowledge and can be used for evaluating competency.
(11) *Table-top exercises:* This model is suited for transfer of skills and knowledge on administrative tasks, such as the ICS or strategic management training, and can be used for competency evaluation if planned by the instructor team.
(12) *Full-scale exercises:* This model is suited for maximum transfer of skills and knowledge and can be used for evaluating competency. Real-time, unannounced exercises are beneficial for maximum evaluation.
(13) *One-on-one evaluation:* This model is best suited for evaluating individual skill competencies.

A.9.8 E-learning can provide a low-cost alternative for external training deliveries. These programs can evaluate competency and learning. E-learning can provide either individual or group instruction on topics that would otherwise be difficult to provide. Delivery times are often more convenient for the student. E-learning deliveries include the following:

(1) *Computer-based training (CBT):* CBT is an e-learning method composed of a software program loaded onto a stand-alone computer or local area net (LAN) and runs independent of the Internet. These software programs are either purchased or obtained at little to no cost and can be taken by HMRP personnel at their convenience. If utilized, the AHJ should provide a computer station and allow sufficient time for personnel to complete the training. It is recommended that the CBT program be reviewed in advance by the training officer to ensure the content meets several factors, including technical accuracy, applicability to the AHJ's mission, and an evaluation of competency following the training.

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(2) *Web-based training (WBT):* WBT is an e-learning method composed of a program accessed through a remote Internet server. The entire content of the program can reside on a third-party system with access by the AHJ through an Internet site. These programs are either purchased or obtained at little to no cost and can be taken by HMRP personnel at their convenience. If utilized, the AHJ should provide a computer station to complete the WBT, and that station should have an Internet connection with sufficient speed to participate in the training without delays. The AHJ should allow sufficient time for personnel to complete the training.

    It is recommended that the WBT program be reviewed in advance by the training officer to ensure the content meets several factors, including technical accuracy, applicability to the AHJ's mission, and an evaluation of competency following the training.

(3) *Modeling, simulation, and simulators (MS&S) training:* Existing technologies for MS&S offer opportunities to enhance and improve emergency preparedness and response training programs. MS&S is an e-learning method composed of a program that is either loaded on a stand-alone computer or LAN, or accessed through an intranet or the Internet.

The interagency board (IAB) for Equipment Standardization and Interoperability has developed several papers about the use of modeling, simulations, and simulators in the emergency response community, including the following:

(1) Modeling, simulations, and simulators (MS&S) e-tool: https://iab.gov/MSS_Home.aspx
(2) E-tool white paper: https://iab.gov/Uploads/NT_Modeling, Simulation, & Simulators White Paper.pdf

It is recommended that the MS&S program be reviewed in advance by the HMRP to ensure the content meets several factors, including technical accuracy, applicability to the AHJ's mission, and an evaluation of competency following the training.

The components of the MS&S program are defined as follows:

(1) *Modeling:* A computer-generated approximation or representation that behaves or operates like a real-world process or problem, thereby enabling the prediction of behavior based on a set of parameters and conditions.
(2) *Simulation:* Computer-generated-imagery (CGI) that attempts to simulate real-world conditions over time. Tends to be knowledge-based and cognitive oriented.
(3) *Simulator:* A piece of equipment using CGI designed to artificially duplicate the conditions that could be encountered in some operation or with a device or instrument. Tends to be skill-based and psychomotor oriented.

It is recommended that e-learning techniques be followed by practical application exercises to reinforce the transfer of knowledge to the student.

9.9 Training Delivery Methodologies and Models.

9.9.1 Competency-Based Training. OSHA and NFPA both reference the term *competency* throughout their respective documents. Title 29 CFR 1910.120 states in paragraph (q)(6) under each response level that the responder is required to demonstrate competency in each skill area referenced. NFPA 472 defines competence as possessing knowledge, skills, and judgment needed to perform indicated objectives and assigned tasks.

9.9.1.1* Various methods can be used to evaluate learning. HMRP managers should use one of the following methodologies to evaluate the competency of a team:

(1) *Level 1 evaluation:* This evaluation level measures the *reaction* to the training delivered. This reaction is typically measured using an evaluation form. These forms provide the training program manager with feedback of the training's effectiveness from the trainee's

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perspective and should include questions on the content, delivery, and relevance of the training material. Evaluation forms do not prove competence, but they do help validate the training delivery.

(2) *Level 2 evaluation:* This evaluation level measures *learning*. Learning is typically measured by a metric-based, quantifiable evaluation tool such as written tests, skills testing, or observation of performance. There are many techniques to enhance learning measurement, such as measuring pretesting prior to training delivery against posttraining testing.
(3) *Level 3 evaluation:* This evaluation level measures changes in *behavior*. Behavior change is typically evaluated over time to ensure that knowledge, skills, and judgment are retained. Behavior change can be evaluated through retesting after a period of time or by direct performance observation.

A.9.9.1.1 It should be noted that Dr. Donald Kirkpatrick's evaluation model includes a fourth-level evaluation based on a measurement of the ratio of the cost of the training project in comparison to the return on investment (ROI) to the organization. While a valid business model and a financial consideration for HMRP managers, ROI does not impact the measurement of competency for HMRP personnel and is not discussed further. *(See Kirkpatrick, Evaluating Training Programs: The Four Levels.)*

9.10* Training Facilities.

Well-designed training facilities can enhance learning. Conversely, inadequate training facilities can detract from learning. HMRP managers should work within the AHJ's budget to develop training facilities that provide safe and effective learning environments.

A.9.10 Classrooms should be designed with the needs of students in mind. The following is a list of desirable features in a modern classroom. HMRP managers should consider the following features during new construction or refurbishment of training facilities:

(1) The classroom should have an appropriate number of windows to maximize the visibility of presentations and to minimize distractions for students.
(2) The classroom should have a projector capable of projecting a bright image even in ambient light conditions. It should be suspended from the ceiling or set up for rear projection.
(3) The classroom lighting should allow for ample lighting at students' desks.
(4) The classroom should have ample desk space for each student.
(5) The classroom should be sufficient in size to allow for flexibility and multiple seating configurations.
(6) The classroom should have isolated environmental controls for student comfort.
(7) Each student should have a clear view of the screen.
(8) The classroom should have an audio system capable of playing sound from video presentations and amplifying the instructor's voice.
(9) The classroom should have a computer for multimedia presentations and/or a connection for laptop computers.
(10) The classroom should be capable of playing multimedia presentations.
(11) Consideration should be given to adding an instructor preparation room allowing instructors to discuss the course away from students.

9.10.1* Training Props and Equipment. Meeting the NFPA 472 hazardous materials competencies requires a demonstration of skills using props and equipment that are associated with subject areas including PPE, product control, decontamination, and detection and monitoring. HMRP managers should ensure that training programs have access to equipment and props for team training and evaluation. Training props can be expensive and are

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often too large for existing training facilities. HMRP managers should consider developing regional training centers or partnering with stakeholders to share larger props, such as rail tank cars and tank trucks.

A.9.10.1 Training equipment to be considered for acquisition by training programs can include the following:

(1) SCBA and spare cylinders
(2) Air-purifying respirators
(3) Powered air-purifying respirators
(4) Liquid splash chemical protective clothing
(5) Vapor chemical protective clothing
(6) Thermal/flammable protective clothing
(7) Other protective clothing (e.g., MOPP gear, multithreat tactical gear, bomb disposal suit)
(8) Chemical-resistant boots
(9) Chemical-resistant gloves
(10) Detection and monitoring equipment
(11) Reagent papers
(12) Product control equipment
(13) Advanced detection and monitoring equipment
(14) Decontamination equipment
(15) Rescue and recovery equipment
(16) Illicit laboratory equipment
(17) Evidence preservation and sampling equipment
(18) Field screening tools

Training props might include the following:

(1) Chlorine, 100 lb and 150 lb cylinders
(2) Chlorine, one-ton container ends
(3) Chlorine, DOT-105 tank car housing
(4) Propane tank burn prop
(5) MC306/DOT406 highway cargo tank
(6) MC307/DOT407 chemical cargo tank
(7) MC312/DOT412 corrosive tank
(8) MC331 pressure highway cargo tank
(9) MC338 cryogenic tank
(10) DOT111 (nonpressure/low pressure) railroad tank car
(11) DOT105 or DOT112 (pressure) railroad tank car
(12) Drum leak simulators
(13) Pipe leak trees

Electronic simulation devices might include the following:

(1) Detection and monitoring simulators
(2) Incident command simulators
(3) Virtual reality simulators

9.11 Selection and Competence of Instructors.

HMRP managers should select the instructors to deliver training to members of the HMRP. OSHA gives general guidance for instructor competence in 29 CFR 1910.120(q)(8), stating that instructors delivering instruction on hazardous materials topics should have the following:

(1) Successful completion of a course in training delivery

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(2) Training and/or academic credentials and instructional experience necessary to demonstrate competent instructional skills
(3) A good command of the subject matter to be delivered

9.11.1 HMRP personnel chosen to be instructors should prepare for the training programs they deliver. As OSHA recommends, instructors should have a good command of the subject matter and should be able to deliver the material with confidence. HMRP personnel should also be encouraged to deliver team training.

9.11.2 Critical elements for adult learning include the following (see also Knowles, The Adult Learner):

(1) Adults want to make decisions regarding learning (i.e., self-direction).
(2) Adult life experiences provide a foundation for learning.
(3) Adults should be ready to learn (i.e., have a desire to learn).
(4) Adults want to learn things they can apply to life.
(5) Adults are more internally, rather than externally, motivated to learn.
(6) Adults need to understand the reason they are learning.

9.11.3 Instructors should facilitate learning based on the elements in 9.11.2 and use a variety of teaching techniques. The key is to provide an environment that encourages participants to learn.

9.12 Training and Exercise Safety.

9.12.1 During hazardous materials/WMD training, the instructors-to-student ratio should be determined by the AHJ.

9.12.1.1 During any period of instruction where students don chemical protective clothing, the instructor-to-student ratio should be modified to provide adequate safety oversight at a level determined by the AHJ.

9.12.1.2 The instructor should adjust the instructor-to-student ratio as needed based on the degree of risk and previous hazardous materials experience of the students involved.

9.12.2 Hands-on training includes a simulated work environment that permits each student to experience performing tasks, making decisions, or using equipment appropriate to the job assignment for which training is being conducted. Where training environments involve immediately dangerous to life or health (IDLH) atmospheres, additional health and safety regulations might apply.

9.12.2.1 Where hands-on training is conducted, the following safety precautions are recommended:

(1) All participating students should have authorization of the AHJ or employer to attend.
(2) All participating students and instructors should meet the medical clearance requirements of the training and exercise program.
(3) A safety briefing with all students should be held prior to the start of instruction.
(4) Instructor(s) should be present at all times during hands-on training.
(5) Access to the community's emergency medical care system should be available.
(6) Instructor(s) should ensure adequate breaks are taken based on level of activity and environmental conditions.

9.12.3 During a hazardous materials/WMD training session or exercise, small quantities of hazardous materials can be used to enhance the learning environment, provided the appropriate precautions are taken.

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9.12.3.1 Instructors should attempt to use simulated products in place of hazardous materials wherever possible.

9.12.3.2 Hazardous materials used for training should be kept to the minimum quantity needed to achieve training objectives.

9.12.3.3 Where hazardous materials are used, the following safety precautions are recommended:

(1) All safety recommendations for hands-on training *(see 9.12.2)* should be followed.
(2) The use of hazardous materials should be approved by the hazardous materials program manager.
(3) Products that are in violation of governmental law should not be used or created without authorization from and in close coordination with appropriate law enforcement or regulatory agencies.
(4) Hazardous materials should be shipped or transported in a manner consistent with all governmental laws and regulations.
(5) Approved PPE should be used based on the hazard.
(6) An emergency decontamination area should be available based on the degree of hazard per 29 CFR 1910.151(c).
(7) Safety data sheets (SDSs) should be available for all products used if the product's identity is not revealed to students for training purposes. *(See 29 CFR 1910.1200.)*
(8) Instructors should know the identity of all products involved.
(9) Each product involved should be labeled with a means to determine the identity of the product.

9.12.3.4 Hazardous materials not consumed during training should be stored or disposed of in compliance with governmental regulations.

9.12.4 Where an IDLH hazardous materials environment is created for training purposes, the training event should be treated as an actual hazardous materials emergency.

9.12.4.1 Students participating in hazardous materials training involving IDLH environments should have the requisite knowledge, skills, and abilities prior to entering the IDLH situation.

9.12.4.2 If a student or instructor suffers a hazardous materials exposure during training, the exposure should be documented and treated in accordance with the policies of the AHJ.

9.12.5 Hazardous materials exercises, including practical skill sessions, scenario-based practical sessions, and full-scale exercises, are intended to simulate real situations involving hazardous materials/WMD. It is possible that a real emergency could be mistaken for a simulated emergency during an exercise.

9.12.5.1 Each hazardous materials exercise should have a prearranged signal to indicate an actual emergency during an exercise. All participants should be briefed on the emergency signal prior to the start of the exercise. Upon notification of an actual emergency, all exercise participants should stop and await instruction.

9.12.5.2 No participant or observer should be permitted to bring live firearms or weapons into the exercise site. All weapons should be identified and rendered safe in accordance with the AHJ.

9.12.5.3 The following safety guidelines are recommended for the use of simulated explosives, training props, IEDs, or simulated weapons:

(1) All simulated explosives should be identified.
(2) Simulated chemical containers intended as training props should not contain any hazardous material and should be marked.

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(3) All simulated weapons and explosives/IEDs should be accounted for according to AHJ policies.
(4) Simulated weapons, explosives devices, and training chemical containers should be secured if not in use.

9.13 Training Records Management.

9.13.1 The HMRP manager should ensure all training sessions and exercises are documented. Each training session should be documented to include the following information:

(1) Date, time(s), and duration of the training
(2) Where the training was conducted
(3) Name of training instructor(s)
(4) Training topic or exercise title
(5) Overview of course content
(6) Students that attended
(7) Competencies that were demonstrated

9.13.2 Hazardous materials/WMD exercises should include documentation of all lessons learned and any corrective actions taken.

9.13.3 Each student that completes a hazardous materials/WMD certification training course should receive a printed certificate of completion. The certificate of completion should include the following information *(see also 29 CFR 1910.120, Appendix E)*:

(1) Student's name
(2) Course title
(3) Course date
(4) Statement that the student successfully completed the course
(5) Standard, rule, or law the training session complied with, if applicable
(6) Name and address of the training provider
(7) Signature of the instructor, program manager, or training director

9.13.4 The HMRP manager should maintain a record of the individual NFPA 472 competencies demonstrated by each HMRP member on an annual basis.

9.13.4.1 Hazardous materials/WMD competencies can be demonstrated during training, critiques, or exercises if instructional personnel are present to evaluate the student.

9.13.4.2 Hazardous materials/WMD competencies can be demonstrated during an incident provided the demonstration is validated and documented in accordance with the AHJ and applicable governmental regulations.

9.13.5 All training records should be kept for at least 5 years or a period of time determined by the AHJ.

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Health and Medical

10

10.1 Scope.

This chapter applies to those organizations or jurisdictions responsible for organizing, managing, and sustaining a hazardous materials/weapons of mass destruction (WMD) response program (HMRP) and provides guidance for establishing a comprehensive health and medical program for an HMRP.

10.2 Purpose.

This chapter addresses preincident considerations, functional capacity, response considerations, postincident surveillance, and medical surveillance programs that should be in place for a safe and effective response program. The preservation of life, productivity, and quality of life in response to a hazardous materials/WMD incident in accordance with Occupational Safety Health Organization (OSHA) regulations and clinical practices are also addressed.

10.2.1 This chapter is not intended to replace, supersede, or otherwise circumvent existing governmental laws associated with medical surveillance programs, but rather serve as a guide in the development, implementation, and management of such programs. Program and medical personnel should know and understand all applicable laws, rules, and regulations for medical surveillance programs in their organization/jurisdiction, as well as for other geographical and jurisdictional areas if applicable to the HMRP.

10.2.2 Title 29 CFR 1910.120(f) mandates that employees involved in emergency response operations for releases, or substantial threats of releases, of hazardous substances be covered by a medical surveillance program. Per 29 CFR 1910.120(f), medical examinations and consultations will be made available by the authority having jurisdiction (AHJ) to each covered member of the HMRP.

10.3 Preincident Considerations.

The baseline or preincident health state of HMRP personnel is often underconsidered relative to the physical demands and other challenges that can be encountered during an HRMP response. Fit, optimized personnel can be more resilient and effective. A wellness program, which can vary according to the AHJ, should include a fitness standard and fit-for-duty (FFD) program, so that preincident health optimization can be a part of preincident planning.

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10.3.1 A wellness program is designed to promote general health and improve and extend the quality of an individual's life.

10.3.2* FFD is a specific assessment related to an individual's job, mission, or responsibility. An FFD assessment should include an evaluation of the following:

(1) Infectious diseases
(2) Malignant neoplasms
(3) Gastrointestinal diseases
(4) Cardiovascular system
(5) Blood or blood-forming organ diseases
(6) Mental disorders
(7) Nervous system diseases
(8) Musculoskeletal system
(9) Skin lesions or active skin disease
(10) Endocrine and metabolic disorders
(11) Genitourinary system
(12) Respiratory system
(13) Ear, nose, and throat
(14) Ophthalmic and visual acuity
(15) Dental health
(16) Medications
(17) Pregnancy
(18) Pulmonary function, if necessary
(19) Audiometry, if necessary
(20) Drug and alcohol dependency

A.10.3.2 The composition and considerations of health and medical fitness should include a medical assessment and reporting, and appropriate functional capacity as determined by the AHJ. The foundation of an FFD program is the medical assessment performed by a qualified healthcare provider. This includes scrutiny and examination for chronic and active medical maladies or conditions that might create unwarranted risks for increased disease, injury, or death.

10.4 Functional Capacity.

In some cases, additional functional capacity could be warranted to better address the physical and exertion requirements of a particular job or class of jobs to identify those individuals who might be at greater risk for illness, injury, or death associated with a particular task. Individual business units should assess the need for this application, the incremental or incident-related nature of any requirement, and the frequency on a case-by-case or classification basis.

10.4.1 The preincident medical assessment might inform the deployment or response time medical approval, check-in, or response health screening and scrutiny. Acute medical conditions can influence the response health and medical process. The information and awareness of the steady-state should support the process. Some pre-incident contributing factors to optimal health protection and effectiveness of HMRP personnel can include familiarity with procedures, treatments, and the logistics of treatment, prophylaxis, countermeasures and more.

10.5 Response Considerations.

Response considerations include the following:

(1) Threat and potential for exposure

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(2) Biological protections, antidotes, treatments, and personal protective equipment (PPE)
(3) Physical exertion requirements of the hazardous environment

10.5.1* Medical support personnel should be provided along with the necessary resources to monitor and treat acute medical conditions. Support duties include, but are not limited to, the following:

(1) Dispensing PPE and preventive medicine
(2) Administering patient care
(3) Providing medical expertise to onsite leadership
(4) Providing scene assessment recommendations with regard to medical need
(5) Functioning as a liaison to receiving facilities, hospitals, and healthcare systems
(6) Facilitating medical logistics to and from the scene
(7) Monitoring and assessing personnel
(8) Recognizing signs and symptoms of exposure and toxicity
(9) Treating exposure and toxicity
(10) Recognizing metabolic stress from working in PPE
(11) Treating dehydration and temperature extremes
(12) Maintaining clinical documentation that is compliant with regulations and patient privacy considerations

A.10.5.1 The responsible medical entity should anticipate and identify the elements of a response that are critical to postincident protections and care provisions for HMRP personnel. This should include the type, dose, and concentration of all medications, countermeasures, and antidotes, as well as any therapies or modalities provided. The responsible medical entity should record the times of exposure, additional injuries and illnesses, compliance with PPE recommendations, and other factors that might impact the severity of the injury or illness, and any eventual follow-up.

10.6 Postincident Surveillance.

Postincident surveillance is necessary to safeguard the physical and mental health of HMRP personnel against acute and long-term effects of exposure. The key elements to postincident surveillance can be found in 10.6.1 and 10.6.2.

10.6.1 A postincident surveillance program is designed to capture exposures and execute medical monitoring. It also includes periodic screening of defined populations for specific diseases or biological markers of diseases for which the population is, or could be, at significant risk.

10.6.1.1 Triggers for a postincident surveillance program can be routine and predictable or triggered to activate based on a threat or known incidental exposure. A consistent surveillance program allows cross-referencing for different exposures experienced by the same individual.

10.6.1.2 A postincident surveillance program draws from and communicates with the toxic substance and disease registry, while maintaining all ethical, regulatory, and legal requirements of privacy. A postincident surveillance program should address the following:

(1) Threats (e.g., toxic substances and harmful agents), which includes the following:
  (a) Metals and dusts
  (b) Biological agents (e.g., bacteria, viruses, fungi)
  (c) Physical stress (e.g., noise, cold, vibration, repetitive motion)
(2) Mechanism and medium (e.g., aqueous, marine, aerosol, dust, colloid, particle)
(3) Concentration or magnitude of the exposure
(4) Additional factors

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(5) Qualification and responsibility (e.g., primary or third party)
(6) Accessibility, which is the right of the individual to examine and copy exposure and medical records, and any analysis of the same
(7) Environmental monitoring, which could be the primary responsibility of the medical provider or occupational health administrator and should be included in the registry and record
(8) Responsibility or custodian of records
(9) Notification procedures
(10) Mitigating activities at the time of the exposure
(11) Time, date, and signatures
(12) Acute care administration, including any complicating factors
(13) Manufacturer-specific identifiers (e.g., lot numbers, batch numbers, and so forth)
(14) Health monitoring, which could include workplace air measurements and other data such as safety data sheets (SDSs) and biological monitoring results such as bioassay, dosimetry, serology and urine testing.
(15) Medical records, which should include questionnaires, histories, examination results, healthcare provider opinions, diagnoses, progress notes, first-aid records, and subjective patient information.

10.6.1.3 Medical records should be maintained in accordance with all legal and regulatory requirements, including, but not limited to, the AHJ, the Health Insurance Portability and Accountability Act (HIPAA), and OSHA.

10.6.2 Toxic Substance and Disease Registry. The registry is a program under the direction of the Centers for Disease Control and Prevention (CDC) to prevent and act on harmful exposures and diseases related to toxic substances. The registry uses scientific research to take responsive health actions and provide trusted health information.

10.6.2.1 Harmful exposures and diseases related to toxic substances can be referred to as exposures to toxic substances and harmful physical agents. Reporting terminology can be driven by a professional requirement or regulation, or determined by a threat or known incidental exposure.

10.6.2.2 The registry should maintain the specifics of incidents and the individuals exposed consistent with all legal and regulatory requirements.

10.7 Medical Surveillance Program.

10.7.1 Covered Employees. Title 29 CFR 1910.120(f) specifies that a medical surveillance program be instituted by an employer for the following covered employees:

(1) All employees who have been or could be exposed to hazardous substances or health hazards at or above the established permissible exposure limit or above the published exposure levels, without regard to the use of respirators, for 30 days or more a year
(2) All employees who wear a respirator for 30 days or more a year or as required by 29 CFR 1910.134
(3) All employees who have been injured, become ill, or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation
(4) Members of hazmat teams

10.7.2 Frequency of Medical Examinations and Consultations. Medical examinations and consultations should be made available by the employer to each covered employee at the following instances:

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(1) Prior to assignment
(2) At least once every 12 months unless the attending physician believes a longer, but not greater than biennial, interval is appropriate
(3) At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last 6 months
(4) As soon as possible upon notification that an employee has developed signs or symptoms of possible overexposure to hazardous substances or health hazards, or if an employee has been injured or exposed above the permissible exposure limits or published exposure levels in an emergency situation
(5) If the examining health care provider determines that an increased frequency of examination is medically necessary
(6) For covered employees and for all employees including those of employers covered by the regulation who may have been injured, received a health impairment, developed signs or symptoms which may have resulted from exposure to hazardous substances resulting from an emergency incident, or exposed during an emergency incident to hazardous substances at concentrations above the permissible exposure limits or the published exposure levels without the necessary personal protective equipment being used
(7) As soon as possible following the emergency incident or development of signs or symptoms
(8) At additional times, if the examining health care provider determines that follow-up examinations with consultations are medically necessary

10.7.3* Content of Medical Examinations and Consultations. Medical examinations and consultations should include a medical and work history with an emphasis on symptoms related to the handling of hazardous substances and health hazards, and to FFD, including the ability to wear any required PPE under conditions expected at the work site. The content of medical examinations or consultations made available to employees should be determined by the attending physician or healthcare provider.

A.10.7.3 The guidelines in Appendix D of the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities should be referenced for items to be included in the medical consultation and examination.

10.7.4 Examination by a Physician and Costs. All medical examinations and procedures should be performed by or under the supervision of a licensed physician, preferably one knowledgeable in occupational medicine, and should be provided without cost to the covered employee, without loss of pay, and at a reasonable time and place.

10.7.5 Information Provided to the Physician. The employer should provide one copy of this recommended practice to the attending physician or healthcare provider, along with the following for each covered employee:

(1) A description of the employee's duties as they relate to the employee's exposures
(2) The employee's exposure levels or anticipated exposure levels
(3) A description of any PPE used or to be used
(4) Information from any previous medical examination of the employee that is not readily available to the examining physician
(5) Information required by 29 CFR 1910.134

10.7.6 Physician's Written Opinion. The employer should obtain and furnish the employee with a copy of a written opinion from the examining physician or healthcare provider that contains the following:

(1) The physician's or healthcare provider's opinion as to whether the employee has any detected medical conditions that would place the employee's health at increased risk from work in hazardous waste operations or emergency response, or from respirator use

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(2) The physician's recommended limitations for the employee
(3) The results of the medical examination and any tests, if requested by the employee
(4) A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions that need further examination or treatment
(5) The written opinion should not reveal specific findings or diagnoses unrelated to occupational exposure without the patient's consent

10.7.7 Recordkeeping.

10.7.7.1 Employee Medical Records. The medical records for each employee should be preserved and maintained for at least the duration of employment plus 30 years. The following records need not be retained for any specified period:

(1) Health insurance claims records maintained separately from the employer's medical program and its records per 29 CFR 1910.1020(d)(1)(i)(A)
(2) First-aid records of one-time treatment and subsequent observation of minor scratches, cuts, burns, splinters, and the like that do not involve medical treatment, loss of consciousness, restriction of work or motion, or transfer to another job, if made on-site by a nonphysician and if maintained separately from the employer's medical program and its records per 29 CFR 1910.1020(d)(1)(i)(B)
(3) Medical records of employees who have worked for the employer less than 1 year need not be retained beyond the term of employment if the records are provided to the employee upon termination of employment per 29 CFR 1910.1020(d)(1)(i)(C).

10.7.7.2* Employee Exposure Records. Each employee exposure record should be preserved and maintained for at least 30 years, except for the following:

(1) Background data to workplace monitoring or measuring, such as laboratory reports and worksheets, need only be retained for 1 year as long as the sampling results, the collection methodology, a description of the analytical and mathematical methods used, and a summary of other background data relevant to interpretation of the results obtained are retained for at least 30 years per 29 CFR 1910.1020(d)(1)(ii)(A)
(2) SDSs and 29 CFR 1910.1020 (c)(5)(iv) records concerning the identity of a substance or agent need not be retained for any specified period as long as some record of the identity of the substance or agent, where it was used, and when it was used is retained for at least 30 years per 29 CFR 1910.1020(d)(1)(ii)(B)
(3) Biological monitoring results designated as exposure records by specific occupational safety and health standards should be preserved and maintained as required by the specific standard per 29 CFR 1910.1020(d)(1)(ii)(C)

A.10.7.7.2 Title 29 CFR 1910.1000 subpart Z addresses exposure limits and medical surveillance requirements for employees with an occupational exposure to airborne contaminants of the chemicals listed in Table Z-1. The list does not include exposure limits and medical surveillance requirements for other hazardous materials.

10.7.7.3 Analyses Using Exposure or Medical Records. Each analysis using exposure or medical records should be preserved and maintained for at least 30 years per 29 CFR 1910.1020(d)(1)(iii).

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Financial Management

11

11.1 Scope.

This chapter applies to those organizations or jurisdictions responsible for organizing, managing, and sustaining a hazardous materials/weapons of mass destruction (WMD) response program (HMRP) and provides guidance for managing all financial elements of the program.

11.2 Purpose.

This chapter addresses revenue sources, program costs, inventory control, and cost recovery issues.

11.2.1 Financial management elements can vary based on the type of organization.

11.2.2 Financial management elements can encompass funding sources and processes, budgetary processes and procedures, capital and operations budgets, program costs, and cost recovery.

11.2.3 A critical challenge for an HMRP is to ensure adequate funding for assigned missions and tasks.

11.3 Revenue Sources.

Revenue to support the program can be derived from a number of sources, including response agency or organization budgets, grants, cooperative agreements, donations, fees, and cost recovery. Fiscal responsibilities for organizations participating in a multiagency program agreement should be well defined and agreed on in advance. HMRP managers should be aware of alternative revenue sources that might be available.

11.3.1 Operating Budgets. It is imperative that HMRP managers be knowledgeable of the specific budget policies and practices that govern the program. There are various types of budgets used in the public and private sectors, including the following:

(1) Line-item budgets list budget categories along with expected expenditures. This is the simplest form of budgeting.
(2) Zero-based or justification budgets start at zero dollars each year with no balance brought forward from the preceding year. This budget process allows each program to be scrutinized and validated on an annual basis.
(3) Program budgets organize the functional activities of the agency or organization. The overall budget becomes a sum of its programs and is a way to plan and track expenditures.

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11.3.2 Grant Programs.

11.3.2.1 ***Federal Grant Programs.*** Within the United States, the majority of grant programs used to support HMRPs are promulgated through the U.S. Department of Homeland Security (DHS) and the Federal Emergency Management Agency (FEMA). The FEMA national preparedness grant programs focus on the development and sustainability of core capabilities outlined in the national preparedness goal. Most grants should be tied to state, regional, or local strategic plans. Each grant program has its own application and reporting process. Grant options could include requiring the grantee expend their own funds before being reimbursed; spending funds only to augment or increase capabilities and not to supplant normal funding streams; or a "one-time" award with no sustainability funding provided. The following are examples of current grant programs that might be available to an HMRP:

(1) U.S. DHS National Preparedness Grant Program
(2) Urban Area Security Initiative Grant (UASI)
(3) State Homeland Security Program Grant (HSGP)
(4) U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) — Hazardous Materials Emergency Preparedness (HMEP) Grants
(5) FEMA Assistance to Firefighters Grant (AFG) Program
(6) FEMA Staffing for Adequate Fire and Emergency Response (SAFER)

11.3.2.2 State and Local Grant Programs. State and local grant programs vary from jurisdiction to jurisdiction. Some grant programs are supported by private industry and others come from government agencies. Local agency and industry stakeholders should be contacted to determine what grants are available.

11.4 Program Costs.

All program costs in an HMRP budget should be identified. These can include initial and sustainability costs pertaining to personnel, supplies and equipment, training and exercises, administrative support and services, and fixed asset and capital item maintenance and replacement.

11.4.1 Initial Costs. The initial capital outlay used to purchase, lease, and acquire assets such as facilities, apparatus, equipment, and supplies.

11.4.2 Sustainability and Maintenance Costs. On-going costs and activities necessary to sustain the operational readiness and capability of the HMRP. These can include personnel, equipment, and supply expenses.

11.4.3 Personnel Costs. In career-based organizations, personnel costs can account for a large percentage of the operating budget. Personnel costs could include the following:

(1) Salary and benefits
(2) Preemployment costs
(3) Uniforms
(4) Initial hazardous materials/WMD training
(5) Refresher training
(6) Continuing education and personnel development
(7) Health and safety program
(8) Medical surveillance program
(9) Personal protective equipment (PPE)
(10) Licensing and certifications

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11.4.4* Equipment Costs. Equipment can be divided into the following categories:

(1) Non-capital equipment, which has an expiration date or needs periodic replacement
(2) Capital equipment, which requires an investment that could be amortized or depreciated over time

A.11.4.4 Response agencies and organizations might use fiscal levels to differentiate between capital and noncapital items. Fiscal levels can also be used as the threshold criteria for conducting physical inventories, especially for items acquired under equipment grant programs, such as the U.S. DHS Homeland Security Grant Program.

11.4.4.1 Detection and monitoring equipment can be high-maintenance items that need third-party inspection and maintenance. Based on the technology, equipment costs can be high and can range from parts or equipment replacement to extensive manufacturer inspections. Some HMRPs have internal personnel qualified to perform equipment maintenance and repairs, which can reduce equipment maintenance, repair, replacement, and out-of-service time.

11.4.5 Supply Costs. Supply costs can be a significant expense and should include both initial procurement and inventory sustainability. Some HMRPs rely on grants to acquire initial supplies with the HMRP then assuming responsibility for sustainability costs. The authority having jurisdiction (AHJ) can have ordinances or rules that allow for cost recovery where the responsible party provides reimbursement for certain supplies.

11.4.6 Outside Vendor Support Services Costs. These are costs for services provided by an outside vendor. Vendor-provided support costs might include the following:

(1) Medical exams for personnel
(2) Fleet maintenance and repair
(3) Service contracts or agreements
(4) Administrative support
(5) Bonding and insurance
(6) Waste disposal

11.4.7 Fixed Asset Costs. Fixed asset costs are incurred from the purchase or improvement of land or buildings, or construction of facilities.

11.5 Inventory Control.

Inventory control is an essential part of budgeting and fiscal management and could be required by the AHJ or some grant programs.

11.6* Cost Recovery.

Some jurisdictions have enacted cost recovery policies and procedures. Policy options include flat-rate fees, per-hour rates, or the actual cost of time and materials. For government agencies, cost recovery legislation might be required before the program can be enacted.

A.11.6 Federal, state, local, and provincial programs allow cost recovery to offset equipment purchase and repairs, clean up and disposal, and training costs. Cost recovery provisions can be found in the following:

(1) U.S. EPA Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
(2) EPA's local government reimbursement (LGR) program

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(3) State statutes
(4) Provincial regulations
(5) Local ordinances or bylaws

Cost recovery from a responsible party could include the following:

(1) Personnel costs
(2) Equipment costs
(3) Supply costs
(4) Overhead and administrative fees

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12 Program Influences

12.1 Scope.

This chapter applies to those organizations or jurisdictions responsible for organizing, managing, and sustaining a hazardous materials/weapons of mass destruction (WMD) response program (HMRP) and identifies influences that could affect an organization's/jurisdiction's program.

12.2 Purpose.

This chapter addresses the importance of identifying, understanding, and managing the internal and external influences that could impact an HMRP.

12.3 Influences.

Internal and external influences can impact an HMRP. It is critical to identify these influences, understand their function, and develop a plan to address them.

12.3.1 Internal Influences. Internal influences are those from within the organization/jurisdiction (e.g., local, regional, provincial, tribal, territorial, and state) that affect the organization, management, and sustainability of an HMRP.

12.3.1.1 Internal influences that can impact an HMRP include the following:

(1) Risk assessment results *(see Chapter 5)*, which can influence all aspects of an HMRP, including the following:
   (a) *Prevention activities* — public education, community/jurisdiction support, and involvement activities such as household hazardous waste programs
   (b) *Preparedness activities* — resource and allocation plans, policies, and procedures; training and response levels; team size; developing response capabilities; external resource availabilities; and management
   (c) *Response activities* — incident management issues, response issues, external resources, debriefings
   (d) *Recovery activities* — cleanup and disposal, cause investigation, postincident analysis, and internal and external critiques

(2) Financial decisions by the authority having jurisdiction (AHJ) could force HMRP managers to find other ways of addressing issues as well as other sources of additional financial support to minimize the impact on organizational/jurisdictional risks.

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Documentation of risk assessment and planning activities for requests to the AHJ is critical.

(3) Internal economic conditions can influence funding sources, financial liabilities, budget priorities, resource allocation, and internal and external funding streams, and can also affect management of an HMRP. HMRP managers should be prepared to justify program costs and budget requests. A primary justification should include a reminder that major hazardous materials/WMD incidents are low-frequency, high-consequence occurrences. Budget allocations and priorities can change with each budget cycle. Ongoing cost-benefit analysis and performance tracking are important components of HMRP management.
(4) Internal political influences (e.g., government agencies, business interests, labor agreements, citizen groups, community activities, jurisdictional mutual-aid agreements, and code, ordinance, and regulatory requirements) can impact an HMRP. Local Emergency Planning Committees (LEPCs) can provide funding, planning, and training support.
(5) Industrial and commercial influences are important parts of local economies and can have significant economic impact, employ large numbers of people, generate significant tax revenues, and be an important partner for in-community preparedness and response efforts — all of which can impact an HMRP.

    HMRP managers should be aware of political and organizational sensitivities associated with fixed facilities and transportation modalities to understand the ramifications of hazardous materials/WMD incidents at such facilities.

(6) Internal environmental influences can include land use, zoning, prevailing weather conditions, projected growth, and atmospheric and topographical conditions — all of which could affect planning for and response to hazardous materials/WMD incidents. Land-use and zoning regulations can cluster high-risk facilities and hazardous materials transportation modalities.

12.3.2 External Influences. External influences are those beyond the organization/jurisdiction (e.g., local, regional, provincial, tribal, territorial, and state) that affect the organization, management, and sustainability of an HMRP. These influences can be regional, national, or international.

12.3.2.1 External influences that can impact an HMRP include the following:

(1) Economic influences, including current economic conditions, the business environment, and potential funding streams such as grant programs, donations, and cost recovery programs, affect all aspects of an HMRP. HMRP managers should be familiar with cost recovery programs for hazardous materials/WMD incidents and should develop administrative and financial processes to manage them.
(2) External training programs can provide excellent training opportunities at little to no cost to an HMRP. HMRP managers should monitor and take advantage of such programs.
(3) Industry and other service providers, including jurisdictions; local, state, and federal agencies; and contractors, can influence decisions to add, reduce, or eliminate response capacity and could affect an HMRP's emergency response plans (ERPs), mutual-aid agreements, and program funding. Other service providers that could influence an HRMP include the following:

    (a) Industry and external service providers could provide opportunities for additional funding, training support, team participation, and technical resources.
    (b) State Emergency Response Commissions (SERCs), the Chlorine Institute, the Ammonia Institute, transportation community awareness and emergency response (TRANSCAER), and other organizations could provide funding, planning, and training support.

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(c) State and federal emergency management agencies, the Federal Bureau of Investigation (FBI), the Coast Guard, the Environmental Protection Agency (EPA), civil support teams (CSTs), and similar agencies could provide additional training and technical resources.

(4) External political and governmental actions that influence changes to laws, regulations, directives, and standards could affect an HMRP.

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13 Developing Relationships

13.1 Scope.

This chapter applies to those organizations or jurisdictions responsible for organizing, managing, and sustaining a hazardous materials/weapons of mass destruction (WMD) response program (HMRP) and identifies potential activities and opportunities to support and enhance the program's mission.

13.2 Purpose.

This chapter addresses promoting HMRP capabilities, coordinating with other response entities, and developing relationships to enhance the program.

13.3 Promoting HMRP Capabilities.

HMRP managers should explore opportunities to promote program activities/capabilities and build professional relationships. Program activities/capabilities might include:

(1) Utilizing specialized skills and equipment to allow personnel to act in a health and safety capacity to monitor hazardous environments and preplan for target hazard facilities
(2) Developing and implementing hazardous materials/WMD training programs
(3) Developing response plans for hazardous materials/WMD incidents
(4) Providing recommendations for equipment and supply acquisitions for use during initial responses to hazardous materials/WMD incidents

13.4 Coordination with Other Response Entities.

HMRP managers should explore opportunities to promote program activities, understand organizational capabilities and limitations, and coordinate with other response agencies and organizations to build professional relationships.

13.4.1 HMRP managers should coordinate with task-level teams or units to support their specialized emergency response missions, including the following:

(1) Explosive and ordinance disposal (EOD)
(2) Evidence response

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(3) Rescue and recovery
(4) Medical
(5) Decontamination
(6) Illicit laboratory
(7) Medical examiners

13.4.2 HMRP managers should coordinate with public health agencies to support their activities, including the following:

(1)* Sampling and collection procedures of suspected biological materials.

A.13.4.2(1) Health laboratories, especially those in the laboratory referral network (LRN) system, have established procedures for handling suspected biological threats.

(2) Radiological monitoring activities.

13.4.3* HMRP managers should coordinate with emergency management (EM) to assist with the development of public service announcements (PSAs), which can provide personal protective actions for the public in the event of a hazardous material/WMD incident.

A.13.4.3 PSAs could include the following:

(1) Printed materials (e.g., flyers, pamphlets, handouts, calendars)
(2) News media announcements
(3) Telecommunications
(4) Web-based messaging
(5) Short message services (SMSs)
(6) Social media

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13.5 Local and State Planning Group Relationships.

13.5.1 Local Emergency Planning Committee (LEPC). HMRP personnel should participate in LEPC meetings and activities. An LEPC is a forum for industry members, responders, and the public to interact and it provides an opportunity to build professional relationships. It is also a potential source for planning, training, and grant funding for an HMRP. The annual LEPC exercise, which is required under the Emergency Planning and Community-Right-Know Act (EPCRA), provides an outreach opportunity with the public. Extremely hazardous substances (EHS) facilities participate in LEPCs as well as some Tier II facilities.

13.5.2 State Emergency Response Commission (SERC). SERCs provide guidance and information to LEPCs. In some states, the SERC influences and might even determine statewide responses to hazardous materials/WMD incidents. The SERC provides funding to the LEPC through the hazardous materials emergency planning (HMEP) grant program, which can also be used by the HMRP to support HMRP activities. In many states, administrative support to the SERC is provided by the state EM agency.

13.6 Private Sector Relationships.

HMRP personnel should engage the private sector by participating in committees, boards, commissions, and groups to build and strengthen professional relationships. Participation could be voluntary per industry or a statutory requirement such as those required of EHS facilities. Other opportunities for participating with private sector personnel can be found in 13.6.1 and 13.6.2.

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13.6.1 Training, exercise, and coordinating with industrial mutual-aid groups found in jurisdictions with large numbers of chemical/manufacturing facilities can provide opportunities to build professional relationships. Some of the benefits of these professional relationships might include access to the following:

(1) Fire-fighting foam, including specialized foam
(2) Large quantities of neutralizing materials or agents
(3) Chemists, chemical engineers, industrial hygienists, and product/material experts
(4) Specialized equipment and response vehicles
(5) Facility-based response teams and other trained personnel

13.6.2 Business sector groups, such as Chamber of Commerce, Rotary International, and others, can provide opportunities to develop program support. Opportunities for support might include assistance with the following:

(1) Continuity of operations plans
(2) Emergency action plans (EAPs)
(3) Business interruption plans
(4) Loss prevention plans

13.7 Public Relationships.

HMRP personnel should engage the public by participating in committees, boards, and groups that enhance public awareness, build trust, and provide for a safer environment.

13.7.1 Hosting household hazardous waste collection events provide an opportunity for HMRP personnel to interact with the public. HMRP personnel often work as safety officers and in identifying and classifying hazardous waste, both of which display their knowledge and skills to the public. Other public opportunities include the following:

(1) Education on personal hazardous materials/WMD incident preplanning
(2) Sheltering-in-place measures
(3) Emergency evacuation procedures

13.7.2 Professional relationships with local colleges and universities can develop technical specialist relationships in a given field within their respective facility or the HMRP's jurisdiction and can provide training opportunities.

13.7.3 Relationships with community-based citizen volunteer groups such as community emergency response teams (CERTs), Fire Corps, Medical Reserve Corps, amateur radio emergency services, volunteers in police service programs, and Boy and Girl Scouts can provide opportunities to strengthen their disaster preparedness capabilities.

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ANNEX A

Explanatory Material

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

Annex material is useful information that is included in this document solely to help the user understand the intent of the requirements by providing further information, diagrams, examples, or other details. The Annex A material, along with the mandatory sections of NFPA 475, is voted on by the document's technical committee. For the convenience of the readers of this handbook, Annex A text is inserted after the appropriate paragraphs in Chapter 1 through Chapter 13 and, therefore, is not repeated here.

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ANNEX

B

Informational References

B.1 Referenced Publications.

The documents or portions thereof listed in this annex are referenced within the informational sections of this recommended practice and are not part of the recommendations of this document unless also listed in Chapter 2 for other reasons.

B.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2013 edition.
NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2013 edition.
NFPA 1041, *Standard for Fire Service Instructor Professional Qualifications*, 2012 edition.
NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2013 edition.
NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies*, 2016 edition.
NFPA 1992, *Standard on Liquid Splash–Protective Ensembles and Clothing for Hazardous Materials Emergencies*, 2017 edition.
NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*, 2017 edition.

B.1.2 Other Publications.

B.1.2.1 EPA Publications. U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460.

Standard Operating Safety Guides

B.1.2.2 NIOSH Publications. National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, 1600 Clifton Road, Atlanta, GA 30329-4027.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, 1985.

B.1.2.3 U.S. Government Publications. U.S. Government Publishing Office, Washington, DC 20402.

Title 29, Code of Federal Regulations, Part 1910.120, "Occupational Safety and Health Standards."
Title 29, Code of Federal Regulations, Part 1910.120(8), "Hazardous Waste Operations and Emergency Response," 1994.

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Title 29, Code of Federal Regulations, Part 1910.120(q), "Emergency Response Program to Hazardous Substance Releases."
Title 29, Code of Federal Regulations, Part 1910.1000, "Toxic and Hazardous Substances."
Title 49, Code of Federal Regulations, "Transportation."

B.1.2.4 Other Publications. *E-tool white paper: https://iab.gov/Uploads/NT_Modeling, Simulation, & Simulators White Paper.pdf, InterAgency Board Publications, Arlington, VA 22202.*

Modeling, simulations, and simulators (MS&S) e-tool: https://iab.gov/MSS_Home.aspx, InterAgency Board Publications, Arlington, VA 22202.

B.2 Informational References.

The following documents or portions thereof are listed here as informational resources only. They are not a part of the recommendations of this document.

B.2.1 NRT Publications. U.S. National Response Team, Washington, DC 20593, www.nrt.org.

NRT-1, *Hazardous Materials Emergency Planning Guide*, 2001.

B.2.2 U.S. Coast Guard Publications. U.S. Coast Guard, 2703 Martin Luther King Jr. Ave, SE, Washington, DC 20593-7000, www.uscg.mil

Hazardous Materials Response Special Teams Capabilities and Contact Handbook, 2005.

Chemical Hazards Response Information System (CHRIS).

B.2.3 Other Publications. Knowles, Malcolm, Elwood F. Holton III, and Richard A. Swanson, *The Adult Learner: The Definitive Classic in Adult Education and Human Resource Development*, 6th Edition. Burlington, MA: Elesvier. 2005.

B.3 References for Extracts in Informational Sections. (Reserved)

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PART IV

NFPA® 1072, *Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications*, 2017 Edition

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Part IV of this handbook presents the full text of NFPA 1072, *Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications*.

New to the 2018 edition of the handbook is the addition of this inaugural edition of NFPA 1072, which identifies the minimum job performance requirements (JPRs) for personnel at the scene of a hazardous materials/weapons of mass destruction (WMD) incident at the following levels: awareness, operations, operations mission-specific, hazardous materials technician, and incident commander. The purpose of NFPA 1072 is to specify the minimum JPRs for service at the scene of a hazardous materials/WMD incident at the following levels: awareness, operations, operations mission-specific, hazardous materials technician, and incident commander.

It was the charge of the Technical Committee on Hazardous Materials Response Personnel to develop a professional qualifications (pro-qual) standard for selected positions or levels related to information and referenced material found in NFPA 472. This resulted in a pro-qual document that summarized the tasks in levels of awareness, operations, operations mission-specific, hazardous materials technician, and incident commander for professionals and teams. Over the course of 4 years, the technical committee established a comprehensive document based on information correlated to the long-standing and internationally recognized NFPA 472 standard.

To best recognize the work of the technical committee, and to make the correlation between the documents easy for the stakeholders and users to reference, a matrix at the beginning of this handbook describes the related material in NFPA 1072 and NFPA 472, with an emphasis on Chapters 4–8 — which cover the areas of awareness, operations, operation mission-specific, technician, and incident commander — in both standards.

To better understand the subtle differences between NFPA 472 and NFPA 1072, it is best to distinguish the terms *competence* or *competency* and *qualifications*. The Correlating Committee on Professional Qualifications, which oversees NFPA 1072 from a correlation perspective, has differentiated the terms as follows.

Competence or *competency* is the combination of knowledge, skills, and ability of an individual to do a job properly and efficiently. A competency is a set of defined behaviors that provide a structure to enable the identification, evaluation, and continued professional development of the behaviors in

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individual employees that are required to be performed in an accurate and effective manner within an assigned or specific role.

Qualification is work- or job-related knowledge acquired through formal or informal education that is competency based, coupled with the developed skills and knowledge or abilities that are required to do a particular job in an accurate, efficient, and effective manner. These qualifications are based on national pro-qual standards and are assessed in the workplace to verify that an individual is able to perform the task or level of performance specified in the JPR.

NFPA 1072 identifies the minimum job performance requirements for personnel to respond to incidents involving hazardous materials/WMD. The standard should be used to ensure that personnel are qualified at the scene of a hazardous materials/WMD incident at the levels of awareness, operations, operations mission-specific, hazardous materials technician, and incident commander.

Job performance requirements (JPRs) for each level and position are the tasks personnel shall perform to accomplish the job duties. Personnel at the scene of a hazardous materials/WMD incident at the levels of awareness, operations, operations mission-specific, hazardous materials technician, and incident commander are encouraged to remain current with the general knowledge, skills, and JPRs addressed for each level or position of qualification.

Note that an asterisk (*) after a standard paragraph number indicates that advisory annex material pertaining to the requirement in that paragraph appears in Annex A. Paragraphs that begin with the letter A are extracted from Annex A of the standard. Although printed in black ink, this is nonmandatory material and purely explanatory in nature. For ease of use, this handbook places Annex A material immediately after the standard paragraph to which it refers.

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1 Administration

1.1* Scope.

This standard identifies the minimum job performance requirements (JPRs) for personnel at the scene of a hazardous materials/weapons of mass destruction (WMD) incident at the following levels: awareness, operations, operations mission-specific, hazardous materials technician, and incident commander.

A.1.1 The committee recognizes that emergency services organizations might have to invest considerable resources to provide the equipment and training needed to respond to incidents involving hazardous materials or weapons of mass destruction (WMD) in a safe and efficient manner. The committee does not mean to imply that organizations with limited resources cannot provide response services, only that the individuals charged with responsibilities are qualified to specific levels according to this standard.

1.2 Purpose.

The purpose of this standard is to specify the minimum JPRs for service at the scene of a hazardous materials/weapons of mass destruction incident at the following levels: awareness, operations, operations mission-specific, hazardous materials technician, and incident commander.

1.2.1 This standard shall define personnel at the scene of a hazardous materials/weapons of mass destruction incident at the following levels: awareness, operations, operations mission-specific, hazardous materials technician, and incident commander.

1.2.2 The intent of this standard shall be to ensure that personnel at the scene of a hazardous materials/weapons of mass destruction incident at the levels of awareness, operations, operations mission-specific, hazardous materials technician, and incident commander are qualified.

1.2.3* This standard shall not address organization or management responsibility.

A.1.2.3 Organization and management responsibilities should be addressed by the agency that personnel represent. The authority having jurisdiction should define the agency requirements for progression to positions of management responsibility.

1.2.4 It is not the intent of this standard to restrict any jurisdiction from exceeding or combining these minimum requirements.

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1.2.5 JPRs for each level and position are the tasks personnel shall be able to perform to carry out the job duties.

1.2.6* Personnel at the scene of a hazardous materials/weapons of mass destruction incident at the levels of awareness, operations, operations mission-specific, hazardous materials technician, and incident commander shall remain current with the general knowledge and skills and JPRs addressed for each level or position of qualification.

A.1.2.6 The committee recognizes the importance of formal and continuing education and training programs to ensure that personnel at the various response levels — awareness, operations, operations mission-specific, hazardous materials technician, and incident commander — have maintained and updated the necessary skills and knowledge for the level of qualification. Continuing education and training programs can be developed or administered by local, state, provincial, or federal agencies as well as by professional associations and accredited institutions of higher education. The methods of learning would include areas of technology, refresher training, skills practices, and knowledge application to standards. The subject matter should directly relate to the requirements of this standard.

1.3 Application.

The application of this standard is to specify which requirements within the document shall apply to personnel at the scene of a hazardous materials/weapons of mass destruction incident at the following levels: awareness, operations, operations mission-specific, hazardous materials technician, and incident commander.

1.3.1 The JPRs shall be accomplished in accordance with the requirements of the authority having jurisdiction (AHJ) and all applicable NFPA standards.

1.3.2 It shall not be required that the JPRs be mastered in the order in which they appear. The AHJ shall establish instructional priority and the training program content to prepare personnel to meet the JPRs of this standard.

1.3.3* Performance of each requirement of this standard shall be evaluated by personnel approved by the AHJ.

A.1.3.3 It is recommended, where practical, that evaluators be individuals who were not directly involved as instructors for the requirement being evaluated.

1.3.4 The JPRs for each level or position shall be completed in accordance with recognized practices and procedures or as defined by law or by the AHJ.

1.3.5 Personnel assigned the duties at the awareness level shall meet all the requirements defined in Chapter 4 prior to being qualified. Personnel assigned the duties at the operations level shall meet all the requirements defined in Chapter 5 prior to being qualified. Personnel assigned the duties at the technician level shall meet all the requirements defined in Chapter 7 prior to being qualified. Personnel assigned the duties of incident commander shall meet all the requirements defined in Chapter 8 prior to being qualified.

1.3.5.1 Personnel qualified at the operations level who are assigned mission-specific duties of personal protection equipment (PPE), mass decontamination, technical decontamination, evidence preservation and sampling, product control, detection, monitoring, and sampling, victim rescue and recovery, and illicit laboratory incidents shall meet all the requirements defined in the applicable subsection within Chapter 6 prior to being qualified.

1.3.6 The AHJ shall provide personal protective clothing and the equipment necessary to conduct assignments.

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1.3.7 JPRs involving exposure to products of combustion shall be performed in approved PPE.

1.3.8 Prior to training to meet the requirements of this standard, personnel shall meet the following requirements:

(1) Educational requirements established by the AHJ
(2) Age requirements established by the AHJ
(3) Medical requirements established by the AHJ
(4) Job-related physical performance requirements established by the AHJ

1.3.9 Wherever in this standard the terms *rules*, *regulations*, *policies*, *procedures*, *supplies*, *apparatus*, or *equipment* are referred to, it is implied that they are those of the AHJ.

1.4 Units.

In this standard, equivalent values in SI units shall not be considered as the requirement, as these values can be approximate. *(See Table 1.4.)*

TABLE 1.4 *U.S.–SI Conversion Factors*

Quantity	*U.S. Unit/Symbol*	*SI Unit/Symbol*	*Conversion Factor*
Length	inch (in.) foot (ft)	millimeter (mm) meter (m)	1 in. = 25.4 mm 1 ft = 0.305 m
Area	square foot (ft^2)	square meter (m^2)	1 ft^2 = 0.0929 m^2
Volume	gallon (gal) quart (qt)	liter (L) liter (L)	1 gal = 3.785 l 1 qt = 0.9463 l
Weight	pound (lb)	gram (g)	1 lb = 453.6 g
Pressure	atmosphere (atm) inches of mercury (in. Hg) inches of water (in. H_2O) pounds per square inch (psi) pounds per square inch (psi) pounds per square inch (psi)	millimeters of mercury (mm Hg) millimeters of mercury (mm Hg) millimeters of mercury (mm Hg) millimeters of mercury (mm Hg) bar pascal (Pa)	1 atm = 760 mm Hg 1 in. Hg = 25.4 mm Hg 1 in H_2O = 1.87 mm Hg 1 psi = 51.7 mm Hg 1 psi = 0.068 bar 1 psi = 6894.8 Pa
Radiation	rad rem curie (Ci)	gray (Gy) sievert (Sv) becquerel (Bq)	100 rad = 1 Gy 100 rem = 1 Sv 1 Bq = 2.7×10^{-11} Ci

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Referenced Publications

2

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, Quincy, MA 02169-7471.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, 2017 edition.

2.3 Other Publications.

2.3.1 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Emergency Response Guidebook, Pipeline and Hazardous Materials Administration, U.S. Department of Transportation, 2016.

Title 18, U.S. Code, Section 2332a, "Use of Weapons of Mass Destruction."

2.3.2 Other Publications. *Merriam-Webster's Collegiate Dictionary,* 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 51, *Standard for the Design and Installation of Oxygen–Fuel Gas Systems for Welding, Cutting, and Allied Processes*, 2013 edition.

NFPA 70®, *National Electrical Code®*, 2017 edition.

NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2013 edition.

NFPA 1000, *Standard for Fire Service Professional Qualifications Accreditation and Certification Systems*, 2017 edition.

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3 Definitions

3.1 General.

The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary,* 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

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.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

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.

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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.

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.

3.2.4 Shall. Indicates a mandatory requirement.

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

3.2.6 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1* Allied Professional. That person who possesses the knowledge, skills, and technical competence to provide assistance in the selection, implementation, and evaluation of tasks at a hazardous materials/weapons of mass destruction (WMD) incident.

A.3.3.1 Allied Professional. Examples include certified safety professional (CSP), certified health physicist (CHP), certified industrial hygienist (CIH), radiation safety officer (RSO), or similar credentialed or competent individuals as determined by the authority having jurisdiction (AHJ). Can also be referred to as a technical specialist or subject matter expert (SME).

3.3.2 Analyze. To identify a hazardous materials/weapons of mass destruction (WMD) problem and determine likely behavior and harm within the training and capabilities of the emergency responder.

3.3.3 Assignment. A job, task, role, or function to be performed that can come from a supervisor or other established authority as determined by the authority having jurisdiction (AHJ) (e.g., hazardous materials technician, allied professional, emergency response plans, or standard operating procedures).

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

3.3.5 CANUTEC. The Canadian Transport Emergency Centre, operated by Transport Canada, that provides emergency response information and assistance on a 24-hour basis for responders to hazardous materials/weapons of mass destruction (WMD) incidents.

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3.3.6 CHEMTREC. A public service of the American Chemistry Council that provides emergency response information and assistance on a 24-hour basis for responders to hazardous materials/weapons of mass destruction (WMD) incidents.

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

3.3.8* Confined Space. An area large enough and so configured that a person can enter and perform assigned work but that has limited or restricted means for entry and exit and is not designed for continuous human occupancy.

A.3.3.8 Confined Space. Additionally, a confined space is further defined as having one or more of the following characteristics:

(1) The area contains or has the potential to contain a hazardous atmosphere, including an oxygen-deficient atmosphere.
(2) The area contains a material with the 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.

3.3.9 Container. A receptacle, piping, or pipeline used for storing or transporting material of any kind; synonymous with "packaging" in transportation.

3.3.9.1 Bulk Transportation Containers. Containers, including transport vehicles, having a liquid capacity of more than 119 gal (450 L), a solids capacity of more than 882 lb (400 kg), or a compressed gas water capacity of more than 1001 lb (454 kg) that are either placed on or in a transport vehicle or vessel or are constructed as an integral part of the transport vehicle, including the following: a. cargo tanks including nonpressure tanks — MC-306/DOT-406 or equivalent, low-pressure tanks — MC-307-DOT-407 or equivalent, corrosive liquid tanks — MC-312/DOT-412 or equivalent, high-pressure tanks — MC-331 or equivalent, and cryogenic tanks — MC-338 or equivalent, compressed gas tubes trailers, and dry bulk cargo tanks; b. portable tanks such as intermodal tanks, including nonpressure tanks, pressure tanks, cryogenic tanks, and tube modules; c. tank cars including nonpressure tank cars, pressure tanks cars, and cryogenic tank cars; and d. ton containers.

3.3.9.2 Facility Storage Tanks. Atmospheric and low-pressure storage tanks; pressurized storage tanks; and cryogenic storage tanks.

3.3.9.3 Intermediate Bulk Containers (IBCs). Pressure, nonpressure, and cryogenic rigid or flexible portable containers, other than cylinders or portable tanks, designed for mechanical lifting.

3.3.9.4 Nonbulk Containers. Containers, including bags, boxes, carboys, cylinders, drums, and Dewar flasks for cryogenic liquids, having a liquid capacity of 119 gal (450 L) or less, a solids capacity of 882 lb (400 kg) or less, or a compressed gas water capacity of 1001 lb (454 kg) or less.

3.3.9.5 Pipeline. A length of pipe including pumps, valves, flanges, control devices, strainers, and/or similar equipment for conveying fluids. [**70:**427.2]

3.3.9.6 Piping. Assemblies of piping components used to convey, distribute, mix, separate, discharge, meter, control, or snub fluid flows. Piping also includes pipe-supporting elements but does not include support structures, such as building frames, bents, foundations, or any other equipment excluded from this standard. [**51,** 2013]

3.3.9.7* Radioactive Materials Containers. Excepted packaging, industrial packaging, Type A, Type B, and Type C packaging for radioactive materials.

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A.3.3.9.7 Radioactive Materials Containers. *Excepted packaging* is used to transport materials with extremely low levels of radioactivity that meet only general design requirements for any hazardous material. Excepted packaging ranges from a product's fiberboard box to a sturdy wooden or steel crate, and typical shipments include limited quantities of materials, instruments, and articles such as smoke detectors. Excepted packaging will contain non-life-endangering amounts of radioactive material.

Industrial packaging is used to transport materials that present limited hazard to the public and the environment. Examples of these materials are contaminated equipment and radioactive waste solidified in materials such as concrete. This packaging is grouped into three categories based on the strength of packaging: IP-1, IP-2, and IP-3. Industrial packaging will contain non-life-endangering amounts of radioactive material.

Type A packaging is used to transport radioactive materials with concentrations of radioactivity not exceeding the limits established in 49 CFR 173.431. Typically, Type A packaging has an inner containment vessel made of glass, plastic, or metal and packing material made of polyethylene, rubber, or vermiculite. Examples of materials shipped in Type A packaging include radiopharmaceuticals and low-level radioactive wastes. Type A packaging will contain non-life-endangering amounts of radioactive material.

Type B packaging is used to transport radioactive materials with radioactivity levels higher than those allowed in Type A packaging, such as spent fuel and high-level radioactive waste. Limits on activity contained in Type B packaging are provided in 49 CFR 173.431. Type B packaging ranges from small drums [55 gal (208 L)] to heavily shielded steel casks that sometimes weigh more than 100 tons (90.7 metric tonnes). Type B packaging can contain potentially life-endangering amounts of radioactive material.

Type C packaging is used for consignments transported by aircraft of high-activity radioactive materials that have not been certified as "low dispersible radioactive material" (including plutonium). They are designed to withstand severe accident conditions associated with air transport without loss of containment or significant increase in external radiation levels. The Type C packaging performance requirements are significantly more stringent than those for Type B packaging. Type C packaging is not authorized for domestic use but can be authorized for international shipments of high-activity radioactive material consignments. Regulations require that both Type B and Type C packaging be marked with a trefoil symbol to ensure that the package can be positively identified as carrying radioactive material. The trefoil symbol must be resistant to the effects of both fire and water so that it is likely to survive a severe accident and serve as a warning to emergency responders.

The performance requirements for Type C packaging include those applicable to Type B packaging with enhancements on some tests that are significantly more stringent than those for Type B packaging. For example, a 200 mph (321.8 km/hr) impact onto an unyielding target is required instead of the 30 ft (9.1 m) drop test required for Type B packaging; a 60-minute fire test is required instead of the 30-minute test for Type B packaging; and a puncture/tearing test is required. These stringent tests are expected to result in packaging designs that will survive more severe aircraft accidents than Type B packaging designs.

3.3.10 Contaminant. A hazardous material, or the hazardous component of a weapon of mass destruction (WMD), 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.

3.3.11 Contamination. The process of transferring a hazardous material, or the hazardous component of a weapon of mass destruction (WMD), from its source to people, animals, the environment, or equipment, which can act as a carrier.

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

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3.3.12 Control. The procedures, techniques, and methods used in the mitigation of hazardous materials/weapons of mass destruction (WMD) incidents, including containment, extinguishment, and confinement.

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

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

3.3.12.3 Extinguishment. To cause to cease burning.

3.3.13* Control Zones. The areas at hazardous materials/weapons of mass destruction (WMD) incidents within an established perimeter that are designated based upon safety and the degree of hazard.

A.3.3.13 Control Zones. Law enforcement agencies might utilize different terminology for site control, for example, *inner* and *outer* perimeters as opposed to *hot* and *cold* zones. The operations level responder should be familiar with the terminology and procedures used by the authority having jurisdiction (AHJ) and coordinate on-scene site control operations with law enforcement. Many terms are used to describe these control zones; however, for the purposes of this standard, zones are defined as hot, warm, and cold zones.

3.3.13.1 Cold Zone. The control zone of hazardous materials/weapons of mass destruction (WMD) incidents that contains the incident command post and such other support functions as are deemed necessary to control the incident.

3.3.13.2 Decontamination Corridor. The area usually located within the warm zone where decontamination is performed.

3.3.13.3 Hot Zone. The control zone immediately surrounding hazardous materials/weapons of mass destruction (WMD) incidents, which extends far enough to prevent adverse effects of hazards to personnel outside the zone and where only personnel who are trained, equipped, and authorized to do assigned work are permitted to enter.

3.3.13.4* Warm Zone. The control zone at hazardous materials/weapons of mass destruction (WMD) incidents where personnel and equipment decontamination and hot zone support takes place.

A.3.3.13.4 Warm Zone. The warm zone includes control points for the decontamination corridor, thus helping to reduce the spread of contamination. This support can include staging of backup personnel and equipment, staging of evidence, and personnel and equipment decontamination. Additionally, portions of this area can be used as a safe refuge for initial patient evacuation and triage.

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

3.3.15* Decontamination. The physical and/or chemical process of reducing and preventing the spread and effects of contaminants to people, animals, the environment, or equipment involved at hazardous materials/weapons of mass destruction (WMD) incidents.

A.3.3.15 Decontamination. There are three types of decontamination (also known as "decon") performed by emergency responders: emergency, mass, and technical.

Gross decontamination is performed on the following:

(1) Team members before their technical decontamination
(2) Emergency responders before leaving the incident scene
(3) Victims during emergency decontamination

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(4) Persons requiring mass decontamination
(5) Personal protective equipment used by emergency responders before leaving the scene

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

A.3.3.15.1 Emergency Decontamination. This process can be as simple as removal of outer or all garments from the individual to washing down with water from a fire hose or emergency safety shower. The sole purpose is to quickly separate as much of the contaminant as possible from the individual to minimize exposure and injury.

3.3.15.2* Gross Decontamination. A phase of the decontamination process where significant reduction of the amount of surface contamination takes place as soon as possible, most often accomplished by mechanical removal of the contaminant or initial rinsing from handheld hose lines, emergency showers, or other nearby sources of water.

A.3.3.15.2 Gross Decontamination. Victims of a hazardous material release that is potentially life threatening due to continued exposure from contamination are initially put through a gross decontamination, which will significantly reduce the amount of additional exposure. This is usually accomplished by mechanical removal of the contaminant or initial rinsing from handheld hose lines, emergency showers, or other nearby sources of water. Responders operating in a contaminated zone in personal protective equipment (PPE) are put through gross decontamination, which will make it safer for them to remove the PPE without exposure and for members assisting them.

3.3.15.3* Mass Decontamination. The physical process of reducing or removing surface contaminants from large numbers of victims in potentially life-threatening situations in the fastest time possible.

A.3.3.15.3 Mass Decontamination. Mass decontamination is initiated where the number of victims and time constraints do not allow the establishment of an in-depth decontamination process.

Mass decontamination should be established at once to reduce the harm being done to the victims by the contaminants. Initial operations are most often performed with handheld hose lines or master streams supplied from fire apparatus while a more formal process is being set up. A formal technical decontamination might be necessary if it is determined through detection, observation, or concern that the initial emergency decontamination was not effective. For example, this could be the case for victims exposed to a radiological dispersal device (RDD) or an aerosolized biological agent.

3.3.15.4* Technical Decontamination. The planned and systematic process of reducing contamination to a level that is as low as reasonably achievable.

A.3.3.15.4 Technical Decontamination. Technical decontamination is the process subsequent to gross decontamination designed to remove contaminants from responders, their equipment, and victims. It is intended to minimize the spread of contamination and ensure responder safety. Technical decontamination is normally established in support of emergency responder entry operations at a hazardous materials incident, with the scope and level of technical decontamination based on the type and properties of the contaminants involved. In non-life-threatening contamination incidents, technical decontamination can also be used on victims of the initial release. Examples of technical decontamination methods are the following:

(1) Absorption
(2) Adsorption
(3) Chemical degradation

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(4) Dilution
(5) Disinfecting
(6) Evaporation
(7) Isolation and disposal
(8) Neutralization
(9) Solidification
(10) Sterilization
(11) Vacuuming
(12) Washing

The specific decontamination procedure to be used at an incident is typically selected by a hazardous materials technician *(see 7.3.3)* and is subject to the approval of the incident commander.

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

3.3.17* Demonstrate. To show by actual performance.

A.3.3.17 Demonstrate. This performance can be supplemented by simulation, explanation, illustration, or a combination of these.

3.3.18 Describe. To explain verbally or in writing using standard terms recognized by the hazardous materials/weapons of mass destruction (WMD) response community.

3.3.19 Detection and Monitoring Equipment. Instruments and devices used to detect, classify, or quantify materials.

3.3.20 Dispersal Device. Any weapon or combination of mechanical, electrical, or pressurized components that is designed, intended, or used to cause death or serious bodily injury through the release, dissemination, or impact of toxic or poisonous chemicals or their precursors, biological agent, toxin or vector, or radioactive material.

3.3.21 *Emergency Response Guidebook* (ERG). The reference book, written in plain language, to guide emergency responders in their initial actions at the incident scene, specifically the *Emergency Response Guidebook* from the U.S. Department of Transportation, Transport Canada, and the Secretariat of Transport and Communications, Mexico.

3.3.22 Endangered Area. The actual or potential area of exposure associated with the release of a hazardous materials/weapons of mass destruction (WMD).

3.3.23 Evaluate. To assess or judge the effectiveness of a response operation or course of action within the training and capabilities of the emergency responder.

3.3.24 Evidence Preservation. Deliberate and specific actions taken with the intention of protecting potential evidence from contamination, damage, loss, or destruction.

3.3.25 Example. An illustration of a problem serving to show the application of a rule, principle, or method (e.g., past incidents, simulated incidents, parameters, pictures, and diagrams).

3.3.26* Exposure. The process by which people, animals, the environment, property, and equipment are subjected to or come in contact with a hazardous material/weapon of mass destruction (WMD).

A.3.3.26 Exposure. The magnitude of exposure is dependent primarily on the duration of exposure and the concentration of the hazardous material. This term is also used to describe a person, an animal, the environment, or a piece of equipment. The exposure can be external, internal, or both.

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3.3.27 Exposures. The people, animals, environment, property, and equipment that might potentially become exposed at a hazardous materials/weapons of mass destruction (WMD) incident.

3.3.28 Field Screening. A set of procedures, to include at a minimum nondestructive field testing to identify the presence of explosive devices, radiological materials, flammable materials, volatile organic compounds (VOC), strong oxidizers, fluorides, or corrosives, that serves as a protective safety measure prior to collection, transportation, and laboratory analysis.

3.3.29* Fissile Material. Material whose atoms are capable of nuclear fission (capable of being split).

A.3.3.29 Fissile Material. Department of Transportation (DOT) regulations define fissile material as plutonium-239, plutonium-242, uranium-233, uranium-235, or any combination of these radionuclides. This material is usually transported with additional shipping controls that limit the quantity of material in any one shipment. Containers used for fissile material are designed and tested to prevent a fission reaction from occurring during normal transport conditions as well as hypothetical accident conditions.

3.3.30 Harm. Adverse effect created by being exposed to a hazard.

3.3.31 Hazard. Capable of causing harm or posing an unreasonable risk to life, health, property, or environment.

3.3.32* Hazardous Material. Matter (solid, liquid, or gas) or energy that when released is capable of creating harm to people, the environment, and property, including weapons of mass destruction (WMD) as defined in 18 U.S. Code, Section 2332a, as well as any other criminal use of hazardous materials, such as illicit labs, environmental crimes, or industrial sabotage.

A.3.3.32 Hazardous Material. In United Nations model codes and regulations, hazardous materials are called *dangerous goods*. See also 3.3.68 and A.3.3.68, Weapons of Mass Destruction (WMD).

3.3.33* Hazardous Materials Branch/Group. The function within an overall incident management system (IMS) that deals with the mitigation and control of the hazardous materials/weapons of mass destruction (WMD) portion of an incident.

A.3.3.33 Hazardous Materials Branch/Group. This function is directed by a hazardous materials officer and deals principally with the technical aspects of the incident.

3.3.34* Hazardous Materials Officer. The person who is responsible for directing and coordinating all operations involving hazardous materials/weapons of mass destruction (WMD) as assigned by the incident commander (IC).

A.3.3.34 Hazardous Materials Officer. This individual might also serve as a technical specialist for incidents that involve hazardous materials/WMD. The National Incident Management System (NIMS) identifies this person as the Hazardous Materials Branch Director/Supervisor.

3.3.35* Hazardous Materials Response Team (HMRT). An organized group of trained response personnel operating under an emergency response plan and applicable standard operating procedures who perform hazardous material technician level skills at hazardous materials/weapons of mass destruction (WMD) incidents.

A.3.3.35 Hazardous Materials Response Team (HMRT). The team members respond to releases or potential releases of hazardous materials/WMD for the purpose of control or stabilization of the incident.

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3.3.36* Hazardous Materials Safety Officer. The person who works within an incident management system (IMS) (specifically, the hazardous materials branch/group) to ensure that recognized hazardous materials/weapons of mass destruction (WMD) safe practices are followed at hazardous materials/WMD incidents.

A.3.3.36 Hazardous Materials Safety Officer. The hazardous materials safety officer will be called on to provide technical advice or assistance regarding safety issues to the hazardous materials officer and incident safety officer at a hazardous materials/WMD incident. The National Incident Management System (NIMS) identifies this person as the Assistant Safety Officer — Hazardous Materials.

3.3.37* Hazardous Materials Technician. Person who responds to hazardous materials/weapons of mass destruction (WMD) incidents using a risk-based response process to analyze a problem involving hazardous materials/WMD, plan a response to the problem, implement the planned response, evaluate progress of a planned response and adjust as needed, and assist in terminating the incident.

A.3.3.37 Hazardous Materials Technician. This person might have additional competencies that are specific to their response mission, expected tasks, and equipment and training as determined by the authority having jurisdiction (AHJ).

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

3.3.39 Incident. An emergency involving the release or potential release of hazardous materials/weapons of mass destruction (WMD).

3.3.40 Incident Analysis. The process of analyzing the risk at an incident by identifying the materials and containers involved, predicting the likely behavior of each container and its contents, and estimating the potential harm or outcomes associated with that behavior.

3.3.41* Incident Commander (IC). The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and the release of resources.

A.3.3.41 Incident Commander (IC). This position is equivalent to the on-scene incident commander as defined in OSHA 1910.120(8), "Hazardous Waste Operations and Emergency Response." The incident commander (IC) has overall authority and responsibility for conducting incident operations and is responsible for the management of all incident operations at the incident site.

3.3.42 Incident Command System (ICS). A component of an incident management system (IMS) designed to enable effective and efficient on-scene incident management by integrating organizational functions, tactical operations, incident planning, incident logistics, and administrative tasks within a common organizational structure.

3.3.43* Incident Management System (IMS). A process 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 to include the incident command system (ICS), unified command, multiagency coordination systems, training, and management of resources.

A.3.3.43 Incident Management System (IMS). The IMS provides a consistent approach for all levels of government, private sector, and volunteer organizations to work effectively and efficiently together to prepare for, respond to, and recover from domestic incidents, regardless of cause, size, or complexity. An IMS provides for interoperability and compatibility among all capability levels of government, the private sector, and volunteer organizations. The IMS includes a core set of concepts, principles, terminology, and technologies covering

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the incident command system, multiagency coordination systems, training, and identification and management of resources.

3.3.44* Job Performance Requirement (JPR). A written statement that describes a specific job task, lists the items necessary to complete the task, and defines measurable or observable outcomes and evaluation areas for the specific task. [**1000,** 2017]

A.3.3.44 Job Performance Requirements (JPR). See Annex B for further information.

3.3.45 Match. To provide with a counterpart.

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

3.3.47 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.

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

3.3.49* Personal Protective Equipment (PPE). The protective clothing and respiratory protective equipment provided to shield or isolate a person from the hazards encountered at hazardous materials/weapons of mass destruction (WMD) incident operations.

A.3.3.49 Personal Protective Equipment (PPE). 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.

3.3.50 Plan.

3.3.50.1* Emergency Response Plan (ERP). A plan developed by the authority having jurisdiction (AHJ) with the cooperation of all participating agencies and organizations, including a jurisdiction with emergency responsibilities and those outside the jurisdiction who have entered into response/support agreements, that identifies goals and objectives for that emergency type, agency roles, and overall strategies

A.3.3.50.1 Emergency Response Plan (ERP). Emergency response plans can be developed at organizational and governmental levels (agency, local, state, regional, provincial, territorial, tribal, and federal).

3.3.50.2* Incident Action Plan (IAP). An oral or written plan approved by the incident commander (IC) containing general objectives reflecting the overall strategy for managing an incident for a specific time frame and target location.

A.3.3.50.2 Incident Action Plan (IAP). It can include the identification of operational resources and assignments. It can also include attachments that provide direction and important information for management of the incident during one or more operational periods.

3.3.50.3* Site Safety and Control Plan. A site-specific safety document used within the incident command system (ICS) to organize information important to hazardous materials response operations.

A.3.3.50.3 Site Safety and Control Plan. Reflective of the objectives identified in the IAP, the site safety and control plan is used to communicate incident conditions, incident hazards, and branch operations to the hazardous materials team during the safety briefing. Components of a typical site safety and control plan include an overview of the hazardous materials branch organization; personnel assignments; summary of incident hazards, both physical and chemical; branch tactical objectives; site control practices; identification of personal

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protective equipment or ensembles; hazardous materials branch communications; identification of decontamination practices and medical care; and monitoring of the identified hazards.

3.3.51* Planned Response. The incident action plan, with the site safety and control plan, consistent with the emergency response plan and/or standard operating procedures for a specific hazardous materials/weapons of mass destruction (WMD) incident.

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

(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

3.3.52 Predict. To estimate or forecast the future behavior of a hazardous materials/weapons of mass destruction (WMD) container and/or its contents within the training and capabilities of the emergency responder.

3.3.53* Protective Clothing. Equipment designed to protect the wearer from thermal hazards, hazardous materials, or the hazardous component of a weapon of mass destruction (WMD) contacting the skin or eyes.

A.3.3.53 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

3.3.53.1 Ballistic Protective Clothing (BPC). An item of personal protective equipment (PPE) that provides protection against specific ballistic threats by helping to absorb the impact and reduce or prohibit penetration to the body from bullets and steel fragments from handheld weapons and exploding munitions.

3.3.53.2* Chemical-Protective Clothing (CPC). The ensemble elements (garment, gloves, and footwear) provided to shield or isolate a person from the hazards encountered during hazardous materials/WMD incident operations.

A.3.3.53.2 Chemical-Protective Clothing (CPC). 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.

3.3.53.2.1* Liquid Splash–Protective Ensemble. Multiple elements of compliant protective clothing and equipment products that when worn together provide protection from some, but not all, risks of hazardous materials/WMD emergency incident operations involving liquids.

A.3.3.53.2.1 Liquid Splash–Protective Ensemble. This type of protective clothing is a component of EPA Level B chemical protection. Liquid splash–protective ensembles should meet the requirements of NFPA 1992.

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3.3.53.2.2* Vapor-Protective Ensemble. Multiple elements of compliant protective clothing and equipment that when worn together provide protection from some, but not all, risks of vapor, liquid-splash, and particulate environments during hazardous materials/WMD incident operations.

A.3.3.53.2.2 Vapor-Protective Ensemble. This type of protective clothing is a component of EPA Level A chemical protection. Vapor-protective clothing should meet the requirements of NFPA 1991 or NFPA 1994.

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

A.3.3.53.3 High Temperature–Protective Clothing. This type of clothing is usually of limited use in dealing with chemical commodities.

3.3.53.4* Structural Fire-Fighting Protective Clothing. The fire-resistant protective clothing normally worn by fire fighters during structural fire-fighting operations, which includes a helmet, coat, pants, boots, gloves, PASS device, and a fire-resistant hood to cover parts of the head and neck not protected by the helmet and respirator facepiece.

A.3.3.53.4 Structural Fire-Fighting Protective Clothing. Structural fire-fighting protective clothing provides limited protection from heat but might not provide adequate protection from the harmful gases, vapors, liquids, or dusts that are encountered during hazardous materials/WMD incidents. The NFPA 1971 CBRN option is intended to add chemical protection to structural fire-fighting protective clothing.

3.3.54 Public Safety Sampling. The detection, monitoring, or collection of a material for the purposes of determining the hazards present and to guide public safety response decisions.

3.3.55 Qualified. Having knowledge of the installation, construction, or operation of apparatus and the hazards involved.

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

A.3.3.56 Respiratory Protection. Respiratory protection is divided into four types:

(1) Self-contained breathing apparatus (SCBA) that meet the requirements of NFPA 1981, which also incorporates the Statement of Standard for NIOSH CBRN SCBA Testing
(2) Supplied air respirators
(3) Powered air-purifying respirators that meet the Statement of Standard for NIOSH CBRN PAPR Testing
(4) Air-purifying respirators that meet the Statement of Standard for NIOSH CBRN APR Testing

3.3.57* Response. That portion of incident management in which personnel are involved in controlling hazardous materials/weapons of mass destruction (WMD) incidents.

A.3.3.57 Response. The activities in the response portion of a hazardous materials/WMD incident include analyzing the incident, planning the response, implementing the planned response, evaluating progress, and terminating the emergency phase of the incident.

3.3.58 Risk The probability or threat of suffering a harm or loss.

3.3.59 Risk-Based Response Process. Systematic process by which responders analyze a problem involving hazardous materials/weapons of mass destruction (WMD), assess the hazards, evaluate the potential consequences, and determine appropriate response actions based upon facts, science, and the circumstances of the incident.

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3.3.60* Safety Data Sheet (SDS). Formatted information, provided by chemical manufacturers and distributors of hazardous products, about chemical composition, physical and chemical properties, health and safety hazards, emergency response, and waste disposal of the material.

A.3.3.60 Safety Data Sheet (SDS). SDS is a component of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) and replaces the term *material safety data sheet* (MSDS). GHS is an internationally agreed-upon system, created by the United Nations in 1992. It replaces the various classification and labeling standards used in different countries by using consistent criteria on a global level. It supersedes the relevant European Union (EU) system, which implemented the GHS into EU law as the Classification, Labelling and Packaging (CLP) Regulation and United States Occupational Safety and Health Administration (OSHA) standards. The SDS requires more information than MSDS regulations and provides a standardized structure for presenting the required information.

3.3.61* Sampling. The process of selecting materials to analyze.

A.3.3.61 Sampling. During a hazardous materials incident, sampling can be used to determine requirements for public protective actions, decontamination, medical treatments, mitigation, or other related functions.

The collection of evidence for the purposes of investigation is a form of sampling that has extensive enhanced requirements determined by the law enforcement authority having jurisdiction (AHJ).

3.3.62 SETIQ. The Emergency Transportation System for the Chemical Industry in Mexico that provides emergency response information and assistance on a 24-hour basis for responders to emergencies involving hazardous materials/weapons of mass destruction (WMD).

3.3.63 Stabilization. The point in an incident when the adverse behavior of the hazardous material, or the hazardous component of a weapon of mass destruction (WMD), is controlled.

3.3.64 Standard Operating Procedure (SOP). A written directive that establishes specific operational or administrative methods to be followed routinely for the performance of a task or for the use of equipment.

3.3.65 Surrounding Conditions. Conditions to be taken into consideration when identifying the scope of a hazardous materials/WMD incident, including but not limited to topography; land use, including utilities and fiber-optic cables; accessibility; weather conditions; bodies of water, including recharge ponds; public exposure potential; patient presentation; overhead and underground wires and pipelines; storm and sewer drains; possible ignition sources; adjacent land use such as rail lines, highways, and airports; and the nature and extent of injuries.

3.3.66 Termination. That portion of incident management after the cessation of tactical operations in which personnel are involved in documenting safety procedures, site operations, hazards faced, and lessons learned from the incident and include specifications for debriefing, post-incident analysis, and critique in a specific sequence.

3.3.66.1 Debriefing. An element of incident termination that focuses on the following: (1) informing responders exactly what hazmat they were (possibly) exposed to and the signs and symptoms of exposure; (2) identifying damaged equipment requiring replacement or repair; (3) identifying equipment or supplies requiring specialized decontamination or disposal; (4) identifying unsafe work conditions; (5) assigning information-gathering responsibilities for a post-incident analysis.

3.3.66.2 Post-Incident Analysis. An element of incident termination that includes completion of the required incident reporting forms, determining the level of financial responsibility, and assembling documentation for conducting a critique.

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3.3.66.3 Critique. An element of incident termination that examines the overall effectiveness of the emergency response effort and develops recommendations for improvement.

3.3.67* UN/NA Identification Number. The four-digit number assigned to a hazardous material/weapon of mass destruction (WMD)that is used to identify and cross-reference products in the transportation mode.

A.3.3.67 UN/NA Identification Number. United Nations (UN) numbers are four-digit numbers used in international commerce and transportation to identify hazardous chemicals or classes of hazardous materials. These numbers generally range between 0000 and 3500 and usually are preceded by the letters "UN" (e.g., "UN1005") to avoid confusion with number codes.

North American (NA) numbers are identical to UN numbers. If a material does not have a UN number, it may be assigned an NA number. These usually are preceded by "NA" followed by a four-digit number starting with 8 or 9.

3.3.68* Weapon of Mass Destruction (WMD). (1) Any destructive device, such as any explosive, incendiary, or poison gas bomb, grenade, rocket having a propellant charge of more than 4 oz (113 grams), missile having an explosive or incendiary charge of more than 0.25 oz (7 grams), mine, or similar device; (2) any weapon involving toxic or poisonous chemicals; (3) any weapon involving a disease organism; or (4) any weapon that is designed to release radiation or radioactivity at a level dangerous to human life.

A.3.3.68 Weapon of Mass Destruction (WMD). The source of this definition is 18 USC 2332a.

Weapons of mass destruction (WMD) are known by many different abbreviations and acronyms, the most common of which is CBRN, which is the acronym for chemical, biological, and radiological/nuclear, and explosives particulate agents that could be released as the result of a terrorist attack. CBRN agents are further categorized as follows:

(1) *Chemical terrorism agents* are materials used to inflict lethal or incapacitating casualties, generally on a civilian population, and include chemical warfare agents and toxic industrial chemicals:
   (a) *Chemical warfare agents* are solid, liquid, gaseous, and vapor agents, including, but not limited to, GB (Sarin), GD (Soman), HD (sulfur mustard), and VX.
   (b) *Toxic industrial chemicals* include chlorine and ammonia, which have been identified as mass casualty threats.
(2) *Biological terrorism agents* are liquid or particulate agents that can consist of a biologically derived toxin or pathogen to inflict lethal or incapacitating casualties, such as bacteria, viruses, or the toxins derived from biological material.
(3) *Radiological particulate terrorism agents* are particles that emit ionizing radiation in excess of normal background levels used to inflict lethal or incapacitating casualties, generally on a civilian population, as the result of a terrorist attack.

3.3.68.1* Radiological Weapons of Mass Destruction.

A.3.3.68.1 Radiological Weapons of Mass Destruction. The intent of this annex material is to provide information on the different types of radiological/nuclear devices that can be used as a weapon by those with malicious intent.

3.3.68.1.1* Improvised Nuclear Device (IND). An illicit nuclear weapon that is bought, stolen, or otherwise obtained from a nuclear state (that is, a national government with nuclear weapons), or a weapon fabricated from fissile material that is capable of producing a nuclear explosion.

A.3.3.68.1.1 Improvised Nuclear Device (IND). The nuclear explosion from an IND produces extreme heat, powerful shockwaves, and prompt radiation that would be acutely

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lethal for a significant distance. It also produces potentially lethal radioactive fallout, which could spread and deposit over very large areas. It also produces potentially lethal radioactive fallout, which may spread and deposit over very large areas. A nuclear detonation in an urban area could result in over 100,000 fatalities (and many more injured), massive infrastructure damage, and thousands of square kilometers of contaminated land. If the IND fails to work correctly and does not create a nuclear explosion, then the detonation of the conventional explosives would likely disperse radioactive material like an explosive radiological dispersal device (RDD).

3.3.68.1.2* Radiation Exposure Device (RED). A device intended to cause harm by exposing people to radiation without spreading radioactive material.

A.3.3.68.1.2 Radiation Exposure Device (RED). An RED (used interchangeably with the terms *radiological exposure device* or *radiation emitting device*) is a device consisting of radioactive material, either as a sealed source or as material within some type of container or radiation-generating device, that causes harm by exposure to ionizing radiation.

3.3.68.1.3* Radiological Dispersal Device (RDD). A device designed to spread radioactive material through a detonation of conventional explosives or other means.

A.3.3.68.1.3 Radiological Dispersal Device (RDD). An RDD is any device that intentionally spreads radioactive material across an area with the intent to cause harm, without a nuclear explosion occurring. An RDD that uses explosives for spreading or dispersing radioactive material is commonly referred to as a "dirty bomb" or "explosive RDD." Nonexplosive RDDs could spread radioactive material using common items such as pressurized containers, fans, building air-handling systems, sprayers, crop dusters, or even by hand.

3.4 Operations Level Responder Definitions.

3.4.1 Mission-Specific Competencies. The knowledge, skills, and judgment needed by operations level responders who have completed the operations level competencies and who are designated by the authority having jurisdiction (AHJ) to perform mission-specific tasks, such as decontamination, victim/hostage rescue and recovery, evidence preservation, and sampling.

3.4.2* Operations Level Responders. Persons who respond to hazardous materials/weapons of mass destruction (WMD) incidents for the purpose of implementing or supporting actions to protect nearby persons, the environment, or property from the effects of the release.

A.3.4.2 Operations Level Responders. The source of this definition is OSHA 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response." These responders can have additional competencies that are specific to their response mission, expected tasks, and equipment and training as determined by the authority having jurisdiction (AHJ).

3.4.3 Operations Level Responders Assigned to Perform Air Monitoring and Sampling. Persons, competent at the operations level, who are assigned to implement air monitoring and sampling operations at hazardous materials/weapons of mass destruction (WMD) incidents.

3.4.4 Operations Level Responders Assigned to Perform Evidence Preservation and Sampling. Persons, competent at the operations level, who are assigned to preserve forensic evidence, take samples, and/or seize evidence at hazardous materials/weapons of

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mass destruction (WMD) incidents involving potential violations of criminal statutes or governmental regulations.

3.4.5 Operations Level Responders Assigned to Perform Mass Decontamination. Persons, competent at the operations level, who are assigned to implement mass decontamination operations at hazardous materials/weapons of mass destruction (WMD) incidents.

3.4.6 Operations Level Responders Assigned to Perform Product Control. Persons, competent at the operations level, who are assigned to implement product control measures at hazardous materials/weapons of mass destruction (WMD) incidents.

3.4.7 Operations Level Responders Assigned to Perform Technical Decontamination. Persons, competent at the operations level, who are assigned to implement technical decontamination operations at hazardous materials/weapons of mass destruction (WMD) incidents.

3.4.8 Operations Level Responders Assigned to Perform Victim Rescue/Recovery. Persons, competent at the operations level, who are assigned to rescue and/or recover exposed and contaminated victims at hazardous materials/weapons of mass destruction (WMD) incidents.

3.4.9 Operations Level Responders Assigned to Respond to Illicit Laboratory Incidents. Persons, competent at the operations level, who, at hazardous materials/weapons of mass destruction (WMD) incidents involving potential violations of criminal statutes specific to the illegal manufacture of methamphetamines, other drugs, or weapon of mass destruction (WMD), are assigned to secure the scene, identify the laboratory/process, and preserve evidence.

3.4.10 Operations Level Responders Assigned to Use Personal Protective Equipment (PPE). Persons, competent at the operations level, who are assigned to use personal protective equipment at hazardous materials/weapons of mass destruction (WMD) incidents.

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4 Awareness

4.1 General.

4.1.1 Awareness personnel are those persons who, in the course of their normal duties, could encounter an emergency involving hazardous materials/weapons of mass destruction (WMD) and who are expected to recognize the presence of the hazardous materials/WMD, protect themselves, call for trained personnel, and secure the area.

4.1.2* Awareness personnel shall meet the job performance requirements defined in Sections 4.2 through 4.4.

A.4.1.2 Awareness personnel include public works employees, maintenance workers, and others who might see or encounter an incident involving hazardous materials/WMD occur while performing their regular assignment.

4.1.3 General Knowledge Requirements. Role of awareness personnel at a hazardous materials/WMD incident, location and contents of the AHJ emergency response plan, and standard operating procedures for awareness personnel.

4.1.4 General Skills Requirements. (Reserved)

4.2* Recognition and Identification.

A.4.2 While the purpose of the JPR is to require the *Emergency Response Guidebook* (ERG) as the minimum reference at the awareness level, other reference sources can be provided as necessary, including an equivalent guide to the ERG; safety data sheets (SDS); manufacturer, shipper, and carrier (highway, rail, water, air, and pipeline) documents (shipping papers) and contacts; and the U.S. DOT *Hazardous Materials Marking, Labeling and Placarding Guide*. If provided, responders should be able to use these sources to accomplish the goals of the JPR.

In transportation, the name, placard applied, or identification number of the material provides access to information in the ERG or an equivalent document.

4.2.1 Recognize and identify the hazardous materials/WMD and hazards involved in a hazardous materials/WMD incident, given a hazardous materials/WMD incident, and approved reference sources, so that the presence of hazardous materials/WMD is recognized and the materials and their hazards are identified.

(A)* Requisite Knowledge. What hazardous materials and WMD are; basic hazards associated with classes and divisions; indicators to the presence of hazardous materials including

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container shapes, NFPA 704 markings, globally harmonized system (GHS) markings, placards, labels, pipeline markings, other transportation markings, shipping papers with emergency response information, and other indicators; accessing information from the *Emergency Response Guidebook* (ERG) (current edition) using name of the material, UN/NA identification number, placard applied, or container identification charts; and types of hazard information available from the ERG, safety data sheets (SDS), shipping papers with emergency response information, and other approved reference sources.

A.4.2.1(A) Instructors should include indicators of terrorist attacks and other potentials, emphasizing that "if you can smell it, taste it, or feel it, you are now (or might be) part of the problem."

While this is a minimum requirement, the AHJ has the option to select additional information from the operations chapter (Chapter 5) regarding container and hazard information as necessary, based on local conditions and circumstances.

Awareness level personnel should be able to match the hazard classes and divisions with the primary hazards and examples.

Indicators of the presence of hazardous materials include occupancy and locations, including facilities and transportation; container shape (general shape of the container); container owner/operator signage; placards and labels; markings, including NFPA 704 markings, military markings, transportation markings such as identification number marks, marine pollutant marks, elevated temperature marks, commodity markings, inhalation hazard marks, and pipe and pipeline markings and colors; GHS markings; shipping papers and emergency response information and SDS; and sensory clues (dead birds or fish, color of vapors, unusual odors, sheen, hissing noise, dead vegetation, etc.). Other items, such as fume hood exhaust stacks and vents on the exterior of a building, could indicate hazardous materials and can be identified in advance through pre-incident survey activities.

SDS is a component of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) and replaces the term *material safety data sheet* (MSDS). GHS is an internationally agreed-upon system, created by the United Nations in 1992. It replaces the various classification and labeling standards used in different countries by using consistent criteria on a global level. It supersedes the relevant European Union (EU) system, which has implemented the GHS into EU law as the Classification, Labelling and Packaging (CLP) Regulation and United States Occupational Safety and Health Administration (OSHA) standards. The SDS requires more information than MSDS regulations and provides a standardized structure for presenting the required information.

(B)* Requisite Skills. Recognizing indicators to the presence of hazardous materials/WMD; identifying hazardous materials/WMD by name, UN/NA identification number, placard applied, or container identification charts; and using the ERG, SDS, shipping papers with emergency response information, and other approved reference sources to identify hazardous materials/WMD and their potential fire, explosion, and health hazards.

A.4.2.1(B) These requisite skills can be assessed through cognitive testing.

4.3* Initiate Protective Actions.

A.4.3 People not directly involved in emergency response operations should be kept away from the hazard area, and control should be established over the area of operations. Unprotected emergency responders should not be allowed to enter the isolation zone.

At the awareness level, approved reference sources include the current edition of the *Emergency Response Guidebook* (ERG), safety data sheets (SDS), shipping papers with emergency response information, and other approved reference sources.

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4.3.1 Isolate the hazard area and deny entry at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, policies and procedures, and approved reference sources, so that the hazard area is isolated and secured, personal safety procedures are followed, hazards are avoided or minimized, and additional people are not exposed to further harm.

(A)* Requisite Knowledge. Use of the ERG, SDS, shipping papers with emergency response information, and other approved reference sources to identify precautions to be taken to protect responders and the public; policies and procedures for isolating the hazard area and denying entry; and the purpose of and methods for isolating the hazard area and denying entry.

A.4.3.1(A) Recommended precautions found on numbered guides in the ERG include public safety issues; recommended protective clothing; evacuation; emergency response to fire, spill, and leak; and first aid sections.

Examples of required knowledge include (1) precautions for providing emergency medical care to victims; typical ignition sources; ways hazardous materials/WMD are harmful to people, the environment, and property; general routes of entry for human exposure; emergency action (fire, spill, or leak; first aid); actions recommended not to be performed (e.g., closing of pipeline valves); protective actions (isolation of area and denial of entry, evacuation, shelter-in-place); size and shape of recommended initial isolation and protective action distances; difference between small and large spills; conditions that require the use of the ERG Table of Initial Isolation and Protective Action Distances and the isolation distances in the ERG numbered guide; techniques for isolating the hazard area and denying entry to unauthorized persons; how to recognize and protect evidence; and use of approved tools and equipment; (2) basic personal protective actions: staying clear of vapors, fumes, smoke, and spills; keeping vehicle at a safe distance from the scene; approaching from upwind, uphill, and upstream; and (3) types of protective actions and their purpose (e.g., isolate hazard area and deny entry, evacuation, and shelter-in-place); basic factors involved in the choice of protective actions (e.g., hazardous materials/WMD involved, population threatened, and weather conditions).

(B)* Requisite Skills. Recognizing precautions for protecting responders and the public; identifying isolation areas, denying entry, and avoiding minimizing hazards.

A.4.3.1(B) The requisite skills can be assessed through cognitive testing.

4.4 Notification.

4.4.1 Initiate required notifications at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, policies and procedures, and approved communications equipment, so that the notification process is initiated and the necessary information is communicated.

(A) Requisite Knowledge. Policies and procedures for notification, reporting, and communications; types of approved communications equipment; and the operation of that equipment.

(B) Requisite Skills. Operating approved communications equipment and communicating in accordance with policies and procedures.

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Operations

5

5.1 General.

5.1.1 Operations level responders are those persons who respond to hazardous materials/weapons of mass destruction (WMD) incidents for the purpose of implementing or supporting actions to protect nearby persons, the environment, or property from the effects of the release.

5.1.2 Operations level responders shall meet the job performance requirements defined in Sections 4.2 through 4.4.

5.1.3 Operations level responders shall meet the job performance requirements defined in Sections 5.2 through 5.6.

5.1.4 Operations level responders shall have additional competencies that are specific to the response mission and expected tasks as determined by the AHJ.

5.1.5 General Knowledge Requirements. Role of operations level responders at a hazardous materials/WMD incident; location and contents of AHJ emergency response plan and standard operating procedures for operations level responders, including those response operations for hazardous materials/WMD incidents.

5.1.6 General Skills Requirements. (Reserved)

5.2* Identify Potential Hazards.

A.5.2 At the operations level, approved reference sources should include as a minimum of the *Emergency Response Guidebook* (ERG), safety data sheets (SDS), shipping papers, including emergency response information, and other approved reference sources such as CHEMTREC, CANUTEC, and SETIQ; governmental authorities; and manufacturers, shippers, carriers (highway, rail, water, air, and pipeline), and contacts.

5.2.1 Identify the scope of the problem at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment, policies and procedures, and approved reference sources, so that container types, materials, location of any release, and surrounding conditions are identified, hazard information is collected, the potential behavior of a material and its container is identified, and the potential hazards, harm, and outcomes associated with that behavior are identified.

(A)* Requisite Knowledge. Definitions of hazard classes and divisions; types of containers; container identification markings, including piping and pipeline markings and contacting

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information; types of information to be collected during the hazardous materials/WMD incident survey; availability of shipping papers in transportation and of safety data sheets (SDS) at facilities; types of hazard information available from and how to contact CHEMTREC, CANUTEC, and SETIQ, governmental authorities, and manufacturers, shippers, and carriers; how to communicate with carrier representatives to reduce impact of a release; basic physical and chemical properties, including boiling point, chemical reactivity, corrosivity (pH), flammable (explosive) range [LFL (LEL) and UFL (UEL)], flash point, ignition (autoignition) temperature, particle size, persistence, physical state (solid, liquid, gas), radiation (ionizing and nonionizing), specific gravity, toxic products of combustion, vapor density, vapor pressure, and water solubility; how to identify the behavior of a material and its container based on the material's physical and chemical properties and the hazards associated with the identified behavior; examples of potential criminal and terrorist targets; indicators of possible criminal or terrorist activity for each of the following: chemical agents, biological agents, radiological agents, illicit laboratories (i.e., clandestine laboratories, weapons labs, ricin labs), and explosives; additional hazards associated with terrorist or criminal activities, such as secondary devices; and how to determine the likely harm and outcomes associated with the identified behavior and the surrounding conditions.

A.5.2.1(A) At the operations level, responders should be able to recognize the following containers and identify them by name: rail tank cars (pressure, nonpressure, and cryogenic tank cars); highway cargo tanks (compressed gas tube trailers, corrosive liquid tanks, cryogenic tanks, dry bulk cargo tanks, high-pressure tanks, low-pressure chemical tanks, and nonpressure liquid tanks); UN portable tanks/intermodal tanks (nonpressure, pressure, cryogenic, and tube modules); storage tanks (nonpressure, pressure, and cryogenic storage tanks); piping and pipelines; intermediate bulk containers (IBC) and ton containers; radioactive materials packages (excepted, industrial, Type A, and Type B packages); and nonbulk containers (bags, carboys, cylinders, drums, and Dewar flasks for cryogenic liquids).

To ensure that operations level personnel also understand how to obtain information pertaining to a pipeline-involved incident, line markers or pipeline markers are added to supplement the list of information sources. In a pipeline incident, the pipeline markers would be the source of information used since no shipping papers, placards, UN numbers, or other information would be available.

Hazardous materials incident survey information. This includes location, weather conditions, topography, populated buildings, bodies of water, other buildings, remedial actions taken, container/package, contents, release, container damage, time of day, and other factors that help determine the scope of the problem.

Physical and chemical properties. Predicting the behavior of hazardous materials/WMD relies on understanding certain characteristics of the material. Information identifying the following characteristics should be collected and interpreted: boiling point, chemical reactivity, corrosivity (pH), flammable (explosive) range [LFL (LEL) and UFL(UEL)], flash point, ignition (autoignition) temperature, particle size, persistence, physical state (solid, liquid, gas), radiation (ionizing and nonionizing), specific gravity, toxic products of combustion, vapor density, vapor pressure, and water solubility.

Identifying hazards. The process for predicting/identifying the behavior of a hazardous material/WMD and its container under emergency conditions is based on the simple concepts that containers of hazardous materials/WMD under stress can open up and allow the contents to escape. The release of contents will vary in type and speed. A dispersion pattern will be formed by the escaping contents, potentially exposing people, the environment, or property to physical and/or health hazards.

This overall concept for identifying the likely behavior of a container and its contents under emergency conditions is often referred to as a general behavior model. The general behavior model considers the type of stress on the container involved and the potential type

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of breach, release, dispersion pattern, length of contact, and the health and physical hazards associated with the material and its container, as follows:

(1) *Stress*. The three types of stress that could cause a container to release its contents are thermal stress, mechanical stress, and chemical stress.
(2) *Breach*. The five ways in which containers can breach are disintegration, runaway cracking, closures opening up, punctures, and splits or tears.
(3) *Release*. The four ways in which containment systems can release their contents are detonation, violent rupture, rapid relief, and spill or leak.
(4) *Dispersion*. Seven dispersion patterns can be created upon release of agents: hemisphere, cloud, plume, cone, stream, pool, and irregular.
(5) *Contact*. The three general time frames for predicting the length of time that an exposure can be in contact with hazardous materials/WMD in an endangered area are short term (minutes and hours), medium term (days, weeks, and months), and long term (years and generations).
(6) *Hazards*. The seven health and physical hazards that could cause harm in a hazardous materials/WMD incident are thermal, mechanical, poisonous, corrosive, asphyxiating, radiological, and etiologic.

Identifying outcomes. The process for identifying the potential harm and associated outcomes within an endangered area at a hazardous materials/WMD incident includes identifying the size and shape of the endangered area, the number of exposures (people, property, environment, and major systems) within the endangered area, and the physical, health, and safety hazards within the endangered area as determined from approved resources.

Resources for determining the size of an endangered area of a hazardous materials/WMD incident are the current edition of the ERG and plume dispersion modeling results from facility pre-incident plans.

The factors for determining the extent of physical, health, and safety hazards within an endangered area at a hazardous materials/WMD incident are victim presentation (including nonclinical indicators or clues of a material's presence), surrounding conditions, indication of the behavior of the hazardous material and its container, and the degree of hazard.

(B)* Requisite Skills. Identifying container types, materials, location of release, and surrounding conditions at a hazardous materials/WMD incident; collecting hazard information; communicating with pipeline operators or carrier representatives; describing the likely behavior of the hazardous materials or WMD and its container; and describing the potential hazards, harm, and outcomes associated with that behavior and the surrounding conditions.

A.5.2.1(B) The requisite skills can be assessed through cognitive testing.

5.3* Identify Action Options.

A.5.3 At the operations level, approved information sources should include a minimum of ERG; SDS; CHEMTREC, CANUTEC, or SETIQ; local, state, and governmental authorities; and manufacturers', shippers', and carriers' documents (shipping papers) and contacts.

5.3.1 Identify the action options for a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment, policies and procedures, approved reference sources, and the scope of the problem, so that response objectives, action options, safety precautions, suitability of approved personal protective equipment (PPE) available, and emergency decontamination needs are identified.

(A)* Requisite Knowledge. Policies and procedures for hazardous materials/WMD incident operations; basic components of an incident action plan (IAP); modes of operation (offensive,

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defensive, and nonintervention); types of response objectives; types of action options; types of response information available from the *Emergency Response Guidebook* (ERG), safety data sheets (SDS), shipping papers with emergency response information, and other resources; types of information available from and how to contact CHEMTREC, CANUTEC, and SETIQ, governmental authorities, and manufacturers, shippers, and carriers (highway, rail, water, air, pipeline); safety procedures; risk analysis concepts; purpose, advantages, limitations, and uses of approved PPE to determine if PPE is suitable for the incident conditions; difference between exposure and contamination; contamination types, including sources and hazards of carcinogens at incident scenes; routes of exposure; types of decontamination (emergency, mass, and technical); purpose, advantages, and limitations of emergency decontamination; and procedures, tools, and equipment for performing emergency decontamination.

A.5.3.1(A) Modes of operation are offensive, defensive, and nonintervention and include the following:

(1) Common response objectives, for example, product control; fire control; protection of people, the environment, and property; identification and isolation; evidence protection; rescue; recovery; and termination
(2) Common response options, for example, spill control, leak control, foam, control exposures, evacuation, isolation, shelter-in-place, and establishment of product control zones
(3) Contamination types: primary, secondary, and tertiary

(B)* Requisite Skills. Identifying response objectives and action options based on the scope of the problem and available resources; identifying whether approved PPE is suitable for the incident conditions; and identifying emergency decontamination needs based on the scope of the problem.

A.5.3.1(B) The requisite skills can be assessed through cognitive testing.

5.4* Action Plan Implementation.

A.5.4 Operations level responders should be able to identify their role during hazardous materials/WMD incidents as specified in the emergency response plan and/or standard operating procedures; the levels of hazardous materials/WMD incidents as defined in the emergency response plan; the purpose, need, benefits, and elements of the incident command system for hazardous materials/WMD incidents; the duties and responsibilities of the incident safety officer and hazardous materials branch or group; considerations for determining the location of the incident command post; procedures for requesting additional resources; and the role and response objectives of other responding agencies.

Executive Summary – Field Decon

Over the past decade, research has been published linking higher rates of cancer in fire service personnel to repeated, chronic exposure to the by-products of smoke and particulates from structure fires. Various studies have proven that fire fighters are experiencing higher rates of certain types of cancers and that they are more likely to have rare forms of cancers than the general population. See NIOSH Study of Cancer among U.S. Fire Fighters at www.cdc.gov/niosh/firefighters/ffcancerstudy.html.

The fire service has begun to adapt to these findings by changing organizational practices in order to minimize exposures to known and suspected carcinogenic by-products in structure fires. Evolving adaptations include decontamination processes relating to fireground activities. Changes include, but are not limited to, forced air and water decontamination of structural fire-fighting personal protective equipment (PPE), modifying station practices, such as mandating that structural PPE be laundered after exposure to fire contaminants, and personal

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hygiene changes, such as mandating personnel to shower as soon as possible after interior fire-fighting activities at structure fires. In some instances, fire departments are assigning hazardous materials response assets to structure fire incidents to assist with scene (field) decontamination tasks.

During the recent meeting of the National Fire Protection Association (NFPA) Technical Committee (TC) – Hazardous Materials Response Personnel (HCZ-AAA), lengthy discussions regarding the role of emergency responders during field decontamination practices took place. These discussions led the Technical Committee to a decision that expanded technical language was needed in relation to job performance requirements (JPRs). Secondly, the TC decided that decontamination management does fit within one or more of the technical documents under the purview of the Committee. Of specific focus was NFPA 1072, *Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications*. A small task group was formed to further research this subject and develop suggested language for possible inclusion into the upcoming version of NFPA 1072, which is currently in the second draft phase.

On January 19, 2016, the task group met via teleconference and determined that information about the previously referenced decontamination practices does indeed fall within the scope of the JPRs that have been developed as part of NFPA 1072. The task group reached a consensus that additional language should be crafted and inserted into the working copy of the second draft in support of the fire service's efforts to reduce or prevent cancer among fire fighters. The task group believes that the expanded information should be added to the existing language that deals with the use of PPE. The three specific areas include gross decontamination, action plan implementation, and decontamination.

As more information becomes available and this movement gains momentum and as best practices are developed, it is projected that field decontamination of personnel will remain a high priority and the means for minimizing fire fighter exposures to carcinogens. As such, it is incumbent upon the fire service that such practices become standardized and documented to ensure that the goals of supporting fire fighter health and safety are met by the broadest base of fire service organizations. If the referenced recommendations are accepted by the TC, it will place the NFPA in a position to play an integral role in addressing fire fighter decontamination and cancer concerns.

5.4.1 Perform assigned tasks at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment with limited potential of contact with hazardous materials/WMD, policies and procedures, the scope of the problem, approved tools, equipment, and PPE, so that protective actions and scene control are established and maintained, on-scene incident command is described, evidence is preserved, approved PPE is selected and used in the proper manner; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; assignments are completed; and gross decontamination of personnel, tools, equipment, and PPE is conducted in the field.

(A)* Requisite Knowledge. Scene control procedures; procedures for protective actions, including evacuation and sheltering-in-place; procedures for ensuring coordinated communications between responders and to the public; evidence recognition and preservation procedures; incident command organization; purpose, importance, benefits, and organization of incident command at hazardous materials/WMD incidents; policies and procedures for implementing incident command at hazardous materials/WMD incidents; capabilities, limitations, inspection, donning, working in, going through decontamination while wearing, doffing approved PPE; signs and symptoms of thermal stress; safety precautions when working at hazardous materials/WMD incidents; purpose, advantages, and limitations of gross decontamination; the need for gross decontamination in the field based on the task(s) performed and contamination received, including sources and hazards of carcinogens at incident scenes; gross decontamination procedures for personnel, tools, equipment, and PPE; and cleaning, disinfecting, and inspecting tools, equipment, and PPE.

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A.5.4.1(A) *Evidence preservation.* Preservation of evidence is essential to the integrity and credibility of an incident investigation. Preservation techniques must be acceptable to the law enforcement agency having jurisdiction; therefore, it is important to get that agency's input ahead of time on the techniques specified in the AHJ emergency response plan or the organization's standard operating procedures.

General procedures for preserving evidence include the following:

(1) Secure and isolate any incident area where evidence is located. This can include discarded personal protection equipment, specialized packaging (shipping or workplace labels and placards), biohazard containers, glass or metal fragments, containers (e.g., plastic, pipes, cylinders, bottles, fuel containers), and other materials that appear relevant to the occurrence, such as roadway flares, electrical components, fluids, and chemicals.
(2) Leave fatalities and body parts in place and secure the area in which they are located.
(3) Isolate any apparent source location of the event (e.g., blast area, spill release point).
(4) Leave in place any explosive components or housing materials.
(5) Place light-colored tarpaulins on the ground of access and exit corridors, decontamination zones, treatment areas, and rehabilitation sectors to allow possible evidence that might drop during decontamination and doffing of clothes to be spotted and collected.
(6) Secure and isolate all food vending locations in the immediate area.Contaminated food products will qualify as primary or secondary evidence in the event of a chemical or biological incident.

The collection (as opposed to preservation) of evidence is usually conducted by law enforcement personnel, unless other protocols are in place. If law enforcement personnel are not equipped or trained to enter the hot zone, hazardous materials technicians should be trained to collect samples in such a manner as to maintain the integrity of the samples for evidentiary purposes and to document the chain of evidence.

Safety precautions. Safety precautions should include buddy systems, backup systems, accountability systems, safety briefing, and evacuation/escape procedures. The following items should be considered in a safety briefing prior to allowing personnel to work at hazardous materials/WMD incidents:

(1) Preliminary evaluation
(2) Hazard identification
(3) Description of the site
(4) Task(s) to be performed
(5) Length of time for task(s)
(6) Required PPE
(7) Monitoring requirements
(8) Notification of identified risk

(B)* Requisite Skills. Establishing and maintaining scene control; recognizing and preserving evidence; inspecting, donning, working in, going through decontamination while wearing, and doffing approved PPE; isolating contaminated tools, equipment, and PPE; conducting gross decontamination of contaminated personnel, tools, equipment, and PPE in the field; and cleaning, disinfecting, and inspecting approved tools, equipment, and PPE.

A.5.4.1(B) The operations level responder should implement the incident command system as required by the AHJ by completing the following requirements:

(1) Identify the role of the operations level responder during hazardous materials/WMD incidents as specified in the emergency response plan and/or standard operating procedures
(2) Identify the levels of hazardous materials/WMD incidents as defined in the emergency response plan
(3) Identify the purpose, need, benefits, and elements of the incident command system for hazardous materials/WMD incidents

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(4) Identify the duties and responsibilities of the following functions within the incident management system:
  (a) Incident safety officer
  (b) Hazardous materials branch or group
(5) Identify the considerations for determining the location of the incident command post for a hazardous materials/WMD incident
(6) Identify the procedures for requesting additional resources at a hazardous materials/WMD incident
(7) Describe the role and response objectives of other agencies that respond to hazardous materials/WMD incidents

5.5 Emergency Decontamination.

5.5.1 Perform emergency decontamination at a hazardous materials/WMD incident, given a hazardous materials/WMD incident that requires emergency decontamination; an assignment; scope of the problem; policies and procedures; and approved tools, equipment, and PPE for emergency decontamination, so that emergency decontamination needs are identified, approved PPE is selected and used, exposures and personnel are protected, safety procedures are followed, hazards are avoided or minimized, emergency decontamination is set up and implemented, and victims and responders are decontaminated.

(A) Requisite Knowledge. Contamination, cross contamination, and exposure; contamination types; routes of exposure; types of decontamination (emergency, mass, and technical); purpose, advantages, and limitations of emergency decontamination; policies and procedures for performing emergency decontamination; approved tools and equipment for emergency decontamination; and hazard avoidance for emergency decontamination.

(B) Requisite Skills. Selecting an emergency decontamination method; setting up emergency decontamination in a safe area; using PPE in the proper manner; implementing emergency decontamination; preventing spread of contamination; and avoiding hazards during emergency decontamination.

5.6* Progress Evaluation and Reporting.

A.5.6 All responders should understand why their efforts must be evaluated. If they are not making progress, the plan must be re-evaluated to determine why. The evaluation should include what changes have occurred with the circumstances of the incident (behavior of container or its contents).

To decide whether the actions being taken at an incident are effective and the objectives are being achieved, the responder must determine whether the incident is stabilizing or increasing in intensity. Factors to be considered include reduction of potential impact to persons or the environment and status of resources available to manage the incident. The evaluation should take place upon initiation of the IAP, and the IC/unified command and general staff should constantly monitor the status of the incident. The actions taken should be leading to a desirable outcome, with minimal loss of life and property. Changes in the status of the incident should influence the development of the IAP for the next operational period.

5.6.1 Evaluate and report the progress of the assigned tasks for a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment, policies and procedures, status of assigned tasks, and approved communication tools and equipment, so that the effectiveness of the assigned tasks is evaluated and communicated to the supervisor, who can adjust the IAP as needed.

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(A)* Requisite Knowledge. Components of progress reports; policies and procedures for evaluating and reporting progress; use of approved communication tools and equipment; signs indicating improving, static, or deteriorating conditions based on the objectives of the action plan; and circumstances under which it would be prudent to withdraw from a hazardous materials/WMD incident.

A.5.6.1(A) Remaining in the immediate vicinity of an incident when nothing can be done to mitigate it and the situation is about to deteriorate is pointless. If flames are impinging on an LP-Gas vessel, for example, and providing the necessary volume of water to cool it is impossible, it would be prudent to withdraw to a safe distance. ICs should always evaluate the benefit of operations against the risk. Refer to the ERG or other references to determine appropriate action to be taken under the circumstances.

(B)* Requisite Skills. Determining incident status; determining whether the response objectives are being accomplished; using approved communications tools and equipment; and communicating the status of assigned tasks.

A.5.6.1(B) The proper methods for communicating the status of the planned response lie within the guidelines of the ICS and are dictated by the incident-specific IAP. The ICS identifies two types of communication at an incident, formal and informal. Formal communication should be used for all policy-related communication, using the ICS principles of unity of command and chain of command, while maintaining span of control. Ideally, all critical information should be communicated face-to-face.

The format for communications within the ICS must be established by the IC/unified command with input from the general staff.

A procedure should be established to allow responders to notify the IC immediately when conditions become critical and personnel are threatened. For example, the notification could take the form of a pre-established emergency radio message or tone that signifies danger, or it might be repeated blasts on an air horn. The message should not be delayed while responders try to locate a specific person in the chain of command.

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6 Operations Mission-Specific

6.1 General.

6.1.1 Operations level responders assigned mission-specific responsibilities at hazardous materials/WMD incidents are those operations level responders designated by the AHJ to perform additional tasks to support the AHJ's response mission, expected tasks, equipment, and training in the following areas:

(1) Personal protection equipment (PPE) *(see Section 6.2)*
(2) Mass decontamination *(see Section 6.3)*
(3) Technical decontamination *(see Section 6.4)*
(4) Evidence preservation and sampling *(see Section 6.5)*
(5) Product control *(see Section 6.6)*
(6) Detection, monitoring, and public safety sampling *(see Section 6.7)*
(7) Victim rescue and recovery *(see Section 6.8)*
(8) Illicit laboratory incidents *(see Section 6.9)*

6.1.2 Operations level responders assigned mission-specific responsibilities at hazardous materials/weapons of mass destruction (WMD) incidents shall meet the job performance requirements defined in Sections 4.2 through 4.4.

6.1.3 Operations level responders assigned mission-specific responsibilities at hazardous materials/WMD incidents shall meet the job performance requirements defined in Sections 5.2 through 5.6.

6.1.4 Operations level responders assigned mission-specific responsibilities at hazardous materials/WMD incidents shall have additional competencies that are specific to their response mission, expected tasks, equipment, and training as determined by the AHJ.

6.1.5* Qualification for operations level responders assigned mission-specific responsibilities at hazardous materials/WMD incidents is specific to a mission area. For qualification, operations mission-specific responders shall perform all the job performance requirements listed in at least one level of a specialty area (Sections 6.2 through 6.9). Operations mission-specific responders will be identified by their specialty.

A.6.1.5 Operations level responders need only be trained to meet the competencies in Chapter 5. All the competencies listed in Chapter 6 (mission-specific competencies) are not required for qualification as operations level responders and should be viewed as optional at the discretion of the AHJ, based on an assessment of local risks. The purpose of Chapter 6 is to provide a more effective and efficient process so that the AHJ can match the expected tasks and duties of its personnel with the required competencies to perform those tasks.

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6.1.6* Operations level responders assigned mission-specific responsibilities at hazardous materials/WMD incidents shall operate under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures.

A.6.1.6 Although some of the mission-specific JPRs in this chapter are taken from Chapter 7 of NFPA 472, the technical committee wants to clearly state that operations mission-specific responders are not replacements for or qualified as hazardous materials technicians. Operations mission-specific responders can perform some technician skills, but they do not have the broader skills and competencies required of a hazardous materials technician, particularly regarding risk assessment and the selection of control options. The following two options are examples of how guidance can be provided to ensure that operations mission-specific responders do not go beyond their level of training and equipment:

Direct guidance. Operations mission-specific responders are working under the control of a hazardous materials technician or an allied professional who has the ability to (1) continuously assess and/or observe their actions and (2) provide immediate feedback. Guidance by a hazardous materials technician or an allied professional can be provided through direct visual observation or through assessment reports communicated by the operations mission-specific responders to them.

Written guidance. Written standard operating procedures or similar guidance should clearly state the rules of engagement for operations mission-specific responders' competency. Emphasis should be placed on the following:

(1) Tasks expected of operations level responders
(2) Tasks beyond the capability of operations level responders
(3) Required PPE and equipment to perform the expected tasks
(4) Procedures for ensuring coordination within the AHJ ICS

6.1.7 General Knowledge Requirements. (Reserved)

6.1.8 General Skills Requirements. (Reserved)

6.2* Personal Protective Equipment.

A.6.2 At this level, PPE refers to personal protective equipment that would be used in situations where contact with hazardous materials/WMD is possible or expected. Such equipment can include chemical-protective clothing, bomb suits, respirators, or other equipment that typically would not be worn by operations level responders. Specialized PPE also refers to operations level responders' PPE that requires changes to donning, doffing, and usage procedures — for example, taping gaps in fire-fighter protective clothing, doffing in a decontamination corridor, or working in the hot zone as a member of a buddy system. Personnel should be able to describe the types of PPE available and the options for thermal hazards, radiological hazards, asphyxiation hazards, chemical hazards, etiological/biological hazards, and mechanical hazards. (*See also A.6.1.6.*)

6.2.1 Select, don, work in, and doff approved PPE at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; a mission-specific assignment in an IAP that requires use of PPE; the scope of the problem; response objectives and options for the incident; access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures; approved PPE; and policies and procedures, so that under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, approved PPE is selected, inspected, donned, worked in, decontaminated, and doffed; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; and all reports and documentation pertaining to PPE use are completed.

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(A)* Requisite Knowledge. Policies and procedures for PPE selection and use; importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures when selecting and using PPE; the capabilities and limitations of and specialized donning, doffing, and usage procedures for approved PPE; components of an incident action plan (IAP); procedures for decontamination, inspection, maintenance, and storage of approved PPE; process for being decontaminated while wearing PPE; and procedures for reporting and documenting the use of PPE.

A.6.2.1(A) Limitations of PPE include permeation, penetration, and degradation of protective clothing and limitations of respiratory protective equipment, such as air-purifying respirators.

Requisite knowledge includes the ability to describe the types of PPE that are available for response based on NFPA standards and the PPE options for thermal hazards, radiological hazards, asphyxiating hazards, chemical hazards, etiological/biological hazards, and mechanical hazards.

(B) Requisite Skills. Selecting PPE for the assignment; inspecting, maintaining, storing, donning, working in, and doffing PPE; going through decontamination (emergency and technical) while wearing the PPE; and reporting and documenting the use of PPE.

6.3* Mass Decontamination.

A.6.3 See A.6.1.5.

6.3.1 Perform mass decontamination for ambulatory and nonambulatory victims at a hazardous materials/WMD incident, given a hazardous materials/WMD incident that requires mass decontamination; an assignment in an IAP; scope of the problem; policies and procedures; approved tools, equipment, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, so that under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, a mass decontamination process is selected, set up, implemented, evaluated, and terminated; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; personnel, tools, and equipment are decontaminated; and all reports and documentation of mass decontamination operations are completed.

(A)* Requisite Knowledge. Types of PPE and the hazards for which they are used; advantages and limitations of operations and methods of mass decontamination; policies and procedures for performing mass decontamination; approved tools, equipment, and PPE for performing mass decontamination; crowd management techniques; and AHJ's mass decontamination team positions, roles and responsibilities; and requirements for reporting and documenting mass decontamination operations.

A.6.3.1(A) Policies and procedures for performing mass decontamination include containment of runoff according to the following EPA guidance: "During a hazardous materials incident (including a chemical/biological agent terrorist event), first responders should undertake any necessary emergency actions to save lives and protect the public and themselves. Once any imminent threats to human health and life are addressed, first responders should immediately take all reasonable efforts to contain the contamination and avoid or mitigate environmental consequences. EPA will not pursue enforcement actions against state and local responders for the environmental consequences of necessary and appropriate emergency response actions. First responders would not be protected under CERCLA from intentional contamination such as washing hazardous materials down the storm-sewer during a response action as an alternative to costly and problematic disposal or in order to avoid extra effort."

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(B)* Requisite Skills. Selecting and using PPE; selecting a mass decontamination method to minimize the hazard; setting up and implementing mass decontamination operations in a safe location; evaluating the effectiveness of the mass decontamination method; and completing required reports and supporting documentation for mass decontamination operations.

A.6.3.1(B) Methods that can be useful in assessing the effectiveness of decontamination (determining if entry personnel, tools and equipment, and victims have been decontaminated) include the following:

(1) Visual observation (stains, discolorations, corrosive effects, etc.)
(2) Monitoring devices [such as photoionization detectors (PIDs), detector tubes, radiation monitors, and pH paper strips/meters] that show whether contamination levels are at least below the device's detection limit]
(3) Wipe sampling, which provides after-the-fact information on the effectiveness of decontamination (Once a wipe swab is taken, it is analyzed by chemical means, usually in a laboratory. Protective clothing, equipment, and skin can be tested using wipe samples.)

6.4* Technical Decontamination.

A.6.4 See A.6.1.6.

6.4.1 Perform technical decontamination in support of entry operations and for ambulatory and nonambulatory victims at a hazardous materials/WMD incident, given a hazardous materials/WMD incident that requires technical decontamination; an assignment in an IAP; scope of the problem; policies and procedures for technical decontamination; approved tools, equipment, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, so that under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, a technical decontamination method is selected, set up, implemented, evaluated, and terminated; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; personnel, tools, and equipment are decontaminated; and all reports and documentation of technical decontamination operations are completed.

(A)* Requisite Knowledge. Types of PPE and the hazards for which they are used; importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures; advantages and limitations of operations and methods of technical decontamination; technical decontamination methods and their advantages and limitations; policies and procedures for performing technical decontamination; approved tools, equipment, and PPE for performing technical decontamination; AHJ's technical decontamination team positions, roles, and responsibilities; and requirements for reporting and documenting technical decontamination operations.

A.6.4.1(A) See A.6.3.1(A).

(B)* Requisite Skills. Selecting and using PPE; selecting a technical decontamination procedure to minimize the hazard; setting up and implementing technical decontamination operations; evaluating the effectiveness of the technical decontamination process; and completing reporting and documentation requirements.

A.6.4.1(B) See A.6.3.1(B).

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6.5* Evidence Preservation and Public Safety Sampling.

A.6.5 See A.6.1.6.

6.5.1 Perform evidence preservation and public safety sampling at a hazardous materials/WMD incident, given a hazardous materials/WMD incident involving potential violations of criminal statutes or governmental regulations, including suspicious letters and packages, illicit laboratories, a release/attack with a WMD agent, and environmental crimes; an assignment in an IAP; scope of the problem; policies and procedures; approved tools, equipment, and PPE; and access to a hazardous materials technician, an allied professional, including law enforcement personnel or others with similar authority, an emergency response plan, or standard operating procedures, so that under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, hazardous materials/WMD incidents with a potential violation of criminal statutes or governmental regulations are identified; notify agency/agencies having investigative jurisdiction and hazardous explosive device responsibility for the type of incident are notified; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; evidence is identified and preserved; public safety samples are collected, and packaged, and the outside packaging is decontaminated; emergency responders, tools, and equipment are decontaminated; and evidence preservation and public safety sampling operations are reported and documented.

(A) Requisite Knowledge. Types of PPE and the hazards for which they are used; importance of working under the guidance of a hazardous materials technician, an allied professional including law enforcement personnel or others with similar authority, an emergency response plan, or standard operating procedures; unique aspects of a suspicious letter, a suspicious package or device, an illicit laboratory, or a release/attack with a WMD agent; potential violations of criminal statutes or governmental regulations; agencies having response authority to collect evidence and public safety samples; agencies having investigative law enforcement authority to collect evidence or public safety samples; notification procedures for agencies having investigative law enforcement authority and hazardous explosive device responsibility; chain-of-custody procedures; securing, characterization, and preservation of the scene and potential forensic evidence; approved documentation procedures; types of evidence; use and limitations of equipment to conduct field screening of samples to screen for corrosivity, flammability, oxidizers, radioactivity, volatile organic compounds (VOC), and fluorides for admission into the Laboratory Response Network or other forensic laboratory system; use of collection kits; collection and packaging of public safety samples; decontamination of outside packaging; prevention of secondary contamination; protection and transportation requirements for sample packaging; and requirements for reporting and documenting evidence preservation and public safety sampling operations.

(B) Requisite Skills. Identifying incidents with a potential violation of criminal statutes or governmental regulations; identifying the agency having investigative jurisdiction over an incident that is potentially criminal in nature or a violation of government regulations; operating field screening and sampling equipment to screen for corrosivity, flammability, oxidizers, radioactivity, volatile organic compounds (VOC), and fluorides; securing, characterizing, and preserving the scene; identifying and protecting potential evidence until it can be collected by an agency with investigative authority; following chain-of-custody procedures; characterizing hazards; performing protocols for field screening samples for admission into the Laboratory Response Network or other forensic laboratory system; protecting evidence from secondary contamination; determining agency having response authority to collect public safety samples; collecting public safety samples; packaging and labeling samples; decontaminating samples; determining agency having investigative law enforcement authority to collect evidence and public safety samples; decontaminating outside sample packaging; preparing samples for protection and transportation to a laboratory;

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and completing required reports and supporting documentation for evidence preservation and public safety sampling operations.

6.6* Product Control.

A.6.6 See A.6.1.6.

For the purposes of this section, the intent is to focus on confining or containing the release with limited risk of personal exposure. The applicable techniques include absorption, adsorption, damming, diking, dilution, diversion, remote valve shutoff, retention, vapor dispersion, and vapor suppression. Product control also includes techniques for controlling flammable liquid incidents and flammable gas incidents.

Tools and equipment include such items as Class B foam application equipment, diking equipment, damming equipment, approved absorbent materials and products, shovels and other hand tools, piping, heavy equipment (such as backhoes), floats, and spill booms.

Control agents can include Class B foam, dispersal agents, and so on.

6.6.1 Perform product control techniques with a limited risk of personal exposure at a hazardous materials/WMD incident, given a hazardous materials/WMD incident with release of product; an assignment in an IAP; scope of the problem; policies and procedures; approved tools, equipment, control agents, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, so that under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; a product control technique is selected and implemented; the product is controlled; victims, personnel, tools, and equipment are decontaminated; and product control operations are reported and documented.

(A)* Requisite Knowledge. Types of PPE and the hazards for which they are used; importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures; definitions of control, confinement, containment, and extinguishment; policies and procedures; product control methods for controlling a release with limited risk of personal exposure; safety precautions associated with each product control method; location and operation of remote/emergency shutoff devices in cargo tanks and intermodal tanks in transportation and containers at facilities, that contain flammable liquids and flammable gases; characteristics and applicability of approved product control agents; use of approved tools and equipment; and requirements for reporting and documenting product control operations.

A.6.6.1(A) Product control techniques that focus on confining/containing the release with limited risk of personal exposure include absorption, adsorption, damming, diking, dilution, diversion, remote valve shutoff, retention, vapor dispersion, and vapor suppression. Product control also includes techniques for controlling flammable liquid incidents and flammable gas incidents.

Remote/emergency shutoff devices include those for MC-306/DOT-406, MC-407/DOT-407, MC-331 cargo tanks, and intermodal tanks.

(B)* Requisite Skills. Selecting and using PPE; selecting and performing product control techniques to confine/contain the release with limited risk of personal exposure; using approved control agents and equipment on a release involving hazardous materials/WMD; using remote control valves and emergency shutoff devices on cargo tanks and intermodal tanks in transportation and containers at fixed facilities; and performing product control techniques.

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A.6.6.1(B) Product control techniques that focus on confining/containing the release with limited risk of personal exposure include absorption, adsorption, damming, diking, dilution, diversion, remote valve shutoff, retention, vapor dispersion, and vapor suppression. Techniques for controlling flammable liquid incidents and flammable gas incidents (e.g., hose handling, nozzle patterns, and attack operations) can be found in NFPA 1001.

6.7* Detection, Monitoring, and Sampling.

A.6.7 See A.6.1.6.

6.7.1 Perform detection, monitoring, and sampling at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment in an IAP; scope of the problem; policies and procedures; approved resources; detection, monitoring, and sampling equipment; PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, so that under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, detection, monitoring, and sampling methods are selected; approved equipment is selected for detection, monitoring, or sampling of solid, liquid, or gaseous hazardous materials/WMD; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; detection, monitoring, and sampling operations are implemented as needed; results of detection, monitoring, and sampling are read, interpreted, recorded, and communicated; personnel and their equipment are decontaminated; detection, monitoring, and sampling equipment is maintained; and detection, monitoring, and sampling operations are reported and documented.

(A)* Requisite Knowledge. Types of PPE and the hazards for which they are used; capabilities and limitations of approved PPE; importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures; approved detection, monitoring, and sampling equipment; policies and procedures for detection, monitoring, and sampling; process for selection of detection, monitoring, and sampling equipment for an assigned task; operation of approved detection, monitoring, and sampling equipment; capabilities, limitations, and local monitoring procedures, including action levels and field testing; how to read and interpret results; methods for decontaminating detection, monitoring, and sampling equipment according to manufacturers' recommendations or AHJ policies and procedures; maintenance procedures for detection, monitoring, and sampling equipment according to manufacturers' recommendations or AHJ policies and procedures; and requirements for reporting and documenting detection, monitoring, and sampling operations.

A.6.7.1(A) Field tests include bump tests, calibration, and other tests performed at the incident scene to prepare the equipment for use.

(B) Requisite Skills. Selecting and using PPE; field testing and operating approved detection, monitoring, and sampling equipment; reading, interpreting, and documenting the readings from detection, monitoring, and sampling equipment; communicating results of detection, monitoring, and sampling; decontaminating detection, monitoring, and sampling equipment; maintaining detection, monitoring, and sampling equipment according to manufacturers' specifications or AHJ policies and procedures; and completing required reports and supporting documentation for detection, monitoring, and sampling operations.

6.8* Victim Rescue and Recovery.

A.6.8 See A.6.1.6.

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6.8.1 Perform rescue and recovery operations at a hazardous materials/WMD incident, given a hazardous materials/WMD incident involving exposed and/or contaminated victims; an assignment in an IAP; scope of the problem; policies and procedures; approved tools, equipment, including special rescue equipment, and PPE; and access to a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, so that under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures, the feasibility of conducting a rescue or a recovery operation is determined; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; rescue or recovery options are selected within the capabilities of available personnel, approved tools, equipment, special rescue equipment, and PPE; victims are rescued or recovered; victims are prioritized and patients are triaged and transferred to the decontamination group, casualty collection point, area of safe refuge, or medical care in accordance with the IAP; personnel, victims, and equipment used are decontaminated; and victim rescue and recovery operations are reported and documented.

(A)* Requisite Knowledge. Types of PPE and the hazards for which they are used; capabilities and limitations of approved PPE; importance of working under the guidance of a hazardous materials technician, an allied professional, an emergency response plan, or standard operating procedures; the difference between victim rescue and victim recovery; victim prioritization and patient triage methods; considerations for determining the feasibility of rescue or recovery operations; policies and procedures for implementing rescue and recovery; safety issues; capabilities and limitations of approved PPE; procedures, specialized rescue equipment required, and incident response considerations for rescue and recovery in the following situations: (1) line-of-sight with ambulatory victims, (2) line-of-sight with nonambulatory victims, (3) non-line-of-sight with ambulatory victims, (4) non-line-of-sight with nonambulatory victims, and (5) victim rescue operations versus victim recovery operations; AHJ's rescue team positions, roles, and responsibilities; and procedures for reporting and documenting victim rescue and recovery operations.

A.6.8.1(A) Victim prioritization utilizes risk-based factors to establish an action plan for victim removal and eventual treatment. Patient triage is a clinical prioritization employed to maximize survival and to prioritize application of therapeutic modalities.

(B) Requisite Skills. Identifying both rescue and recovery situations; victim prioritizing and patient triaging; selecting proper rescue or recovery options; using available specialized rescue equipment; selecting and using PPE for the victim and the rescuer; searching for, rescuing, and recovering victims; and completing required reports and supporting documentation for victim rescue and recovery operations.

6.9* Response to Illicit Laboratories.

A.6.9 See A.6.1.6.

6.9.1 Perform response operations at an illicit laboratory at a hazardous materials/WMD incident, given a hazardous materials/WMD incident involving an illicit laboratory; an assignment in an IAP; scope of the problem; policies and procedures; approved tools, equipment, and PPE; and access to a hazardous materials technician, an allied professional including law enforcement agencies or others having similar investigative authority, an emergency response plan, or standard operating procedures, so that under the guidance of a hazardous materials technician, an allied professional including law enforcement agencies or others having similar investigative authority, an emergency response plan, or standard operating procedures, the scene is secured; the type of laboratory is identified; potential hazards are identified; approved

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PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; control procedures are implemented; evidence is identified and preserved; personnel, victims, tools, and equipment are decontaminated; and illicit laboratory operations are reported and documented.

(A)* Requisite Knowledge. Types of PPE and the hazards for which they are used; importance of working under the guidance of a hazardous materials technician, an allied professional including law enforcement personnel or others with similar authority, an emergency response plan, or standard operating procedures; types of illicit laboratories and how to identify them; operational considerations at illicit laboratories; hazards and products at illicit laboratories; booby traps often found at illicit laboratories; law enforcement agencies or others having similar investigative authority and responsibilities at illicit laboratories; crime scene coordination with law enforcement agencies or others having similar investigative authority; securing and preserving evidence; procedures for conducting a joint hazardous materials/hazardous devices assessment operation; procedures for determining atmospheric hazards through detection, monitoring, and sampling; procedures to mitigate immediate hazards; safety procedures and tactics; factors to be considered in the selection of decontamination, development of a remediation plan, and in decontaminating tactical law enforcement personnel, weapons, and law enforcement canines; procedures for decontaminating potential suspects; procedures for going through technical decontamination while wearing PPE; and procedures for reporting and documenting illicit laboratory response operations.

A.6.9.1(A) Types of illicit laboratories include chemical, biological, explosive, and drug manufacturing. Booby traps found at illicit laboratories include anti-personnel devices. Clearance of such devices is carried out by explosive ordnance disposal (EOD) personnel trained for these procedures.

Law enforcement agencies having investigative jurisdiction might differ based on whether the situation involves illicit drug manufacturing, illicit WMD manufacturing, or environmental crimes resulting from illicit laboratory operations. Agency jurisdiction, investigative guidelines, and investigative priorities are complex and dynamic. Specific jurisdictional situations should be identified with governmental investigative agencies.

Considerations for decontaminating and contaminate neutralization tactical law enforcement personnel include being aware of specialized equipment used by law enforcement, including weapons; ammunition; concussion devices; persons in custody; procedures for securing evidence, weapons, and ammunition; and coordination to ensure a safe operating zone.

(B) Requisite Skills. Implementing scene control procedures; selecting and using PPE; selecting detection, monitoring, and sampling equipment; implementing technical decontamination for personnel; securing an illicit laboratory; identifying and isolating hazards; identifying safety hazards; conducting a joint hazardous materials/hazardous devices assessment operation; decontaminating potential suspects, tactical law enforcement personnel, weapons and law enforcement canines; and completing required reports and supporting documentation for illicit laboratory response operations.

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7 Hazardous Materials Technician

7.1 General.

7.1.1 Hazardous materials technicians are those persons who respond to hazardous materials/weapons of mass destruction (WMD) incidents using a risk-based response process by which they analyze a problem involving hazardous materials/WMD, plan a response to the problem, implement the planned response, evaluate progress of the planned response, and assist in terminating the incident.

7.1.2 Hazardous materials technicians shall meet the job performance requirements defined in Sections 4.2 through 4.4.

7.1.3 Hazardous materials technicians shall meet the job performance requirements defined in Sections 5.2 through 5.6.

7.1.4 Hazardous materials technicians shall meet the job performance requirements defined in Sections 7.2 through 7.6.

7.1.5 Hazardous materials technicians shall have additional competencies that are specific to the response mission and expected tasks as determined by the AHJ.

7.1.6 General Knowledge Requirements. (Reserved)

7.1.7 General Skills Requirements. Written and verbal communication skills.

7.2 Analyze the Incident.

7.2.1* Detection, Monitoring, and Sampling. Classify hazardous materials/WMD and verify the presence and concentrations of hazardous materials through detection, monitoring, and sampling at a hazardous materials/WMD incident, given a hazardous materials/WMD incident with released identified and unidentified hazardous materials; an assignment in an incident action plan (IAP); policies and procedures; approved resources; detection and monitoring equipment; and personal protective equipment (PPE), so that PPE is selected and used; hazardous materials/WMD are classified by their basic hazard categories; the presence of hazardous materials is verified; the concentrations of hazardous materials in the atmosphere are determined; signs of exposure in victims and responders are recognized and identified; samples of solids, liquids, and gases are collected; results of detection and monitoring equipment are read, interpreted, recorded, and communicated; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; personnel using

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the detection, monitoring, and sampling equipment, as well as the equipment, are decontaminated; detection, monitoring, and sampling equipment is maintained according to manufacturers' recommendations; and detection, monitoring, and sampling operations are reported and documented.

A.7.2.1 The committee determined that the basic hazard categories [corrosivity, energy (explosivity, radioactivity, reactivity), flammability, oxygen concentration, thermal (heat and cold), and toxicity] are core components of a hazardous materials technician's requisite knowledge. The technical committee wanted to specify the hazard categories to eliminate any potential ambiguity.

When sampling, or using methods to identify materials, including those in containers, methods should be used to avoid cross-contaminating the material. These methods are critical when sampling materials, which could be evidentiary in nature.

(A)* Requisite Knowledge. Basic hazard categories, including biological, corrosivity, energy (explosivity, radioactivity, reactivity), flammability, oxygen concentration, thermal (heat and cold), and toxicity and their definitions; policies and procedures; detection, monitoring, and sampling technologies; analysis process for classifying basic hazard categories of identified solid, liquid, and gaseous materials and unidentified contaminants in the atmosphere; types of detection, monitoring, and sampling equipment [colorimetrics (e.g., tubes, chips, papers, strips, reagents); electrochemical cells (e.g., toxic gas sensors), flammable gas/LEL, noncontact thermal detection device, oxygen concentration, photoionization detector (PID), biological detection, and radiation detection and monitoring]; process for determining radiation dose rates from radioactive material labels; determining background, dose rate; determining if a radioactive materials container is leaking/breached by comparing meter readings to Transportation Index (TI); process for monitoring lighter-than-air gases and vapors, heavier-than-air gases and vapors in a confined area, and heavier-than-air gases and vapors in an unconfined area; capabilities and limiting factors of detection, monitoring and sampling equipment; detection, monitoring, and sampling equipment required to classify the basic hazard categories; recognition and identification of signs of exposure in victims and responders; methods for collecting samples of solids, liquids, and gases; reading, interpreting, recording, and communicating test results of detection and monitoring, and sampling equipment; and field maintenance and testing procedures for approved detection, monitoring, and sampling equipment.

A.7.2.1(A) The committee determined that the basic hazard categories [corrosivity, energy (explosivity, radioactivity, reactivity), flammability, oxygen concentration, thermal (heat and cold), and toxicity] are core components of a hazardous materials technician's requisite knowledge. The technical committee wanted to specify the hazard categories to eliminate any potential ambiguity.

(B)* Requisite Skills. Selecting and using PPE; determining radiation dose rates from radioactive material labels; using each of the following types of detection, monitoring, and sampling equipment [colorimetrics (e.g., tubes, chips, papers, strips, reagents); electrochemical cells (e.g., toxic gas sensors), flammable gas/LEL, noncontact thermal detection device, oxygen concentration, photoionization detector (PID), and radiation detection and monitoring devices] to either classify hazardous materials by basic hazard categories, verify the presence of hazardous materials or determine the concentration of hazardous materials; collect samples of gases, liquids, and solids; monitoring, reading, interpreting, recording, and communicating readings from detection, monitoring, and sampling equipment according to the manufacturers' specifications and recommendations; and completing required reports and supporting documentation for detection, monitoring, and sampling operations.

A.7.2.1(B) All hazardous materials technicians must be able to protect themselves and the public from basic everyday response hazards. Therefore, the committee determined that all hazardous materials technicians must have the knowledge and skills necessary to operate each

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of the following pieces of detection and monitoring equipment: colorimetrics (e.g., tubes, chips, papers, strips, reagents); electrochemical cells (e.g., toxic gas sensors), flammable gas/LEL noncontact thermal detection, oxygen concentration, and photoionization detector (PID) devices; and radiation detection and monitoring devices.

7.2.2* Hazard and Response Information Collection and Interpretation. Collect and interpret hazard and response information at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, approved reference sources, and approved tools and equipment, so that hazard and response information is collected, interpreted, and communicated.

A.7.2.2 Approved reference sources beyond the ERG and SDS should include hazardous materials computer databases; information obtained from detection, monitoring, and sampling; reference manuals; technical information centers, including CHEMTREC, CANUTEC, or SETIQ; governmental authorities; and technical information specialists.

Equipment includes monitoring and detection equipment, computers, printers, communication equipment, and so forth.

(A) Requisite Knowledge. Types, advantages, and limitations of hazard and response information available from approved reference sources; significance and application of hazard and response terms, including chemical and physical properties, radiation terms, exposure terms (air reactivity, autorefrigeration, boiling point, catalyst, chemical change, chemical interactions, compound and mixture, concentration, corrosive (acids, bases, alkaline), critical temperature and pressure, cryogenic liquid heat transfer processes (conduction, convection, radiation, and direct contact), dose, dose response, endothermic, evaporization, exothermic, expansion ratio, half-life, inhibitor, maximum safe storage temperature (MSST), melting point and freezing point, miscibility, odor, odor threshold, organic and inorganic, pH, physical change, radioactivity, reactivity, relative density, self-accelerating decomposition temperature (SADT), solubility, solution and slurry, strength, sublimation, temperature of product, and volatility, as well as a higher level of understanding of operations level terms: boiling point, fire point, flammable range (LFL and UFL) and explosive range (LEL and UEL), flash point, ignition (autoignition) temperature, persistence, physical state (solid, liquid, gas), polymerization, specific gravity, toxic products of combustion, vapor density, and vapor pressure); principles of heat transfer associated with cryogenic liquid spills; signs and symptoms and target organ effects of exposure to hazardous materials/WMD; methods for determining the pressure and amount of lading in bulk containers and facility containers; and hazard and response information to be communicated.

(B)* Requisite Skills. Collecting and interpreting hazard and response information; identifying signs and symptoms of exposure to hazardous materials/WMD, including target organ effects of exposure to hazardous materials/WMD; and determining radiation exposure rates from labels attached to radioactive materials containers.

A.7.2.2(B) The requisite skills can be assessed through cognitive testing.

7.2.3* Assessing Container Condition. Assess the condition of a container and its closures at a hazardous materials/WMD incident, given an incident involving hazardous materials/WMD; an assignment in an IAP; policies and procedures; the scope of the incident; identity of material(s) involved and their hazards, including results of detection, monitoring, and sampling; a container with required markings; and approved resources and PPE, so that PPE is selected and used; the container and its closures are inspected; the type of damage to the container and closures is identified; the type of stress on the container is identified; the level of risk associated with container and closure damage and stress is identified; safety procedures are followed; hazards are avoided or minimized; personnel, tools, and equipment are decontaminated; and a description of the condition of the container and its closures is communicated.

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A.7.2.3 The condition of a container can be damaged with no product release, undamaged with no product release, damaged with product release, and undamaged with product release.

Containers include bulk, nonbulk, bulk facility containers, radioactive materials containers, and pipelines and piping, as well as their closures.

Required markings include specification markings for bulk transportation containers, including tank cars (cryogenic liquid, nonpressure, pneumatically unloaded covered hopper cars, and pressure), intermodal tanks/UN portable tanks (nonpressure, pressure, cryogenic liquid, and tube modules), and cargo tanks (compressed gas tube trailers, corrosive liquid, cryogenic liquid, dry bulk, high-pressure, low-pressure chemical, and nonpressure liquid).

Approved resources include printed and technical resources, computer databases, and specialists in the field.

Types of damage to containers include cracks, scores, gouges, dents, closures problems (closures not secure, worn, damaged, or missing), and structural damage to container.

Types of stress on containers include thermal, mechanical, and chemical.

(A)* Requisite Knowledge. Process for assessing container condition; basic design and construction features, including closures for bulk, intermediate bulk, and nonbulk containers, facility containers, radioactive materials containers, and piping and pipelines; types of damage and their level of risk; types of stress; specification markings; and methods for determining the pressure and quantity of lading remaining in containers and indicators of an increase in container pressure.

A.7.2.3(A) Types of containers are as follows:

(1) Bulk containers
   - (a) Cargo tanks, including compressed gas tube trailers, corrosive liquid tanks, cryogenic liquid tanks, dry bulk cargo tanks, high-pressure tanks, low-pressure liquid tanks, and nonpressure liquid tanks
   - (b) Facility tanks, including nonpressure tanks, pressure tanks, and cryogenic liquid tanks
   - (c) Intermediate bulk containers (IBCs), including the following:
     - i. Tote tanks
     - ii. Ton containers
     - iii. Portable tanks, including HM portable tanks [nonpressure (T11-T22, IM-101, IM-102, IMO Type 1, IMO Type 2), pressure (T50, Specification 51, IMO Type 5), cryogenic (T75, IMO Type 7), and tube modules]
   - (d) Piping and pipelines
   - (e) Railroad cars (nonpressure tank cars, pressure tank cars, cryogenic liquid tank cars, and pneumatically unloaded hopper cars)
   - (f) Special containers found in the AHJ area

(2) Nonbulk containers, to include bags, carboys, drums, and cylinders
(3) Radioactive material packages to include excepted, industrial, Type A, and Type B
(4) Piping and pipelines
(5) Specifications for rail tank cars, highway cargo tanks, and intermodal tank containers (UN Portable Tanks)

The capacity of a container is determined using the markings on the container, the shipping papers accompanying the shipment in transportation, or the facility documentation or resources. If the container has more than one compartment, the pressure and the quantity remaining in all compartments should be determined.

(B) Requisite Skills. Assessing the condition of the container and its closures, identifying the type of damage and level of risk associated with the damage, identifying stress(es) on the container, and communicating the condition of the container and its closures and the level of risk associated with that condition.

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7.2.4* Predicting Behavior. Predict the behavior of the hazardous materials/WMD involved in a hazardous materials/WMD incident, given an incident involving multiple hazardous materials/WMD; an assignment in an IAP; policies and procedures; physical and chemical properties of the materials involved; results of detection, monitoring, and sampling; condition of the container (damage and stress); surrounding conditions; and approved reference sources, so that the behavior of each hazardous materials/WMD container and its contents is identified, the reactivity issues and hazards of the combined materials are identified, and a description of the likely behavior of the hazards is communicated.

A.7.2.4 Surrounding conditions include topography; land use, including utilities and fiber optic cables; accessibility; weather condition; bodies of water, including recharge ponds; 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 the nature and extent of injuries. Building information, such as floor drains, ventilation ducts, and air returns, also should be included where appropriate.

Approved reference sources include printed and technical resources, computer databases, specialists in the field, and approved resources available at the awareness, operations, and technician levels.

Behavior of the container includes the effects of damage and stress on the container and the expected breach type.

Behavior of the contents include the expected release type, dispersion pattern, length of contact, time with exposures, and potential hazards.

Also see A.5.2.1(A).

(A)* Requisite Knowledge. Process for predicting behavior, resources that indicate the reactivity issues of mixing various hazardous materials/WMD, impact of fire and safety features on the behavior of products at facilities, heat transfer processes that occur as a result of a cryogenic liquid spill, and methods for communicating the results of predicting behavior.

A.7.2.4(A) The process for predicting behavior should take into consideration the following factors: stress on the container in addition to damage on the container, breach of the container, release of contents, dispersion pattern of released matter or energy, contact time, hazards creating harm, and synergistic effects of mixing multiple materials. The following are the types of conditions to be aware of:

(1) Types of stresses (thermal, mechanical, chemical)
(2) Types of potential breaches (disintegration, runaway cracking, closures opening up, punctures, and splits or tears)
(3) Types of potential releases (detonation, violent rupture, rapid relief, and spill or leak)
(4) Types of potential dispersion patterns (hemisphere, cloud, plume, cone, stream, pool, and irregular)
(5) Length of potential contact time (short term, medium term, long term)
(6) Potential hazards that could cause harm (thermal, radiological, asphyxiation, chemical, etiological, and mechanical)

Fire and safety features to be considered for incidents at facilities include fire protection systems, monitoring and detection systems, pressure relief and vacuum relief protection, product spillage and control (impoundment and diking), tank spacing, and transfer operations. Should transportation containers be involved at facilities, fire and safety features should be considered where appropriate.

(B)* Requisite Skills. Using the process to predict likely behavior of materials and their containers when multiple materials are involved, identifying reactivity issues associated with mixing various hazardous materials, and communicating the predicted behavior.

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A.7.2.4(B) The process for predicting behavior should take into consideration the following factors: damage to the container, stress on the container in addition to the damage on the container, breach of the container, release of contents, dispersion pattern of released matter or energy, contact time, hazards creating harm, and synergistic effects of mixing multiple materials.

7.2.5* Estimating Outcomes. Estimate the potential outcomes at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, the likely behavior of the container and its contents, and approved resources and equipment, so that the concentrations of materials within the endangered area are measured or predicted; physical, health, and safety hazards within the endangered area are identified; areas of potential harm in the endangered area are identified; potential outcomes within the endangered area are identified; and potential outcomes are communicated.

(A) Requisite Knowledge. Methods for determining concentrations of materials within the endangered area; methods for identifying physical, health, and safety hazards within the endangered area; health hazard terms and exposure values,including Acute Exposure Guideline Levels for airborne chemicals (AEGLs), counts per minute, kilocounts per minute, immediately dangerous to life and health, incapacitating concentration (IC_{50}), incubation period, infectious dose (ID), lethal concentrations (LD_{50}), lethal dose (LD), parts per billion, parts per million, permissible exposure limit (PEL), radiation absorbed dose (rad), gray (Gy), roentgen equivalent man (rem), millirem (mrem), microrem (μrem), sievert (Sv), millisievert (mSv), microsievert (μSv), curie (Ci), becquerel (Bq), threshold limit value ceiling, threshold limit value short-term exposure limit, threshold limit value time weighted average, and their significance in the analysis process; methods for identifying areas of potential harm within the endangered area; methods for identifying potential outcomes in the areas of potential harm within the endangered area; and procedures for communicating potential outcomes.

(B) Requisite Skills. Using approved resources and equipment; determining concentrations of materials within the endangered area; identifying the physical, health, and safety hazards within the endangered area; identifying the areas of potential harm in the endangered area; estimating the potential outcomes in the endangered area; and communicating the potential outcomes.

A.7.2.5 Results of the incident analysis include weather conditions (current and projected); terrain; time of day; buildings; people; bodies of water; hazard and response information collected; results of detection, monitoring, and sampling; condition of container; and predicted behavior of the container and its contents.

Approved resources include printed and technical resources, computer databases, and specialists in the field.

7.3 Response Planning.

7.3.1 Response Objectives and Options. Develop and recommend to the incident commander or hazardous materials officer response objectives and action options at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis, including incident-related information, life safety risks, environmental risks, and property risks; available resources; and policies and procedures, so that response objectives are identified for the incident and action options are identified for each response objective.

(A) Requisite Knowledge. Steps for developing response objectives and steps for identifying action options for each response objective.

(B) Requisite Skills. Developing response objectives for a hazardous materials incident and identifying action options for each response objective.

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7.3.2* Personal Protective Equipment (PPE)Selection. Select the PPE ensemble required for a given response option at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, results of the incident analysis, response objectives and options for the incident, approved references, and policies and procedures, so that required PPE is identified for each response option.

A.7.3.2 PPE includes both respiratory protection and liquid splash–protective ensembles, vapor-protective clothing, high temperature–protective ensembles, and structural fire-fighting protective ensembles.

(A)* Requisite Knowledge. Identify the PPE available for response based on NFPA PPE standards and certification levels; levels of PPE (A, B, C, and D); advantages of using certified PPE; types of PPE available for various hazards, including thermal, radiological, asphyxiation, chemical, etiological, and mechanical (TRACEM); factors to be considered in selecting respiratory protection; factors to be considered in selecting chemical-protective clothing (CPC); significance of degradation, penetration, and permeation on the selection of protective clothing; indications of material degradation of protective clothing; advantages and limitations of the different designs of liquid splash–protective ensembles and vapor-protective ensembles; types, advantages, and limitations of cooling measures for cooling personnel wearing PPE; information provided on chemical compatibility charts; and effects of physiological and psychological stresses on users of PPE.

A.7.3.2(A) Levels of protection specified by the OSHA/EPA are Level A, Level B, Level C, and Level D with explanations. Table A.7.3.2(A) cross-references the OSHA/EPA level with the NFPA PPE standards.

TABLE A.7.3.2(A) *Ensemble Description*

Ensemble Description Using Performance-Based Standard(s)	*OSHA/EPA Level*
NFPA 1991 worn with NFPA 1981 SCBA	A
NFPA 1992 worn with NFPA 1981 SCBA	B
NFPA 1994 Class 2 worn with NFPA 1981 SCBA	B
NFPA 1994 Class 3 worn with NFPA 1981 SCBA	C
NFPA 1994 Class 3 worn with NIOSH CBRN PAPR	C
NFPA 1994 Class 3 worn with NIOSH CBRN APR	C

Hazards include thermal, radiological, asphyxiating, chemical, etiological, and mechanical.

(B)* Requisite Skills. Selecting PPE ensemble for a specified response option based on all hazards identified and determining the effectiveness of protective clothing based on its uses and limitations.

A.7.3.2(B) PPE includes dermal and respiratory protection elements. If CPC is selected, determine the effectiveness of protective ensemble construction material using chemical compatibility charts.

7.3.3 Decontamination Method Selection. Select the decontamination method for a given response option at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, results of the incident analysis, response objectives and options for the incident, available resources, and policies and procedures, so that a decontamination method to minimize the hazards for each response option is identified and the equipment required to implement the decontamination method is identified.

(A)* Requisite Knowledge. Decontamination methods including absorption, adsorption, chemical degradation, dilution, disinfecting, evaporation, isolation and dispersal, neutralization, solidification, sterilization, vacuuming, and washing; advantages and limitations of

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decontamination methods; reference sources for determining applicable decontamination operations and methods; methods for accessing these resources; and equipment required to implement specified decontamination operations and methods.

A.7.3.3(A) Decontamination operations include emergency decontamination, gross decontamination, mass decontamination, and technical decontamination. Gross decontamination is the phase of the decontamination process during which the amount of surface contaminants is significantly reduced.

Decontamination methods include absorption, adsorption, chemical degradation, dilution, disinfecting, evaporation, isolation and disposal, neutralization, solidification, sterilization, vacuuming, and washing.

(B) Requisite Skills. Selecting decontamination procedures (operations and methods) and identifying the equipment required to implement decontamination procedure (operations and methods).

7.3.4* Action Plan Development. Develop a plan of action for a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, results of the incident analysis, response objectives and options for the given incident, available resources, and policies and procedures, so that the tasks and resources required to meet the response objectives are identified, specified response objectives and response options are addressed, plan is consistent with the emergency response plan and policies and procedures, and plan is within the capability of available personnel, PPE, and control equipment.

A.7.3.4 The hazardous materials technician's responsibility is to develop a plan of action for an assignment, including site safety and control, that is consistent with the emergency response plans and standard operating procedures and within the capability of available personnel, PPE, and control equipment.

(A)* Requisite Knowledge. Components of an IAP and subplans; definitions of control, confinement, containment, and extinguishment; purpose of, procedures for, required tools and equipment for, and safety precautions for various techniques for hazardous materials/WMD (product) control; components of a safety briefing; atmospheric and physical safety hazards associated with hazardous materials/WMD in confined spaces; pre-entry tasks to be performed; and procedures, equipment, and safety precautions for preserving and collecting legal evidence.

A.7.3.4(A) Components of an IAP and subplans should include site safety and control tasks.

Techniques for hazardous materials/WMD (product) control include absorption; adsorption; blanketing; covering, damming, diking, dilution, dispersion, diversion; fire suppression; neutralization; overpacking, patching; plugging; sealing closures; pressure isolation and reduction (flaring, venting, vent and burn; isolation of valves, pumps, or energy sources); remote valve shut-off; retention; sealing closures [valves, pressure relief devices (pressure relief valves, rupture disks, fusible plugs)]; solidification; transfer; and vapor control (dispersion, suppression).

(B) Requisite Skills. Preparing an action plan, identifying site safety and control components, identifying points for a safety briefing, identifying pre-entry tasks, identifying atmospheric and physical safety hazards when incident involves a confined space, and preserving and collecting legal evidence.

7.4 Action Plan Implementation.

7.4.1 Performing Assigned IMS/ICS Duties. Perform assigned hazardous materials branch or group functions within the incident command system (ICS) at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment in an IAP;

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results of the incident analysis; policies and procedures, including an emergency response plan and standard operating procedures; the IAP; and approved resources, so that the assigned functions within the hazardous materials branch or group are completed.

(A)* Requisite Knowledge. Organizational structure of the hazardous materials branch or group; duties and responsibilities of hazardous materials branch or group functions; resources available to complete assigned functions; reporting structure; and procedures for communicating with the hazardous materials branch or group supervisor, ICS operations section chief, or IC.

A.7.4.1(A) The functions of the hazardous materials branch or group include hazardous materials branch director/group supervisor, assistant safety officer—hazardous materials, site access control group supervisor, decontamination group supervisor, technical specialist—hazardous materials reference, entry team group supervisor, and safe refuge group supervisor.

(B) Requisite Skills. Performing the duties and responsibilities of an assigned function in the hazardous materials branch or group organization;and communicating observations to hazardous materials branch director/group supervisor, ICS operations section chief, or IC.

7.4.2* Personal Protective Equipment Use. Don, work in, and doff PPE at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, results of the incident analysis, response objectives and options for the incident, and PPE ensembles as identified in the IAP, so that PPE is selected, inspected, donned, worked in, decontaminated, and doffed; safety procedures are followed; hazards are avoided or minimized; equipment is maintained and stored properly; and the use of PPE is reported and documented.

A.7.4.2 PPE at this level includes chemical-protective clothing (liquid splash–protective and vapor-protective clothing) and respiratory protection as well as any other specialized protective clothing provided by the AHJ.

(A)* Requisite Knowledge. Types of PPE and the hazards for which they are used; capabilities, advantages, limitations, selection, and use of PPE; components of an IAP; safety procedures for personnel working in PPE; additional safety concerns of working in the hot zone; procedures for decontamination, maintenance, inspection, and storage of PPE; procedures for being decontaminated while wearing PPE; procedures for maintenance, testing, inspection, and storage of PPE according to manufacturers' specifications and recommendations; importance of personnel exposure records, steps in keeping an activity log and exposure records, requirements for reporting and documenting the use of PPE, and requirements for filing documents and maintaining records.

A.7.4.2(A) Safety procedures for personnel working in CPC should address: keeping the individual cool and protected from heat exposure, prevention of dehydration, medical monitoring, and stringent accounting of time spent on air and in the suit.

Safety concerns of working in the hot zone include visibility, mobility, and communications issues; emergency procedures for personnel working in chemical-protective clothing; loss of suit integrity; loss of verbal communications; the buddy system; and use of backup personnel wearing the same level of PPE.

(B) Requisite Skills. Inspecting, donning, working in, going through technical decontamination while wearing PPE; and completing required reports and supporting documents for the use of PPE.

7.4.3 Performing Control Functions.

7.4.3.1* Product Control. Perform product control techniques at a hazardous materials/WMD incident, given a hazardous materials/WMD incident with release of product, an assignment in an IAP, results of the incident analysis, policies and procedures for product control,

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response objectives and options for the incident, and approved tools, equipment, control agents, and PPE, so that an approved product control technique is selected and implemented; the product is controlled; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; personnel, victims, tools, and equipment used are decontaminated; tools and equipment are inspected and maintained; and product control operations are reported and documented.

A.7.4.3.1 Product control techniques include absorption, adsorption, blanketing, damming, diking, dilution, dispersion, diversion, neutralization, overpacking, patching, plugging, sealing closures, retention, remote valve shutoff, vapor dispersion, and vapor suppression. Note: It will be necessary for non–fire fighters to develop fire-fighting skills (hose handling, nozzle control, application techniques, etc.) before performing fire-fighting operations.

Tools and equipment include such items as Class B foam application equipment, diking equipment, damming equipment, approved absorbent materials and products, shovels and other hand tools, piping, dispersal agents, heavy equipment (such as backhoes), floats, and spill booms.

Product control agents can include Class B foam, dispersal agents, and so forth.

Safety procedures can include grounding, bonding, and monitoring as necessary.

(A)* Requisite Knowledge. Types of PPE and the hazards for which they are used; policies and procedures for product control; product control techniques (absorption, adsorption, blanketing, damming, diking, dilution, dispersion, diversion, neutralization, overpacking, patching, plugging, pressure isolation and reduction, retention, remote valve shutoff, vapor dispersion, and vapor suppression); purpose of, procedures for, required tools and equipment for, and safety precautions for hazardous materials/WMD control techniques; location and operation of remote emergency shutoff devices; characteristics, applicability, and use of approved product control agents; use of approved tools and equipment; and procedures for inspection and maintenance of tools and equipment.

A.7.4.3.1(A) See A.7.4.3.1.

Remote/emergency shutoff devices include emergency shutoff devices for MC-306/DOT-406, MC-307/DOT-407, and MC-331 cargo tanks as well as remote shutoff valves at fixed facilities.

(B)* Requisite Skills. Selecting and using PPE, selecting and using approved control agents and equipment on a release involving hazardous materials/WMD, using container control valves and remote emergency shutoff devices, performing product control techniques, inspecting and maintaining tools and equipment; and completing required and supporting documentation for product control operations.

A.7.4.3.1(B) See A.7.4.3.1.

7.4.3.2* Controlling Container Leaks. Control leaks from containers and their closures at a hazardous materials/WMD incident, given three scenarios, including (1) a leak from a bulk or nonbulk pressure container or its closures, (2) a leak from a nonbulk liquid container or its closures, and (3) a leak from a bulk liquid container or its closures; an assignment in an IAP; results of the incident analysis; policies and procedures for controlling leaks from containers and/or their closures; and approved tools, equipment, and PPE, so that an approved product control technique is selected and used; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; hazard monitoring is completed; leaks are controlled (confined or contained); emergency responders, tools, and equipment used are decontaminated; tools and equipment are inspected and maintained; and product control operations are reported and documented.

A.7.4.3.2 Containers include nonbulk containers (bags, barrels, bottles, boxes, jerry cans, pails, drums, and cylinders, including UN pressure receptacles and "y" cylinders) radioactive materials containers (excepted; industrial, Type A, Type B).

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Closures include valves, pressure relief devices (pressure relief valves, rupture discs, fusible plugs), manways, flanged fittings, screwed caps, plugs, packing glands, drum bungs, and drum lids.

Leaks include punctures (nail holes, fork truck punctures); rips, tears, splits, cracks, and ruptures; chime leaks; and leaking closures [screwed fitting leaks (bung leaks), open valves, missing plugs, packing gland leaks, flange leaks, gasket leaks, blown rupture discs].

(A)* Requisite Knowledge. Types of PPE and the hazards for which they are used, policies and procedures for product control; types of containers and their closures; ways in which containers and their closures develop leaks, hazards of and safety precautions for controlling; container/closure leaks; methods for controlling container or closure leaks on nonbulk, intermediate bulk, radioactive, facility containers, and pipe and pipelines; location and operation of remote emergency shutoff devices on cargo tanks and at facilities; characteristics, applicability, and use of approved product control agents; approved tools and equipment used to control container/closure leaks; and procedures for inspection and maintenance of tools and equipment.

A.7.4.3.2(A) See A.7.4.3.2.

(B)* Requisite Skills. Selecting and using PPE, selecting and using approved control agents and equipment; controlling leaks on containers and their closures (patching, plugging, sealing closures, remote valve shutoff, closing valves, repositioning container; replacing missing plugs, and tightening loose fittings); decontaminating tools and equipment; inspecting and maintaining tools and equipment; and requirements for reporting and documenting product control operations.

A.7.4.3.2(B) See A.7.4.3.2.

7.4.3.3* Overpacking Nonbulk and Radioactive Materials Containers. Overpack damaged or leaking nonbulk and radioactive materials containers at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; a loaded damaged or leaking container; a suitable overpack container; policies and procedures; and approved tools, equipment, and PPE, so that an approved overpack technique is selected; the damaged or leaking container is placed into a suitable overpack and the overpack is closed, marked, and labeled; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; emergency responders, tools, and equipment are decontaminated; tools and equipment are inspected and maintained; and product control operations are reported and documented.

(A) Requisite Knowledge. Types of PPE and the hazards for which they are used; policies and procedures for overpacking damaged or leaking nonbulk and radioactive materials containers; ways in which nonbulk and radioactive materials containers are damaged; hazards associated with overpacking damaged or leaking nonbulk and radioactive materials containers; methods to overpack damaged or leaking nonbulk and radioactive materials containers; marking and labeling overpack containers; the tools and equipment used to overpack damaged or leaking nonbulk and radioactive materials containers; and equipment and maintenance procedures.

(B) Requisite Skills. Selecting and using PPE; placing a damaged or leaking nonbulk materials container into the overpack container; placing a damaged or leaking radioactive materials container into an overpack container; following safety procedures and minimizing and avoiding hazards; decontaminating tools and equipment; inspecting and maintaining tools and equipment; and completing requirements for reporting and documenting product control operations.

A.7.4.3.3 For example, there are three overpack methods for a leaking 55 gal (208 L) drum: rolling slide-in, slip-over, or other approved method.

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7.4.3.4 Liquid Product Transfer. Transfer liquids from leaking nonpressure containers at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; a leaking nonpressure container and a recovery container; policies and procedures for transferring liquids from leaking nonpressure containers; and approved tools, equipment, and PPE, so that an approved product transfer method is selected and used; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; hazard monitoring is completed; the containers are bonded and grounded; product is transferred to the recovery container; emergency responders, tools, and equipment used are decontaminated; tools and equipment are inspected and maintained; and product control operations are reported and documented.

(A) Requisite Knowledge. Types of PPE and the hazards for which they are used; policies and procedures for liquid product transfer; identifying a compatible recovery container; requirements for hazard monitoring; methods for transferring liquid product; grounding and bonding methods; methods for vapor suppression; use of approved tools and equipment; procedures for inspection and maintenance of tools and equipment; and requirements for reporting and documenting product control operations.

(B) Requisite Skills. Selecting and using PPE; identifying a compatible recovery container and transfer equipment; monitoring for hazards; grounding and bonding containers; transferring liquid product from a leaking container to a recovery container; suppressing vapors; decontaminating tools and equipment; inspecting and maintaining tools and equipment; and completing reports and supporting documentation for product control operations.

7.4.4 Decontamination.

7.4.4.1 Mass Decontamination. Perform mass decontamination for ambulatory and nonambulatory victims at a hazardous materials/WMD incident, given a hazardous materials/WMD incident requiring mass decontamination; an assignment in an IAP; results of the incident analysis; policies and procedures; and approved PPE, tools, and equipment, so that PPE is selected and used; a mass decontamination procedure is selected, set up, implemented, evaluated, and terminated; victims are decontaminated; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; personnel, tools, and equipment are decontaminated; and mass decontamination operations are reported and documented.

(A)* Requisite Knowledge. Types of PPE and the hazards for which they are used; advantages and limitations of operations and methods of mass decontamination; policies and procedures; approved tools, equipment, and PPE; procedures for performing mass decontamination; safety precautions; crowd management techniques; AHJ mass decontamination unit duties within the command structure; and required reports and supporting documentation for mass decontamination operations.

A.7.4.4.1(A) See A.6.3.1(A).

(B)* Requisite Skills. Selecting and using suitable PPE, selecting a mass decontamination procedure to minimize the hazard, setting up and implementing mass decontamination operations for ambulatory and nonambulatory victims, evaluating the effectiveness of the mass decontamination process, and completing reporting and documentation requirements.

A.7.4.4.1(B) See A.6.3.1(B).

7.4.4.2 Technical Decontamination. Establish and implement technical decontamination in support of entry operations and for ambulatory and nonambulatory victims at a hazardous materials/WMD incident, given a hazardous materials/WMD incident requiring technical decontamination; an assignment in an IAP; results of the incident analysis; policies and procedures; and approved PPE, tools, and equipment, so that approved PPE is selected and

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used; a technical decontamination procedure is selected, set up, implemented, evaluated, and terminated; victims are decontaminated; safety procedures are followed; hazards are avoided or minimized; if contaminated, personnel, tools, and equipment are decontaminated; and all reports and documentation of technical decontamination operations are completed.

(A)* Requisite Knowledge. Types of PPE and the hazards for which they are used; advantages and limitations of operations and methods of technical decontamination; policies and procedures; approved tools, equipment, and PPE; procedures for performing technical decontamination; safety precautions; crowd management techniques; technical decontamination unit duties within the command structure; and approved forms for reporting and documenting technical decontamination.

A.7.4.4.2(A) See A.6.3.1(A).

(B)* Requisite Skills. Selecting and using PPE, selecting a technical decontamination procedure to minimize the hazard, setting up and implementing technical decontamination operations, evaluating the effectiveness of the technical decontamination procedure, and completing required reports and supporting documentation for technical decontamination operations.

A.7.4.4.2(B) See A.6.3.1(B).

7.5 Evaluating and Reporting Progress.

7.5.1 Evaluate and report the progress of assigned tasks at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, current incident conditions, response options and actions taken, and approved communication equipment, so that the actual behavior of material and container is compared to that predicted, the effectiveness of response options and actions in accomplishing response objectives is determined, modifications to the response options and actions are made, and the results are communicated.

(A) Requisite Knowledge. Procedures for evaluating whether the response options and actions are effective in accomplishing the response objectives; resources for identifying improving, static, or deteriorating conditions; approved communication procedures and communication equipment; and the process for modifying response options and action.

(B) Requisite Skills. Comparing predicted behavior of the material and its container to the actual behavior, determining effectiveness of response options and actions, communicating the status of response options and actions, and modifying the response options and actions based on the incident status review.

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7.6* Terminating the Incident.

A.7.6 Documentation and reporting requirements include ensuring that required reports (e.g., incident reports and critique reports) and records (e.g., training records, exposure records, activity logs, hot zone entry and exit logs, and PPE logs) are completed and verified; supporting documentation is provided; reports, records, and supporting documentation are forwarded as required; reports, records, and supporting documentation are filed as required; and files are maintained as required.

7.6.1 Terminate a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, operational observations of response operations (incident information), and approved forms for documentation and reporting, so

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that assistance in scheduled incident debriefings and critiques is provided, and incident operations are reported and documented.

(A) Requisite Knowledge. Purpose, regulatory issues, elements, and procedures for conducting debriefings and critiques; documentation and reporting requirements; approved forms and procedures for completing required reports, records, and supporting documentation; and importance of and requirements for reporting and documenting incident operations, including filing and maintenance requirements.

(B) Requisite Skills. Communicating operational observations (incident information) at debriefings and critiques; and completing, forwarding, and filing required reports, records, and supporting documentation.

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Incident Commander

8

8.1 General.

8.1.1 The incident commander (IC) is that person, designated by the AHJ, responsible for all incident activities/operations, including the development of strategies and tactics and the ordering and release of resources.

8.1.2 An IC shall meet the job performance requirements defined in Sections 4.2 through 4.4.

8.1.3 An IC shall meet the job performance requirements defined in Sections 5.2 through 5.6.

8.1.4 An IC shall meet the job performance requirements defined in Sections 8.2 through 8.6.

8.1.5 General Knowledge Requirements. Knowledge of incident management system/incident command system (IMS/ICS) and importance of command presence.

8.1.6 General Skills Requirements. (Reserved)

8.2 Analyze the Incident.

8.2.1 Analyze a hazardous materials/weapons of mass destruction (WMD) incident, given a hazardous material/WMD incident; incident information; policies and procedures; available resources; approved references; and access to a hazardous materials technician, an allied professional, an emergency plan, or standard operating procedures, so that the hazards are assessed and risks are evaluated.

(A) Requisite Knowledge. Advantages and limitations of hazardous materials databases, detection and monitoring equipment, reference manuals, technical information centers, and technical information specialists; methods available to obtain local weather conditions and predictions; resources to predict behavior and estimate outcomes.

(B) Requisite Skills. Assessing hazards and evaluating risks; written and verbal communication.

8.3 Plan the Response.

8.3.1 Plan the response to a hazardous materials/WMD incident, given an hazardous materials/WMD incident, the results of the incident analysis, and available resources, so that the response objectives are identified, potential response options are identified, level

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of personal protective equipment (PPE) is approved, decontamination process is approved, response options are selected based on available resources, and an IAP is developed.

(A)* Requisite Knowledge. Response objectives, purpose of hazardous materials control techniques, approving the level of PPE, steps for developing an IAP, factors to be evaluated in public protective actions, making tactical assignments, and safe operating practices and procedures.

A.8.3.1(A) Hazardous materials control techniques include absorption, adsorption, blanketing, covering, contamination isolation, damming, diking, dilution, dispersion, diversion, fire suppression, neutralization, overpacking, patching, plugging, pressure isolation and reduction (flaring, venting, vent and burn, isolation of valves, pumps, or energy sources), retention, solidification, transfer, and vapor control (dispersion and suppression).

Approving the level of PPE requires knowledge of the four levels of chemical-protective clothing (CPC), the equipment required for each level, and conditions under which each level is used; impact and significance of degradation, penetration, and permeation on CPC; safety considerations for personnel working in vapor-protective, liquid splash–protective, and high temperature–protective clothing; and physiological and psychological stresses that can affect users of PPE.

Tactical assignments include 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 operations-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 incident command post security.
(22) Provide incident or crime scene investigation.
(23) Provide evidence collection and sampling.

Safe operating practices and procedures include pre-incident planning; safety briefings; buddy system; backup teams; safety precautions for search, rescue, and recovery missions; advantages and limitations of decontamination methods; and hazardous materials atmospheric and physical safety hazards in confined spaces.

Decontamination methods include the following:

(1) Absorption
(2) Adsorption
(3) Chemical degradation
(4) Dilution
(5) Disinfection

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(6) Evaporation
(7) Isolation and disposal
(8) Neutralization
(9) Solidification
(10) Sterilization
(11) Vacuuming
(12) Washing

(B) Requisite Skills. Approving the personal protective equipment for response options, developing a plan of action, and ability to use verbal and written communication.

8.4 Implement the Incident Action Plan (IAP).

8.4.1 Implement the planned response in a hazardous materials/WMD incident, given a hazardous materials/WMD incident and resources and equipment available, so that IMS/ICS is implemented, resources are directed, a focal point for information transfer is established, and actions are taken to meet the response objectives of the IAP.

(A)* Requisite Knowledge. Role of the command element, concept of unified command and its application and use, duties and responsibilities of hazardous materials branch/group functions, transfer of command, implementing IMS/ICS, directing resources, and establishing a focal point for information transfer.

A.8.4.1(A) Functions include the following:

(1) Decontamination
(2) Entry (backup)
(3) Hazardous materials branch director or group supervisor
(4) Hazardous materials safety
(5) Information and research

(B) Requisite Skills. Implementing IMS/ICS including unified command as necessary, assigning and directing resources, and establishing information transfer focal point.

8.5* Evaluate Progress and Adjust IAP.

A.8.5 Effectiveness of response options and actions include control, containment, confinement, and extinguishment operations; decontamination process; established control zones; personnel being used; and PPE.

8.5.1 Evaluate the progress and adjust the IAP as needed at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, actions taken, and changing incident conditions, so that actual behavior of material and container is compared to that predicted, effectiveness of action options and actions is determined, and modifications to the IAP are made as needed until the scene is determined to be stabilized and hazards are controlled.

(A) Requisite Knowledge. Determination of safe versus unsafe, procedures for evaluating whether the action options are effective in accomplishing the objectives, steps for comparing actual behavior of the material and the container to that predicted, and procedures for making modifications to the IAP.

(B) Requisite Skills. Comparing predicted behavior of the material and its container to the actual behavior, determining effectiveness of action options and actions, and modifying the IAP when needed.

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8.6* Termination.

A.8.6 Final documentation and reporting requirements include ensuring that required reports (e.g., incident reports and critique reports) and records (e.g., training records, exposure records, activity logs, hot zone entry and exit logs, and personal protective equipment logs) are completed and verified; supporting documentation is provided; reports, records, and supporting documentation are forwarded as required; reports, records, and supporting documentation are filed as required; and files are maintained as required.

8.6.1 Terminate response operations at a hazardous materials/WMD incident, given a hazardous materials/WMD incident that has been determined to be stabilized with hazards controlled, operational observations, and approved forms for documentation and reporting, so that command is transferred, debriefings are held, post-incident analysis is completed, a critique is conducted, and overall incident response operations are reported and documented.

(A)* Requisite Knowledge. Transition from safe and nonsafe; regulatory issues; elements and procedures for conducting a debriefing, a post-incident analysis, and a critique; and requirements for reporting and documenting overall incident response operations.

A.8.6.1(A) Explanation of transition from safe to nonsafe or unsafe.

(B) Requisite Skills. Transferring command; participating in a debriefing, post-incident analysis, and critiques; and completing required reports and supporting documentation for overall incident response operations.

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ANNEX

A

Explanatory Material

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

Annex material is useful information that is included in this document solely to help the user understand the intent of the requirements by providing further information, diagrams, examples, or other details. The Annex A material, along with the mandatory sections of NFPA 475, is voted on by the document's technical committee. For the convenience of the readers of this handbook, Annex A text is inserted after the appropriate paragraphs in Chapter 1 through Chapter 8 and, therefore, is not repeated here.

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ANNEX

B

Explanation of the Professional Qualifications Standards and Concepts of JPRs

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

B.1 Explanation of the Professional Qualifications Standards and Concepts of Job Performance Requirements (JPRs).

The primary benefit of establishing national professional qualifications standards is to provide both public and private sectors with a framework of the job requirements for emergency services personnel. Other benefits include enhancement of the profession, individual as well as organizational growth and development, and standardization of practices.

NFPA professional qualifications standards identify the minimum job performance requirements (JPRs) for specific emergency services levels and positions. The standards can be used for training design and evaluation; certification; measuring and critiquing on-the-job performance; defining hiring practices; job descriptions; and setting organizational policies, procedures, and goals.

Professional qualifications standards for specific jobs are organized by major areas of responsibility defined as "duties". For example, the fire fighter's duties might include fire department communications, fireground operations, and preparedness and maintenance, whereas the fire and life safety educator's duties might include education and implementation, planning and development, and evaluation. Duties are major functional areas of responsibility within a specific job.

The professional qualifications standards are written as JPRs. JPRs describe the performance required for a specific job and are grouped according to the duties of the job. The complete list of JPRs for each duty defines what an individual must be able to do in order to perform and achieve that duty.

B.2 The Parts of a JPR.

B.2.1 Critical Components. The JPR comprises three critical components, which are as follows:

(1) Task to be performed, partial description using an action verb
(2) Tools, equipment, or materials that are to be provided to complete the task
(3) Evaluation parameters and performance outcomes

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Table B.2.1 gives an example of the critical components of a JPR.

TABLE B.2.1 *Example of a JPR*

Component	*Example*
(1) Task to be performed	(1) Perform overhaul at a fire scene,
(2) Tools, equipment, or materials	(2) given approved PPE, attack line, hand tools, flashlight, and an assignment,
(3) Evaluation parameters and performance outcomes	(3) so that structural integrity is not compromised, all hidden fires are discovered, fire cause evidence is preserved, and the fire is extinguished.

B.2.1.1 The Task to Be Performed. The first component is a concise statement of what the person is required to do. A significant aspect of that phrase is the use of an action verb, which sets the expectation for what is to be accomplished.

B.2.1.2 Tools, Equipment, or Materials That Must Be Provided for Successful Completion of the Task. This component ensures that all individuals completing the task are given the same tools, equipment, or materials when they are being evaluated. Both the individual and the evaluator will know what will be provided in order for the individual to complete the task.

B.2.1.3 Evaluation Parameters and Performance Outcomes. This component defines — for both the performer and the evaluator — how well the individual should perform each task. The JPR guides performance toward successful completion by identifying evaluation parameters and performance outcomes. This portion of the JPR promotes consistency in evaluation by reducing the variables used to gauge performance.

B.2.2 Requisite Knowledge and Skills. In addition to these three components, the JPR describes requisite knowledge and skills. As the term *requisite* suggests, these are the necessary knowledge and skills the individual should have prior to being able to perform the task. Requisite knowledge and skills are the foundation for task performance.

B.2.3 Examples. With the components and requisites combined, a JPR might read similar to the following two examples.

B.2.3.1 Example: Fire Fighter I. Perform overhaul at a fire scene, given approved PPE, attack line, hand tools, flashlight, and an assignment, so that structural integrity is not compromised, all hidden fires are discovered, fire cause evidence is preserved, and the fire is extinguished.

(A) Requisite Knowledge. Knowledge of types of fire attack lines and water application devices for overhaul, water application methods for extinguishment that limit water damage, types of tools and methods used to expose hidden fire, dangers associated with overhaul, signs of area of origin or signs of arson, and reasons for protection of fire scene.

(B) Requisite Skills. The ability to deploy and operate an attack line; remove flooring, ceiling, and wall components to expose void spaces without compromising structural integrity; apply water for maximum effectiveness; expose and extinguish hidden fires in walls, ceilings, and subfloor spaces; recognize and preserve signs of area of origin and arson; and evaluate for complete extinguishment.

B.2.3.2 Example: Fire and Life Safety Educator II. Prepare a written budget proposal for a specific program or activity, given budgetary guidelines, program needs, and delivery expense projections, so that all guidelines are followed and the budget identifies all program needs.

(A) Requisite Knowledge. Knowledge of budgetary process; governmental accounting procedures; federal, tribal, state, and local laws; organizational bidding process; and organization purchase requests.

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(B) Requisite Skills. The ability to estimate project costs; complete budget forms; requisition/purchase orders; collect, organize, and format budgetary information; complete program budget proposal; and complete purchase requests.

B.3 Potential Uses for JPRs.

B.3.1 Certification. JPRs can be used to establish the evaluation criteria for certification at a specific job level. When used for certification, evaluation should be based on the successful completion of the JPRs.

The evaluator would verify the attainment of requisite knowledge and skills prior to JPR evaluation. Verification could be through documentation review or testing.

The individual seeking certification would be evaluated on completion of the JPRs. The individual would perform the task and be evaluated based on the evaluation parameters and performance outcomes. This performance-based evaluation is based on practical exercises for psychomotor skills and written examinations for cognitive skills.

Psychomotor skills are those physical skills that can be demonstrated or observed. Cognitive skills cannot be observed but rather are evaluated on how an individual completes the task (process-oriented) or on the task outcome (product-oriented).

Performance evaluation requires that individuals be given the tools, equipment, or materials listed in the JPR in order to complete the task.

B.3.2 Curriculum Development and Training Design and Evaluation. The statements contained in this document that refer to job performance were designed and written as JPRs. Although a resemblance to instructional objectives might be present, these statements should not be used in a teaching situation until after they have been modified for instructional use.

JPRs state the behaviors required to perform specific skills on the job, as opposed to a learning situation. These statements should be converted into instructional objectives with behaviors, conditions, and degree to be measured within the educational environment.

While the differences between JPRs and instructional objectives are subtle in appearance, their purposes differ. JPRs state what is necessary to perform the job in practical and actual experience. Instructional objectives, on the other hand, are used to identify what students must do at the end of a training session and are stated in behavioral terms that are measurable in the training environment.

By converting JPRs into instructional objectives, instructors would be able to clarify performance expectations and avoid confusion caused by the use of statements designed for purposes other than teaching. Instructors would be able to add jurisdictional elements of performance into the learning objectives as intended by the developers.

Requisite skills and knowledge could be converted into enabling objectives, which would help to define the course content. The course content would include each item of the requisite knowledge and skills ensuring that the course content supports the terminal objective.

B.3.2.1 Example: Converting a Fire Fighter I JPR into an Instructional Objective. The instructional objectives are just two of several instructional objectives that would be written to support the terminal objective based on the JPR.

JPR: Perform overhaul at a fire scene, given approved PPE, attack line, hand tools, flashlight, and an assignment, so that structural integrity is not compromised, all hidden fires are discovered, fire cause evidence is preserved, and the fire is extinguished.

Instructional Objective (Cognitive): The Fire Fighter I will identify and describe five safety considerations associated with structural integrity compromise during overhaul as part of a written examination.

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Instructional Objective (Psychomotor): The Fire Fighter I will demonstrate the designed use of tools and equipment during overhaul to locate and extinguish hidden fires without compromising structural integrity.

B.3.2.2 Example: Converting a Fire and Life Safety Educator II JPR into an Instructional Objective. The instructional objectives are just two of several instructional objectives that would be written to support the terminal objective based on the JPR.

JPR: Prepare a written budget proposal for a specific program or activity, given budgetary guidelines, program needs, and delivery expense projections, so that all guidelines are followed and the budget identifies all program needs.

Instructional Objective (Cognitive): The Fire and Life Safety Educator II will list and describe the bidding process for the purchase of a published program using budgetary guidelines, program needs, and the guidelines established by local organizational procedures as part of a written examination.

Instructional Objective (Psychomotor): The Fire and Life Safety Educator II will lead in the purchase of a specific fire and life safety educational program by following the bidding process to completion, using local organizational guidelines, including budgetary procedures, program needs, and delivery expense projections.

B.4 Other Uses for JPRs.

While the professional qualifications standards are used to establish minimum JPRs for qualification, they have been recognized as guides for the development of training and certification programs, as well as a number of other potential uses.

These areas might include the following:

(1) *Employee Evaluation/Performance Critiquing.* The professional qualifications standards can be used as a guide by both the supervisor and the employee during an evaluation. The JPRs for a specific job define tasks that are essential to perform on the job, as well as the evaluation criteria to measure completion of the tasks.
(2) *Establishing Hiring Criteria.* The professional qualifications standards can be helpful in a number of ways to further the establishment of hiring criteria. The authority having jurisdiction (AHJ) could simply require certification at a specific job level, for example, Fire Fighter I. The JPRs could also be used as the basis for pre-employment screening to establish essential minimal tasks and the related evaluation criteria. An added benefit is that individuals interested in employment can work toward the minimal hiring criteria at local colleges.
(3) *Employee Development.* The professional qualifications standards can be practical for both the employee and the employer in developing a plan for the employee's growth within the organization. The JPRs and the associated requisite knowledge and skills can be used as a guide to determine additional training and education required for the employee to master the job or profession.
(4) *Succession Planning.* Succession planning addresses the efficient placement of individuals into jobs in response to current needs and anticipated future needs. A career development path can be established for targeted employees to prepare them for growth within the organization. The JPRs and requisite knowledge and skills could then be used to develop an educational path to aid in the employee's advancement within the organization or profession.
(5) *Establishing Organizational Policies, Procedures, and Goals.* The professional qualifications standards can be functional for incorporating policies, procedures, and goals into the organization or agency.

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B.5 Bibliography.

Annett, J., and N. E. Stanton, *Task Analysis*. London and New York: Taylor and Francis, 2000.

Brannick, M. T., and E. L. Levine, *Job Analysis: Methods, Research, and Applications for Human Resource Management in the New Millennium.* Thousand Oaks, CA: Sage Publications, 2002.

Dubois, D. D., *Competency-Based Performance Improvement: A Strategy for Organizational Change.* Amherst, MA: HRD Press, 1999.

Fine, S. A., and S. F. Cronshaw, *Functional Job Analysis: A Foundation for Human Resources Management (Applied Psychology Series).* Mahwah, NJ: Lawrence Erlbaum Associates, 1999.

Gupta, K., C. M. Sleezer (editor), and D. F. Russ-Eft (editor), *A Practical Guide to Needs Assessment.* San Francisco: Jossey-Bass/Pfeiffer, 2007.

Hartley, D. E., *Job Analysis at the Speed of Reality.* Amherst, MA: HRD Press, 1999.

Hodell, C., *ISD from the Ground Up: A No-Nonsense Approach to Instructional Design*, 3rd edition. Alexandria, VA: American Society for Training & Development, 2011.

Jonassen, D. H., M. Tessmer, and W. H. Hannum, *Task Analysis Methods for Instructional Design.* Mahwah, NJ: Lawrence Erlbaum Associates, 1999.

McArdle, G., *Conducting a Needs Analysis* (Fifty-Minute Book). Boston: Crisp Learning, 1998.

McCain, D. V., *Creating Training Courses (When You're Not a Trainer).* Alexandria, VA: American Society for Training & Development, 1999.

NFPA 1001, *Standard for Fire Fighter Professional Qualifications*, 2013 edition.

NFPA 1035, *Standard for Fire and Life Safety Educator, Public Information Officer, Youth Firesetter Intervention Specialist, and Youth Firesetter Program Manager Professional Qualifications*, 2015 edition.

Phillips, J. J., *In Action: Performance Analysis and Consulting.* Alexandria, VA: American Society for Training & Development, 2000.

Phillips, J. J., and E. F. Holton III, *In Action: Conducting Needs Assessment.* Alexandria, VA: American Society for Training & Development, 1995.

Robinson, D. G., and J. C. Robinson (Eds.), *Moving from Training to Performance: A Practical Guidebook.* Alexandria, VA: American Society for Training & Development; San Francisco: Berett-Koehler, 1998.

Schippmann, J.S., *Strategic Job Modeling: Working at the Core of Integrated Human Resources*. Mahwah, NJ: Lawrence Erlbaum Associates, 1999.

Shepherd, A., *Hierarchical Task Analysis*. London and New York: Taylor and Francis, 2000.

Zemke, R., and T. Kramlinger, *Figuring Things Out: A Trainer's Guide to Needs and Task Analysis*. New York: Perseus Books, 1993.

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ANNEX

C

An Overview of JPRs for Hazardous Materials/WMD Response Personnel

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

C.1 Hazardous Materials/WMD Response Personnel.

The matrices shown in Table C.1 are included to provide the user of the standard with an overview of the JPRs and the progression of the various levels found in the document. They are intended to assist the user of the document with the implementation of the requirements and the development of training programs using the JPRs.

***TABLE C.1** Overview of JPRs for Hazardous Materials/WMD Response Personnel*

Awareness	*Operations*	*Technician*
4.2 Recognize and identify the hazardous materials/WMD and hazards involved in a hazardous materials/WMD incident, given a hazardous materials/WMD incident and approved reference sources, so that the presence of hazardous materials/WMD is recognized and the materials and their hazards are identified.	5.2 Identify the scope of the problem at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment, policies and procedures, and approved reference sources, so that container types, materials, location of any release, and surrounding conditions are identified, hazard information is collected, the potential behavior of a material and its container is identified, and the potential hazards, harm, and outcomes associated with that behavior are identified.	7.2.1 Classify hazardous materials/WMD and verify the presence and concentrations of hazardous materials through detection, monitoring, and sampling at a hazardous materials/WMD incident, given a hazardous materials/WMD incident with released identified and unidentified hazardous materials; an assignment in an incident action plan (IAP); policies and procedures; approved resources; detection and monitoring equipment, and personal protective equipment (PPE), so that PPE is selected and used; hazardous materials/WMD are classified by their basic hazard categories; the presence of hazardous materials is verified; the concentrations of hazardous materials in the atmosphere are determined; signs of exposure in victims and responders are recognized and identified; samples of solids, liquids, and gases are collected; results of detection and monitoring equipment are read, interpreted, recorded, and communicated; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; personnel using the detection, monitoring, and sampling equipment, as well as the equipment, are decontaminated; detection, monitoring, and sampling equipment is maintained according to manufacturers' recommendations; and detection, monitoring, and sampling operations are reported and documented.

(Continues)

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TABLE C.1 *Continued*

Awareness	*Operations*	*Technician*
4.3 Isolate the hazard area and deny entry at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, policies and procedures, and approved reference sources, so that the hazard area is isolated and secured, personal safety procedures are followed, hazards are avoided or minimized, and additional people are not exposed to further harm.	5.3 Identify the action options for a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment, policies and procedures, approved reference sources, and the scope of the problem, so that response objectives, action options, safety precautions, suitability of approved personal protective equipment (PPE) available, and emergency decontamination needs are identified.	7.2.2 Collect and interpret hazard and response information at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, approved reference sources, and approved tools and equipment, so that hazard and response information is collected, interpreted, and communicated.
4.4 Initiate required notifications at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, policies and procedures, and approved communications equipment, so that the notification process is initiated and the necessary information is communicated.	5.4 Perform assigned tasks at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment with limited potential of contact with hazardous materials/WMD, policies and procedures, the scope of the problem, approved tools, equipment, and PPE, so that protective actions and scene control are established and maintained, on-scene incident command is described, evidence is preserved, approved PPE is selected and used in the proper manner; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; assignments are completed; and gross decontamination of personnel, tools, equipment, and PPE is conducted in the field.	7.2.3 Assess the condition of a container and its closures at a hazardous materials/WMD incident, given an incident involving hazardous materials/WMD; an assignment in an IAP; policies and procedures; the scope of the incident; identity of material(s) involved and their hazards, including results of detection, monitoring, and sampling; a container with required markings; and approved resources and PPE, so that PPE is selected and used; the container and its closures are inspected; the type of damage to the container and closures is identified; the type of stress on the container is identified; the level of risk associated with container and closure damage and stress is identified; safety procedures are followed; hazards are avoided or minimized; personnel, tools, and equipment are decontaminated; and a description of the condition of the container and its closures is communicated.

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TABLE C.1 Continued

Awareness	*Operations*	*Technician*
	5.5 Perform emergency decontamination at a hazardous materials/WMD incident, given a hazardous materials/WMD incident that requires emergency decontamination; an assignment; scope of the problem; policies and procedures; and approved tools, equipment, and PPE for emergency decontamination, so that emergency decontamination needs are identified, approved PPE is selected and used, exposures and personnel are protected, safety procedures are followed, hazards are avoided or minimized, emergency decontamination is set up and implemented, and victims and responders are decontaminated.	7.2.4 Predict the behavior of the hazardous materials/WMD involved in a hazardous materials/WMD incident, given an incident involving multiple hazardous materials/WMD; an assignment in an IAP; policies and procedures; physical and chemical properties of the materials involved; results of detection, monitoring, and sampling; condition of the container (damage and stress); surrounding conditions; and approved reference sources, so that the behavior of each hazardous materials/WMD container and its contents is identified, the reactivity issues and hazards of the combined materials are identified, and a description of the likely behavior of the hazards is communicated.
	5.6 Evaluate and report the progress of the assigned tasks for a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment, policies and procedures, status of assigned tasks, and approved communication tools and equipment, so that the effectiveness of the assigned tasks is evaluated and communicated to the supervisor, who can adjust the IAP as needed.	7.2.5 Estimate the potential outcomes at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, the likely behavior of the container and its contents, and approved resources and equipment, so that the concentrations of materials within the endangered area are measured or predicted; physical, health, and safety hazards within the endangered area are identified; areas of potential harm in the endangered area are identified; potential outcomes within the endangered area are identified; and potential outcomes are communicated.
		7.3.1 Develop and recommend to the incident commander or hazardous materials officer response objectives and action options at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis, including incident-related information, life safety risks, environmental risks, and property risks; available resources; and policies and procedures, so that response objectives are identified for the incident and action options are identified for each response objective. 7.3.2 Select the PPE ensemble required for a given response option at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, results of the incident analysis, response objectives and options for the incident, approved references, and policies and procedures, so that required PPE is identified for each response option.

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TABLE C.1 Continued

Awareness	Operations	Technician
		7.3.3 Select the decontamination method for a given response option at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, results of the incident analysis, response objectives and options for the incident, available resources, and policies and procedures, so that a decontamination method to minimize the hazards for each response option is identified and the equipment required to implement the decontamination procedure is identified.
		7.3.4 Develop a plan of action for a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, results of the incident analysis, response objectives and options for the given incident, available resources, and policies and procedures, so that the tasks and resources required to meet the response objectives are identified, specified response objectives and response options are addressed, plan is consistent with the emergency response plan and policies and procedures, and plan is within the capability of available personnel, PPE, and control equipment.
		7.4.1 Perform assigned hazardous materials branch or group functions within the incident command system (ICS) at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; policies and procedures, including an emergency response plan and standard operating procedures; the IAP; and approved resources, so that the assigned functions within the hazardous materials branch or group are completed.
		7.4.2 Don, work in, and doff PPE at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, results of the incident analysis, response objectives and options for the incident, and PPE ensembles as identified in the IAP, so that PPE is selected, inspected, donned, worked in, decontaminated, and doffed; safety procedures are followed; hazards are avoided or minimized; equipment is maintained and stored properly; and the use of PPE is reported and documented.
		7.4.3.1 Perform product control techniques at a hazardous materials/WMD incident, given a hazardous materials/WMD incident with release of product, an assignment in an IAP, results of the incident analysis, policies and procedures for product control, response objectives and options for the incident, and approved tools, equipment, control agents, and PPE, so that an approved product control technique is selected and implemented; the product is controlled; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; personnel, victims, tools, and equipment used are decontaminated; tools and equipment are inspected and maintained; and product control operations are reported and documented.

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TABLE C.1 Continued

Awareness	*Operations*	*Technician*
		7.4.3.2 Control leaks from containers and their closures at a hazardous materials/WMD incident, given three scenarios, including (1) a leak from a bulk or nonbulk pressure container or its closures, (2) a leak from a nonbulk liquid container or its closures, and (3) a leak from a bulk liquid container or its closures; an assignment in an IAP; results of the incident analysis; policies and procedures for controlling leaks from containers and/or their closures; and approved tools, equipment, and PPE, so that an approved product control technique is selected and used; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; hazard monitoring is completed; leaks are controlled (confined or contained); emergency responders, tools, and equipment used are decontaminated; tools and equipment are inspected and maintained; and product control operations are reported and documented. 7.4.3.3 Overpack damaged or leaking nonbulk and radioactive materials containers at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; a loaded damaged or leaking container; a suitable overpack container; policies and procedures; and approved tools, equipment, and PPE, so that an approved overpack technique is selected; the damaged or leaking container is placed into a suitable overpack and the overpack is closed, marked, and labeled; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; emergency responders, tools, and equipment are decontaminated; tools and equipment are inspected and maintained; and product control operations are reported and documented. 7.4.3.4 Transfer liquids from leaking nonpressure containers at a hazardous materials/WMD incident, given a hazardous materials/WMD incident; an assignment in an IAP; results of the incident analysis; a leaking nonpressure container and a recovery container; policies and procedures for transferring liquids from leaking nonpressure containers; and approved tools, equipment, and PPE, so that an approved product transfer method is selected and used; approved PPE is selected and used; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; hazard monitoring is completed; the containers are bonded and grounded; product is transferred to the recovery container; emergency responders, tools, and equipment used are decontaminated; tools and equipment are inspected and maintained; and product control operations are reported and documented.

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TABLE C.1 *Continued*

Awareness	*Operations*	*Technician*
		7.4.4.1 Perform mass decontamination for ambulatory and nonambulatory victims at a hazardous materials/WMD incident, given a hazardous materials/WMD incident requiring mass decontamination; an assignment in an IAP; results of the incident analysis; policies and procedures; and approved PPE, tools, and equipment, so that PPE is selected and used; a mass decontamination procedure is selected, set up, implemented, evaluated, and terminated; victims are decontaminated; exposures and personnel are protected; safety procedures are followed; hazards are avoided or minimized; personnel, tools, and equipment are decontaminated; and mass decontamination operations are reported and documented. 7.4.4.2 Establish and implement technical decontamination in support of entry operations and for ambulatory and nonambulatory victims at a hazardous materials/WMD incident, given a hazardous materials/WMD incident requiring technical decontamination; an assignment in an IAP; results of the incident analysis; policies and procedures; and approved PPE, tools, and equipment, so that approved PPE is selected and used; a technical decontamination procedure is selected, set up, implemented, evaluated, and terminated; victims are decontaminated; safety procedures are followed; hazards are avoided or minimized; if contaminated, personnel, tools, and equipment are decontaminated; and all reports and documentation of technical decontamination operations are completed.
		7.5 Evaluate and report the progress of assigned tasks at a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, current incident conditions, response options and actions taken, and approved communication equipment, so that the actual behavior of material and container is compared to that predicted, the effectiveness of response options and actions in accomplishing response objectives is determined, modifications to the response options and actions are made, and the results are communicated. 7.6 Terminate a hazardous materials/WMD incident, given a hazardous materials/WMD incident, an assignment in an IAP, policies and procedures, operational observations of response operations (incident information), and approved forms for documentation and reporting, so that assistance in scheduled incident debriefings and critiques is provided, and incident operations are reported and documented.

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ANNEX

D

National Fallen Firefighters Foundation

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

D.1 16 Firefighter Life Safety Initiatives. In 2004, the NFFF held an unprecedented gathering of the fire service leadership when more than 200 individuals assembled in Tampa, Florida to focus on the troubling question of how to prevent line-of-duty deaths and injuries. Every year approximately 100 fire fighters lose their lives in the line of duty in the United States; about one every 80 hours. Every identifiable segment of the fire service was represented and participated in the Summit.

The first Firefighter Life Safety Summit marked a significant milestone, because it not only gathered all the segments of the fire service behind a common goal but it also developed the "16 Firefighter Life Safety Initiatives." The summit attendees agreed that the "16 Firefighter Life Safety Initiatives" serve as a blueprint to reduce line-of-duty deaths and injuries. In 2014, a second Life Safety Summit was held and more than 300 fire service leaders gathered. At the second Firefighter Life Safety Summit, the "16 Firefighter Life Safety Initiatives" were reaffirmed as being relevant to reduce line-of-duty deaths and injuries.

NFFF "16 Firefighter Life Safety Initiatives."

(1) Define and advocate the need for a cultural change within the fire service relating to safety; incorporating leadership, management, supervision, accountability and personal responsibility.
(2) Enhance the personal and organizational accountability for health and safety throughout the fire service.
(3) Focus greater attention on the integration of risk management with incident management at all levels, including strategic, tactical, and planning responsibilities.
(4) All fire fighters must be empowered to stop unsafe practices.
(5) Develop and implement national standards for training, qualifications, and certification (including regular recertification) that are equally applicable to all fire fighters based on the duties they are expected to perform.
(6) Develop and implement national medical and physical fitness standards that are equally applicable to all fire fighters, based on the duties they are expected to perform.
(7) Create a national research agenda and data collection system that relates to the initiatives.
(8) Utilize available technology wherever it can produce higher levels of health and safety.
(9) Thoroughly investigate all fire fighter fatalities, injuries, and near misses.

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(10) Grant programs should support the implementation of safe practices and/or mandate safe practices as an eligibility requirement.
(11) National standards for emergency response policies and procedures should be developed and championed.
(12) National protocols for response to violent incidents should be developed and championed.
(13) Fire fighters and their families must have access to counseling and psychological support.
(14) Public education must receive more resources and be championed as a critical fire and life safety program.
(15) Advocacy must be strengthened for the enforcement of codes and the installation of home fire sprinklers.
(16) Safety must be a primary consideration in the design of apparatus and equipment.

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ANNEX

E

Informational References

E.1 Referenced Publications.

The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

E.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2013 edition.
NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, 2017 edition.
NFPA 1001, *Standard for Fire Fighter Professional Qualifications*, 2013 edition.
NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2013 edition.
NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services,* 2013 edition.
NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies and CBRN Terrorism Incidents*, 2016 edition.
NFPA 1992, *Standard on Liquid Splash–Protective Ensembles and Clothing for Hazardous Materials Emergencies*, 2017 edition.
NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*, 2017 edition.

E.1.2 Other Publications.

E.1.2.1 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Emergency Response Guidebook, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, 2016.
Hazardous Materials Marking, Labeling and Placarding Guide, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation.
Standard Operating Safety Guides, Environmental Protection Agency, June 1992.
Title 18, U.S. Code, Section 2332a, "Use of Weapons of Mass Destruction."
Title 29, Code of Federal Regulations, Parts 1910.119–1910.120.
Title 49, Code of Federal Regulations, Part 173.431.

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E.1.2.2 Other Publications. "16 Firefighter Life Safety Initiatives," National Fallen Firefighters Foundation, Emmitsburg, MD, 2004, reaffirmed 2014.

E.2 Informational References.

The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

E.2.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2016 edition.
NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2017 edition.
NFPA 30, *Flammable and Combustible Liquids Code*, 2015 edition.
NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.
NFPA 306, *Standard for the Control of Gas Hazards on Vessels*, 2014 edition.
NFPA 424, *Guide for Airport/Community Emergency Planning*, 2013 edition.
NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2013 edition.
NFPA 600, *Standard on Facility Fire Brigades*, 2015 edition.
NFPA 1031, *Standard for Professional Qualifications for Fire Inspector and Plan Examiner*, 2014 edition.
NFPA 1404, *Standard for Fire Service Respiratory Protection Training*, 2013 edition.
NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 2013 edition.
NFPA 1561, *Standard on Emergency Services Incident Management System*, 2014 edition.
NFPA 1581, *Standard on Fire Department Infection Control Program*, 2015 edition.
NFPA 1951, *Standard on Protective Ensembles for Technical Rescue Incidents*, 2013 edition.
Hazardous Materials/Weapons of Mass Destruction Response Handbook, 2008.
Wright, Charles J., "Managing the Hazardous Materials Incident," Section 13, Chapter 8 in *Fire Protection Handbook*, 20th edition, 2008.

E.2.2 American Chemistry Council Publications. American Chemistry Council, 700 Second St., NE, Washington, DC 20002.

Recommended Terms for Personal Protective Equipment, 1985.

E.2.3 Annex B Bibliography.

Annett, J., and N. E. Stanton, *Task Analysis*. London and New York: Taylor and Francis, 2000.
Brannick, M. T., and E. L. Levine, *Job Analysis: Methods, Research, and Applications for Human Resource Management in the New Millennium*. Thousand Oaks, CA: Sage Publications, 2002.
Dubois, D. D., *Competency-Based Performance Improvement: A Strategy for Organizational Change*. Amherst, MA: HRD Press, 1999.
Fine, S. A., and S. F. Cronshaw, *Functional Job Analysis: A Foundation for Human Resources Management (Applied Psychology Series)*. Mahwah, NJ: Lawrence Erlbaum Associates, 1999.
Gupta, K., C. M. Sleezer (editor), and D. F. Russ-Eft (editor), *A Practical Guide to Needs Assessment.* San Francisco: Jossey-Bass/Pfeiffer, 2007.
Hartley, D. E., *Job Analysis at the Speed of Reality*. Amherst, MA: HRD Press, 1999.
Hodell, C., *ISD from the Ground Up: A No-Nonsense Approach to Instructional Design*, 3rd edition. Alexandria, VA: American Society for Training & Development, 2011.
Jonassen, D. H., M. Tessmer, and W. H. Hannum, *Task Analysis Methods for Instructional Design*. Mahwah, NJ: Lawrence Erlbaum Associates, 1999.

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McArdle, G., *Conducting a Needs Analysis* (Fifty-Minute Book). Boston: Crisp Learning, 1998.

McCain, D. V., *Creating Training Courses (When You're Not a Trainer).* Alexandria, VA: American Society for Training & Development, 1999.

NFPA 1001, *Standard for Fire Fighter Professional Qualifications*, 2013 edition.

NFPA 1035, *Standard for Fire and Life Safety Educator, Public Information Officer, Youth Firesetter Intervention Specialist, and Youth Firesetter Program Manager Professional Qualifications*, 2015 edition.

Phillips, J. J., *In Action: Performance Analysis and Consulting.* Alexandria, VA: American Society for Training & Development, 2000.

Phillips, J. J., and E. F. Holton III, *In Action: Conducting Needs Assessment.* Alexandria, VA: American Society for Training & Development, 1995.

Robinson, D. G., and J. C. Robinson (Eds.), *Moving from Training to Performance: A Practical Guidebook.* Alexandria, VA: American Society for Training & Development; San Francisco: Berett-Koehler, 1998.

Schippmann, J.S., *Strategic Job Modeling: Working at the Core of Integrated Human Resources*. Mahwah, NJ: Lawrence Erlbaum Associates, 1999.

Shepherd, A., *Hierarchical Task Analysis*. London and New York: Taylor and Francis, 2000.

Zemke, R., and T. Kramlinger, *Figuring Things Out: A Trainer's Guide to Needs and Task Analysis*. New York: Perseus Books, 1993.

E.2.4 API Publications. American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.

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.

E.2.5 ASTM Publication. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA, 19428-2959.

ASTM E2458, *Standard Practices for Bulk Sample Collection and Swab Sample Collection of Visible Powders Suspected of Being Biothreat Agents from Nonporous Surfaces,* 2010.

ASTM E2601, *Standard Practice for Radiological Emergency Response*, 2008.

ASTM E2601, *Standard Practice for Radiological Emergency Response*, 2008.

ASTM E2770, *Standard Guide for Operational Guidelines for Initial Response to a Suspected Biothreat Agent*, 2010.

E.2.6 IMO Publications. International Maritime Organization, 4 Albert Embankment, London SEI 7SR, UK.

Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code).

International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code).

International Code for the Construction and Equipment of Ships Carrying Dangerous Liquefied Gases in Bulk (IGC Code).

International Maritime Dangerous Goods Code (IMDG Code).

MARPOL 73/78.

Safety of Life at Sea (SOLAS).

E.2.7 NRT Publications. U.S. National Response Team, Washington, DC 20593, www.nrt.org.

NRT-1, *Hazardous Materials Emergency Planning Guide*, 2001.

E.2.8 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

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Department of Homeland Security (DHS), Responder Knowledge Base. http://www.rkb.mipt.org

Emergency Planning and Community Right-to-Know Act, Public Law 99-499, 1986.

Emergency Response Guidebook, U.S. Department of Transportation, 2008 edition.

National Incident Management System (NIMS), *Site Safety and Control Plan* (formerly ICS 208 HM)

National Incident Management System (NIMS), March 2004, http://www.fema.gov/nims/nims_compliance.shtm#nimsdocument.

National Preparedness Goal, March 2005, https://www.llis.dhs.gov.

National Preparedness Guidance, April 2005, https://www.llis.dhs.gov.

National Response Plan, December 2004, http://www.dhs.gov/Xprepresp/committees/editorial_0566.shtm.

National Toxicology Program, U.S. Department of Health and Human Services, *9th Report on Carcinogens*, Washington, DC, 2011.

NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, October 1985.

NIOSH Pocket Guide to Chemical Hazards, DHHS (NIOSH) Publication No. 2007-149, September 2007: http://www.cdc.gov/niosh.npg.

Target Capabilities List, May, 2005, https://www.llis.dhs.gov.

Title 29, Code of Federal Regulations, Part 1910.134.

Title 33, Code of Federal Regulations, "Navigation and Navigable Waters." 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 46, Code of Federal Regulations, "Shipping."

Title 49, Code of Federal Regulations, Parts 170–180.

Universal Task List, May 2005, https://www.llis.dhs.gov.

E.2.9 Other Publications. Association of American Railroads, *Field Guide to Tank Cars*, Bureau of Explosions, Pueblo, CO 2010.

Grey, G. L., et al., *Hazardous Materials/Waste Handling for the Emergency Responder*, Fire Engineering Publications, New York, 1989.

International Chamber of Shipping Tanker Safety Guide (chemicals), 3rd edition, Witherby and Co., London, 1990.

International Chamber of Shipping Tanker Safety Guide (liquefied gases), 2nd edition, Witherby and Co., London, 1996.

International Safety Guide for Oil Tankers and Terminals, Witherby Seamanship International, 5th edition, 2006.

Maslansky, C. J., and Stephen P. Maslansky, *Air Monitoring Instrumentation*, New York, Van Nostrand Reinhold, 1993.

Noll, G., and M. Hildebrand, *Hazardous Materials: Managing the Incident*, 3rd edition, Fire Protection Publications, Stillwater, OK, 2005.

OCIMF *Ship to Ship Transfer Safety Guide* (petroleum) (liquefied gases), 3rd edition, International Chamber of Shipping OCIMF, London, 1997.

Provisional Categorization of Liquid Substances, MEPC.2/Circ.10 2004, International Maritime Organization, London.

SIGTTO *Liquefied Gas Handling Principles on Ships and in Terminals*, 3rd edition, McGuire and White (Authors) London, 2000, Witherby Seamanship International.

U.S. Army Research, Development, and Engineering Command (RDECOM), Edgewood Chemical Biological Center, Emergency Response, Command, and Planning Guidelines (various documents) for terrorist incidents involving chemical and biological agents. http://www.ecbc.army.mil/hld.

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E.3 References for Extracts in Informational Sections.

NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2013 edition.

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PART V

Glossary

Part V of this handbook contains all Chapter 3 definitions from the following documents:

- NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents* (2018 edition)
- NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents* (2018 edition)
- NFPA 475, *Recommended Practice for Organizing, Managing, and Sustaining a Hazardous Materials/Weapons of Mass Destruction Response Program* (2017 edition)
- NFPA 1072, *Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications* (2017 edition)

The definitions are either NFPA primary definitions, or they have been established by the NFPA Technical Committee on Hazardous Materials Response Personnel for specific use in all four documents charged to the committee: NFPA 472, NFPA 473, NFPA 475, and NFPA 1072.

This part of the handbook can be used to refer to all definitions from the four hazardous materials response documents in one location. The terms help the user understand the competencies or qualifications presented throughout the handbook. The committee has made every effort to present definitions of terms that are commonly used and widely understood by emergency responders. The phrase *hazardous materials/weapons of mass destruction* is abbreviated to the acronym *HM/WMD* or the term *hazmat/WMD* throughout the commentary of this handbook.

To view the original definition chapters, see Chapter 3 of each of the four documents in Parts I through IV of this handbook, or visit www.nfpa.org.

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Glossary of Terms for NFPA 472, NFPA 473, NFPA 475, and NFPA 1072

The definitions contained in this part of the handbook apply to the terms used in NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*; NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents*; NFPA 475, *Recommended Practice for Organizing, Managing, and Sustaining a Hazardous Materials/Weapons of Mass Destruction Response Program*; and NFPA 1072, *Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications.*

NFPA Official Definitions.

Approved. Acceptable to the authority having jurisdiction.

Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

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.

Recommended Practice. A document that is similar in content and structure to a code or standard but that contains only nonmandatory provisions using the word "should" to indicate recommendations in the body of the text.

Shall. Indicates a mandatory requirement.

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

Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

General Definitions

Action Options. Tasks responders perform to meet response objectives at hazardous materials/weapons of mass destruction (WMD) incidents.

Advanced Life Support (ALS). Emergency medical treatment beyond basic life support level as defined by the medical authority having jurisdiction in conjunction with the American Heart Association guidelines.

Emergency Medical Technician — Intermediate (EMT-I). An individual who has completed a course of instruction that includes selected modules of the U.S. Department of Transportation National Standard EMT — Paramedic curriculum and who holds an intermediate level EMT-I or EMT-C certification from the authority having jurisdiction.

Emergency Medical Technician — Paramedic (EMT-P). An individual who has successfully completed a course of instruction that meets or exceeds the requirements of the U.S. Department of Transportation National Standard EMT — Paramedic curriculum and who holds an EMT-P certification from the authority having jurisdiction.

Medical Director. An individual who plans and directs all aspects of an organization's or system's medical policies and programs, including operations and offline (protocol) and online medical direction (direct communication consultation); is responsible for strategic clinical relationships with other physicians; oversees the development of the clinical content in materials; ensures all clinical programs are in compliance; writes and reviews research publications appropriate to support clinical service offerings; requires an active degree in medicine with specialty experience or training in emergency and disaster medical mitigation, administration, and management; relies on experience and judgment to plan and accomplish goals; and typically coordinates with the incident command.

Medical Team Specialist. Any health care provider or medically trained specialist acting under the authority of the medical director, and within the context of the National Incident Management System, authorized to act as the medical point of contact for an incident.

Allied Professional. That person who possesses the knowledge, skills, and technical competence to provide assistance

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in the selection, implementation, and evaluation of tasks at a hazardous materials/weapons of mass destruction (WMD) incident.

Analyze. The process of identifying a hazardous materials/weapons of mass destruction (WMD) problem and determining likely behavior and harm within the training and capabilities of the emergency responder.

Area of Specialization

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

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

Assignment. A job, task, role, or function to be performed that can come from a supervisor or other established authority as determined by the authority having jurisdiction (AHJ) (e.g., hazardous materials technician, allied professional, emergency response plans, or standard operating procedures).

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

Basic Life Support (BLS). Emergency medical treatment at a level as defined by the medical authority having jurisdiction in conjunction with American Heart Association guidelines.

Emergency Care First Responder (ECFR). An individual who has successfully completed the specified emergency care first responder course developed by the U.S. Department of Transportation and who holds an ECFR certification from the authority having jurisdiction.

Emergency Medical Technician — Ambulance/Basic (EMT-A/B). An individual who has successfully completed an EMT-A or EMT-B curriculum developed by the U.S. Department of Transportation or equivalent and who holds an EMT-A/B certification from the authority having jurisdiction.

CANUTEC. The Canadian Transport Emergency Centre, operated by Transport Canada that provides emergency response information and assistance on a 24-hour basis for responders to hazardous materials/weapons of mass destruction (WMD) incidents.

CHEMTREC. 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/weapons of mass destruction (WMD) incidents.

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

Components of Emergency Medical Service (EMS) System. The parts of a comprehensive plan to treat an individual in need of emergency medical care following an illness or injury.

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**.**

Consensus Standard. A standard that has been adopted and promulgated by a nationally recognized standards-producing organization under procedures whereby it can be determined that persons interested and affected by the scope or provisions of the standard have reached substantial agreement on its adoption; was formulated in a manner that afforded an opportunity for diverse views to be considered; and has been designated as such.

Container. A receptacle, piping, or pipeline used for storing or transporting material of any kind; synonymous with "packaging" in transportation.

Bulk Transportation Containers. Containers, including transport vehicles, having a liquid capacity of more than 119 gal (450 L), a solids capacity of more than 882 lb (400 kg), or a compressed gas water capacity of more than 1001 lb (454 kg) that are either placed on or in a transport vehicle, or vessel or are constructed as an integral part of the transport vehicle, including **a.** Cargo tanks including nonpressure tanks — MC-306/DOT-406 or equivalent, low-pressure tanks — MC-307-DOT-407 or equivalent, corrosive liquid tanks — MC-312/DOT-412 or equivalent, high-pressure tanks — MC-331 or equivalent, and cryogenic tanks — MC-338 or equivalent **b.** Portable tanks such as intermodal tanks, including nonpressure tanks, pressure tanks, cryogenic tanks, and tube modules **c.** Tank cars including nonpressure tank cars, pressure tanks cars, and cryogenic tank cars **d.** Ton containers.

Facility Storage Tanks. Atmospheric and low-pressure storage tanks, pressurized storage tanks, and cryogenic storage tanks.

Intermediate Bulk Containers (IBCs). Pressure, nonpressure, and cryogenic rigid or flexible portable containers, other than cylinders or portable tanks, designed for mechanical lifting.

Nonbulk Containers. Containers, including bags, boxes, carboys, cylinders, drums, and Dewar flasks for cryogenic liquids, having a liquid capacity of 119 gal (450 L) or less, a solids capacity of 882 lb (400 kg) or less, or a compressed gas water capacity of 1001 lb (454 kg) or less.

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Pipeline. A length of pipe including pumps, valves, flanges, control devices, strainers, and/or similar equipment for conveying fluids.

Piping. Assemblies of piping components used to convey, distribute, mix, separate, discharge, meter, control, or snub fluid flows. Piping also includes pipe-supporting elements but does not include support structures such as building frames, bents, foundations, or any other equipment excluded from this standard.

Radioactive Materials Containers. Excepted packaging, industrial packaging, Type A, Type B, and Type C packaging for radioactive materials.

Contaminant. A hazardous material, or the hazardous component of a weapon of mass destruction (WMD), that physically remains on or in people, animals, the environment, or equipment, thereby creating a continuing risk of direct injury or a risk of exposure.

Contamination. The process of transferring a hazardous material, or the hazardous component of a weapon of mass destruction (WMD), from its source to people, animals, the environment, or equipment, that can act as a carrier.

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

Control. The procedures, techniques, and methods, used in the mitigation of hazardous materials/weapons of mass destruction (WMD) incidents, including containment, extinguishment, and confinement.

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

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).

Extinguishment. To cause to cease burning.

Control Zones. The areas at hazardous materials/weapons of mass destruction (WMD) incidents within an established/controlled perimeter that are designated based upon safety and the degree of hazard.

Cold Zone. The control zone of hazardous materials/weapons of mass destruction (WMD) incidents that contains the incident command post and such other support functions as are deemed necessary to control the incident.

Decontamination Corridor. The area usually located within the warm zone where decontamination is performed.

Hot Zone. The control zone immediately surrounding hazardous materials/weapons of mass destruction (WMD) incidents, which extends far enough to prevent adverse effects of hazards to personnel outside the zone and where only personnel who are trained, equipped, and authorized to do the assigned work are permitted to enter.

Warm Zone. The control zone at hazardous materials/weapons of mass destruction (WMD) incidents where personnel and equipment decontamination and hot zone support takes place.

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

Decision Point. A predefined circumstance in which the emergency responder is required to determine a path forward to maximize responder safety and public protection.

Decontamination. The physical and/or chemical process of reducing and preventing the spread and effects of contaminants to people, animals, the environment, or equipment involved at hazardous materials/weapons of mass destruction (WMD) incidents.

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

Gross Decontamination. A phase of the decontamination process where significant reduction of the amount of surface contamination takes place as soon as possible, most often accomplished by mechanical removal of the contaminant or initial rinsing from handheld hose lines, emergency showers, or other nearby sources of water.

Mass Decontamination. The process of reducing or removing surface contaminants from large numbers of victims in potentially life-threatening situations in the fastest time possible.

Technical Decontamination. The planned and systematic process of reducing contamination to a level that is as low as reasonably achievable.

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

Demonstrate. To show by actual performance.

Describe. To explain verbally or in writing using standard terms recognized by the hazardous materials/weapons of mass destruction (WMD) response community.

Detection and Monitoring Equipment. Instruments and devices used to detect, classify, or quantify materials.

Dispersal Device. Any weapon or combination of mechanical, electrical, or pressurized components that is designed, intended, or used to cause death or serious bodily injury through the release, dissemination, or impact of toxic or poisonous chemicals or their precursors, biological agent, toxin or vector, or radioactive material.

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Emergency Medical Services (EMS). The provision of treatment, such as first aid, cardiopulmonary resuscitation, basic life support, advanced life support, and other prehospital procedures, including transportation, of patients.

Emergency Response Guidebook (ERG). The reference book, written in plain language, to guide emergency responders in their actions at the incident scene, specifically the Emergency Response Guidebook from the U.S. Department of Transportation; Transport Canada; and the Secretariat of Transportation and Communications, Mexico.

EMS Hazardous Materials (EMS/Hazardous Materials/WMD) Responder.

Emergency Medical Services Responders to Hazardous Materials/Weapon of Mass Destruction at the ALS Level (ALS Responder). Operations-level responders who are ALS certified, assigned EMS mission-specific responsibilities at hazardous materials/WMD incidents, and are trained to meet all competencies of NFPA 472, Chapters 4 and 5, and all competencies for the assigned responsibilities in NFPA 473, Chapters 4 and 5.

Emergency Medical Services Responders to Hazardous Materials/Weapon of Mass Destruction at the BLS Level (BLS Responder). Operations-level responders who are BLS certified, assigned EMS mission-specific responsibilities at hazardous materials/WMD incidents, and are trained to meet all competencies of NFPA 472, Chapters 4 and 5, and all competencies for the assigned responsibilities in NFPA 473, Chapter 4.

Endangered Area. The actual or potential area of exposure associated with the release of a hazardous material/weapon of mass destruction (WMD).

Evaluate. The process of assessing or judging the effectiveness of a response operation or course of action within the training and capabilities of the emergency responder.

Evidence Preservation. Deliberate and specific actions taken with the intention of protecting potential evidence from contamination, damage, loss, or destruction.

Example. An illustration of a problem serving to show the application of a rule, principle, or method (e.g., past incidents, simulated incidents, parameters, pictures, and diagrams).

Exposure. The process by which people, animals, the environment, property, and equipment are subjected to or come in contact with a hazardous material/weapon of mass destruction (WMD).

Exposures. The people, animals, environment, property, and equipment that might become exposed at a hazardous materials/weapons of mass destruction (WMD) incident.

Fissile Material. Material whose atoms are capable of nuclear fission (capable of being split).

Field Screening. A set of procedures, to include at a minimum nondestructive field testing to identify the presence of explosive devices, radiological materials, flammable materials, volatile organic compounds (VOC), strong oxidizers, fluorides, or corrosives, that serves as a protective safety measure prior to collection, transportation, and laboratory analysis.

Fusion Center. A focal point within the state and local environment for the receipt, analysis, gathering, and sharing of threat-related information between the federal government and state, local, tribal, territorial (SLTT), and private sector partners.

Harm. Adverse effect created by being exposed to a hazard.

Hazard. Capable of causing harm or posing an unreasonable risk to life, health, property, or the environment.

Hazardous Material. Matter (solid, liquid, or gas) or energy that when released is capable of creating harm to people, the environment, and property, including weapons of mass destruction (WMD) as defined in 18 U.S. Code, Section 2332a, as well as any other criminal use of hazardous materials, such as illicit labs, environmental crimes, or industrial sabotage.

Hazardous Materials Branch/Group. The function within an overall incident management system (IMS) that deals with the mitigation and control of the hazardous materials/weapons of mass destruction (WMD) portion of an incident.

Hazardous Materials Officer. The person who is responsible for directing and coordinating all operations involving hazardous materials/weapons of mass destruction (WMD) as assigned by the incident commander (IC).

Hazardous Materials Response Program (HMRP). A program designed to manage emergency preparedness issues (i.e., planning, prevention, response, recovery) associated with hazardous materials/weapons of mass destruction (WMD) within a jurisdiction.

Hazardous Materials Response Team (HMRT). An organized group of trained response personnel operating under an emergency response plan and applicable standard operating procedures who perform hazardous material technician level skills at hazardous materials/weapons of mass destruction (WMD) incidents.

Hazardous Materials Safety Officer. The person who works within an incident management system (IMS) (specifically, the hazardous materials branch/group) to ensure that recognized hazardous materials/weapons of mass destruction (WMD) safe practices are followed at hazardous materials/WMD incidents.

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

Incident. An emergency involving the release or potential release of hazardous materials/weapons of mass destruction (WMD).

Incident Analysis. The process of analyzing the risk at an incident by identifying the materials and containers involved, predicting the likely behavior of each container and its contents, and estimating the potential harm/outcomes associated with that behavior.

Incident Commander (IC). The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and the release of resources.

Incident Command System (ICS). A component of an incident management system (IMS) designed to enable effective and efficient on-scene incident management by integrating organizational functions, tactical operations, incident planning, incident logistics, and administrative tasks within a common organizational structure.

Incident Management System (IMS). A process 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 to include the incident command system (ICS), unified command, multiagency coordination system, training, and management of resources.

Job Performance Requirement (JPR).

A written statement that describes a specific job task, lists the items necessary to complete the task, and defines measurable or observable outcomes and evaluation areas for the specific task.

Laws. Legislative action by governmental bodies such as Congress, individual states, and local government that provides broad goals and objectives, sets mandatory dates for compliance, and establishes penalties for noncompliance.

Match. To provide with a counterpart.

Medical Control. The physician or designee providing direction for patient care activities in the prehospital setting.

Medical Surveillance. The ongoing process of medical evaluation of hazardous materials response team members and public safety personnel who respond to a hazardous materials incident.

Mission-Specific Competencies. The knowledge, skills, and judgment needed by operations-level responders who have completed the operations-level competencies and who are designated by the authority having jurisdiction (AHJ) to perform mission-specific tasks, such as decontamination, victim/hostage rescue and recovery, and evidence preservation and sampling.

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

Patient. Any person or persons requiring or requesting a BLS/ALS evaluation or intervention at the scene of a hazardous materials/WMD incident.

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

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

Personal Protective Equipment (PPE). The protective clothing and respiratory protective equipment provided to shield or isolate a person from the hazards encountered at hazardous materials/weapons of mass destruction (WMD) incident operations.

Plan.

Emergency Response Plan (ERP). A plan developed by the authority having jurisdiction (AHJ) with the cooperation of all participating agencies and organizations, including a jurisdiction with emergency responsibilities and those outside the jurisdiction who have entered into response/support agreements that identifies goals and objectives for that emergency type, agency roles, and overall strategies.

Incident Action Plan (IAP). An oral or written plan approved by the incident commander containing general objectives reflecting the overall strategy for managing an incident for a specific time frame and target location.

Site Safety and Control Plan. A site-specific safety document used within the incident command system (ICS) to organize information important to hazardous materials response operations.

Planned Response. The incident action plan, with the site safety and control plan, consistent with the emergency response plan and/or standard operating procedures for a specific hazardous materials/weapon of mass destruction (WMD) incident.

Predict. The process of estimating or forecasting the future behavior of a hazardous materials/weapons of mass destruction (WMD) container and/or its contents within the training and capabilities of the emergency responder.

Productivity and Quality of Life. A multidimensional concept that includes domains related to physical, mental, emotional, and social functioning and focuses on the impact that health status has on quality of life.

Protective Clothing. Equipment designed to protect the wearer from thermal hazards, hazardous materials, or from the hazardous component of a weapon of mass destruction contacting the skin or eyes.

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Ballistic Protective Clothing (BPC). An item of personal protective equipment that provides protection against specific ballistic threats by helping to absorb the impact and reduce or prohibit the penetration to the body from bullets and steel fragments from handheld weapons and exploding munitions.

Chemical-Protective Clothing (CPC). The ensemble elements (garment, gloves, and footwear) provided to shield or isolate a person from the hazards encountered during hazardous materials/WMD incident operations.

Liquid Splash–Protective Clothing. Multiple elements of compliant protective clothing and equipment products that when worn together provide protection from some, but not all, risks of hazardous materials/WMD emergency incident operations involving liquids.

Vapor-Protective Clothing. Multiple elements of compliant protective clothing and equipment that when worn together provide protection from some, but not all, risks of vapor, liquid-splash, and particulate environments during hazardous materials/WMD incident operations.

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

Structural Fire-Fighting Protective Clothing. The fire-resistant protective clothing normally worn by fire fighters during structural fire-fighting operations, which includes a helmet, coat, pants, boots, gloves, PASS device, and a fire-resistant hood to cover parts of the head and neck not protected by the helmet and respirator facepiece.

Protocol. A guideline for a series of sequential steps directing patient treatment.

Public Safety Sampling. The detection, monitoring, or collection of a material for the purposes of determining the hazards present and to guide public safety response decisions.

Qualified. Having knowledge of the installation, construction, or operation of apparatus and the hazards involved.

Radioactive Materials Containers. Excepted packaging, industrial packaging, Type A, Type B, and Type C packaging for radioactive materials.

Region. A geographic area that includes the local and neighboring jurisdiction for an EMS agency.

Regulations. Official rules created by government agencies that detail how something should be done.

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

Response. That portion of incident management in which personnel are involved in controlling hazardous materials/weapons of mass destruction (WMD) incidents.

Risk. The probability or threat of suffering harm or loss.

Risk-Based Response Process. Systematic process by which responders analyze a problem involving hazardous materials/weapons of mass destruction (WMD), assess the hazards, evaluate the potential consequences, and determine appropriate response actions based upon facts, science, and the circumstances of the incident.

Safety Data Sheet (SDS). Formatted information provided by chemical manufacturers and distributors of hazardous products that contains information about chemical composition, physical and chemical properties, health and safety hazards, emergency response, and waste disposal of the material.

Sampling. The process of selecting materials to analyze.

Scenario. A sequence or synopsis of actual or imagined events used in the field or classroom to provide information necessary to meet student competencies; can be based upon threat assessment.

SETIQ. The Emergency Transportation System for the Chemical Industry in Mexico that provides emergency response information and assistance on a 24-hour basis for responders to emergencies involving hazardous materials/weapons of mass destruction (WMD).

Specialist Employees.

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.

Specialist Employee B. That person who, in the course of his or her regular job duties, works with or is trained in the hazards of specific chemicals or containers within the individual's area of specialization.

Specialist Employee C. That person who responds to emergencies involving chemicals and/or containers within the organization's area of specialization.

Stabilization. The point in an incident when the adverse behavior of the hazardous material, or the hazardous component of a weapon of mass destruction (WMD), is controlled.

Standard Operating Guidelines (SOG). A written directive that establishes recommended strategies/concepts of emergency response to an incident.

Standard Operating Procedure (SOP). A written directive that establishes specific operational or administrative methods to be followed routinely for the performance of a task or for the use of equipment.

Surrounding Conditions. Conditions to be taken into consideration when identifying the scope of a hazardous materials/WMD incident, including but not limited to topography; land use, including utilities and fiber-optic cables; accessibility; weather conditions; bodies of water, including

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recharge ponds; public exposure potential; patient presentation; overhead and underground wires and pipelines; storm and sewer drains; possible ignition sources; adjacent land use such as rail lines, highways, and airports; and the nature and extent of injuries.

Termination. That portion of incident management after the cessation of tactical operations in which personnel are involved in documenting safety procedures, site operations, hazards faced, and lessons learned from the incident and include specifications for debriefing, post-incident analysis and critique in a specific sequence: critique, debriefing, and post-incident analysis.

Critique. An element of incident termination that examines the overall effectiveness of the emergency response effort and develops recommendations for improvement.

Debriefing. An element of incident termination that focuses on the following: (1) informing responders exactly what hazmat they were (possibly) exposed to and the signs and symptoms of exposure; (2) identifying damaged equipment requiring replacement or repair; (3) identifying equipment or supplies requiring specialized decontamination or disposal; (4) identifying unsafe work conditions; (5) assigning information-gathering responsibilities for a post-incident analysis.

Post-Incident Analysis. An element of incident termination that includes completion of the required incident reporting forms, determining the level of financial responsibility, and assembling documentation for conducting a critique.

UN/NA Identification Number. The four-digit number assigned to a hazardous material/weapon of mass destruction (WMD), which is used to identify and cross-reference products in the transportation mode.

Victim Prioritization and Patient Triage. Victim prioritization utilizes risk-based factors to establish an action plan for victim removal and eventual treatment. Patient triage is a clinical prioritization employed to maximize survival and to prioritize application of therapeutic modalities.

Weapon of Mass Destruction (WMD). (1) Any destructive device, such as any explosive, incendiary, or poison gas bomb, grenade, rocket having a propellant charge of more than four ounces, missile having an explosive or incendiary charge of more than one quarter ounce (7 grams), mine, or device similar to the preceding description; (2) any weapon involving toxic or poisonous chemicals; (3) any weapon involving a disease organism; or (4) any weapon that is designed to release radiation or radioactivity at a level dangerous to human life.

Radiological Weapons of Mass Destruction.

Improvised Nuclear Device (IND). An illicit nuclear weapon that is bought, stolen, or otherwise obtained from a nuclear state (i.e., a national government with nuclear weapons), or a weapon fabricated from fissile material that is capable of producing a nuclear explosion.

Radiation Dispersal Device (RDD). A device designed to spread radioactive material through a detonation of conventional explosives or other means.

Radiation Exposure Device (RED). A device intended to cause harm by exposing people to radiation without spreading radioactive material.

Operations Level Responders Definitions.

Agent-Specific Competencies. The knowledge, skills, and judgment needed by operations level responders who have completed the operations level competencies and who are designated by the authority having jurisdiction to respond to releases or potential releases of a specific group of WMD agents.

Mission-Specific Competencies. The knowledge, skills, and judgment needed by operations level responders who have completed the operations level competencies and who are designated by the authority having jurisdiction to perform mission-specific tasks, such as decontamination, victim/hostage rescue and recovery, evidence preservation, and sampling.

Operations Level Responders. Persons who respond to hazardous materials/weapons of mass destruction (WMD) incidents for the purpose of implementing or supporting actions to protect nearby persons, the environment, or property from the effects of the release.

Operations Level Responders Assigned to Disablement/Disruption of Improvised Explosives Devices (IED), Improvised WMD Dispersal Devices, and Operations at Improvised Explosive Laboratories. Persons, competent at the operations level, who are assigned to interrupt the functioning of improvised explosive devices (IED) and improvised WMD dispersal devices and to conduct operations at improvised explosive laboratories.

Operations Level Responders Assigned to Perform Air Monitoring and Sampling. Persons, competent at the operations level, who are assigned to implement air monitoring and sampling operations at hazardous materials/weapons of mass destruction (WMD) incidents.

Operations Level Responders Assigned to Perform Evidence Preservation and Sampling. Persons, competent at the operations level, who are assigned to preserve forensic evidence, take samples, and/or seize evidence at hazardous materials/weapons of mass destruction (WMD) incidents involving potential violations of criminal statutes or governmental regulations.

Operations Level Responders Assigned to Perform Mass Decontamination. Persons, competent at the operations

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level, who are assigned to implement mass decontamination operations at hazardous materials/weapons of mass destruction (WMD) incidents.

Operations Level Responders Assigned to Perform Product Control. Persons, competent at the operations level, who are assigned to implement product control measures at hazardous materials/weapons of mass destruction (WMD) incidents.

Operations Level Responders Assigned to Perform Technical Decontamination. Persons, competent at the operations level, who are assigned to implement technical decontamination operations at hazardous materials/weapons of mass destruction (WMD) incidents.

Operations Level Responders Assigned to Perform Victim Rescue/Recovery.

Persons, competent at the operations level, who are assigned to rescue and/or recover exposed and contaminated victims at hazardous materials/weapons of mass destruction (WMD) incidents.

Operations Level Responders Assigned to Respond to Illicit Laboratory Incidents. Persons, competent at the operations level, who, at hazardous materials/weapons of mass destruction (WMD) incidents involving potential violations of criminal statutes specific to the illegal manufacture of methamphetamines, other drugs, or weapons of mass destruction (WMD), are assigned to secure the scene, identify the laboratory/process, and preserve evidence.

Operations Level Responders Assigned Responsibilities for Biological Response. Persons, competent at the operations level, who, at hazardous materials/weapons of mass destruction (WMD) incidents involving biological materials, are assigned to support the hazardous materials technician and other personnel, provide strategic and tactical recommendations to the on-scene incident commander, serve in a technical specialist capacity to provide technical oversight for operations, and act as a liaison between the hazardous materials technician, response personnel, and other outside resources regarding biological issues.

Operations Level Responders Assigned Responsibilities for Chemical Response. Persons, competent at the operations level, who, at hazardous materials/weapons of mass destruction (WMD) incidents involving chemical materials, are assigned to support the hazardous materials technician and other personnel, provide strategic and tactical recommendations to the on-scene incident commander, serve in a technical specialist capacity to provide technical oversight for operations, and act as a liaison between the hazardous material technician, response personnel, and other outside resources regarding chemical issues.

Operations Level Responders Assigned Responsibilities for Radioactive Material Response. Persons, competent at the operations level, who, at hazardous materials/weapons of mass destruction (WMD) incidents involving radioactive materials, are assigned to support the hazardous materials technician and other personnel, provide strategic and tactical recommendations to the on-scene incident commander, serve in a technical specialist capacity to provide technical oversight for operations, and act as a liaison between the hazardous material technician, response personnel, and other outside resources regarding radioactive material issues.

Operations Level Responders Assigned to Use Personal Protective Equipment (PPE). Persons, competent at the operations level, who are assigned to use personal protective equipment (PPE) at hazardous materials/weapons of mass destruction (WMD) incidents.

Hazardous Materials Technician. A person who responds to hazardous materials/weapons of mass destruction (WMD) incidents using a risk-based response process by which they analyze a problem involving hazardous materials/WMD, plan a response to the problem, implement the planned response, evaluate progress of the planned response and adjust accordingly, and assist in terminating the incident.

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

Hazardous Materials Technician with a Flammable Gases Bulk Storage Specialty. A person who, in incidents involving flammable gas bulk storage tanks, provides support to the hazardous materials technician and other personnel, provides strategic and tactical recommendations to the on-scene incident commander, provides oversight for fire control and product removal operations, and acts as a liaison between technicians, fire-fighting personnel, and other resources.

Hazardous Materials Technician with a Flammable Liquids Bulk Storage Specialty. A person who, in incidents involving bulk flammable liquid storage tanks and related facilities, provides support to the hazardous materials technician and other personnel, provides strategic and tactical recommendations to the on-scene incident commander, provides oversight for fire control and product removal operations, and acts as a liaison between technicians, response personnel, and outside resources.

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

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Hazardous Materials Technician with a Marine Tank and Non-Tank Vessel Specialty. A person who provides technical support pertaining to marine tank and non-tank vessels, provides oversight for product removal and movement of damaged marine tank and non-tank vessels, and acts as a liaison between the hazardous materials technician and other outside resources.

Hazardous Materials Technician with a Radioactive Material Specialty. A person who provides support to the hazardous materials technician and other personnel, uses radiation detection instruments, manages the control of radiation exposure, conducts hazards assessment, and acts as a liaison between hazardous materials technicians at incidents involving radioactive materials.

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

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PART VI

Supplements

The five supplements included in this part of the *Hazardous Materials/Weapons of Mass Destruction Response Handbook* provide additional information about key areas of concern for hazardous materials responders. The supplements are not part of the official NFPA documents or the commentary but present additional information for the reader. The following are the supplements included in this edition of the handbook:

1. First Responder Considerations/Guidelines for Gas and Petroleum Well Control and Geophysical Incidents, or Incidents at Petroleum Drilling Sites
2. Fire Protection Research Foundation Project Summaries on Items of Interest to First Responders
3. Risk-Based Selection of Chemical Protective Clothing
4. Fire Service Cancer: NFPA Is On It!

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SUPPLEMENT 1

First Responder Considerations/ Guidelines for Gas and Petroleum Well Control and Geophysical Incidents, or Incidents at Petroleum Drilling Sites

Editor's Note: *In recent years, there has been an energy renaissance in North America regarding removing energy resources efficiently from difficult underground or hard-to-reach areas. These activities have included conventional drilling operations, and workover and natural gas exploration including hydraulic fracturing, or "fracking." Fracking is the process of drilling and injecting fluid at high pressures to break shale rock to release those energy potentials. Some states and local municipalities are granting permits allowing for well development and production at various sites. As safe as these sites may be considered, incidents involving workers, equipment, and product will require emergency responders to be called to the scene. Many local emergency responders have limited training or firsthand experience with oil or gas well incidents. The situations presented at these incidents are challenging to emergency responders.*

This supplement and its revision was prepared by Mike Montgomery, Michael Hildebrand, Danny Snell, Thomas Miller, Ken Uzeloc, Gerald Bimle, Craig Konkle, David Martin, Dr. Matthew Minson, Gregory Noll, and Freddy Gebhardt.

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INTRODUCTION

Increased demands for energy around the world, combined with improved technology for locating and drilling oil and gas, have resulted in thousands of new wells being drilled in rural areas, as well as in and around urban areas. Additionally, urban areas have spread to encompass areas that may have legacy wells or abandoned or orphaned upstream energy sector sites. For the purposes of this document, the discussion will address the "upstream" sector. Many of these wells are deeper and more complex and have much higher operating pressures than in the past. In areas where new wells are being drilled, many local emergency responders have limited training or firsthand experience dealing with oil or gas well incidents. Further, well sites may rely on contractors with minimal training and little experience on the hazards present in these operations.

Two types of well incidents that can occur are well control incidents and incidents involving surface equipment. Each incident type poses different hazards and risks and requires a different approach to emergency response. Emergency responders must understand the hazards and risks found during all phases in the life of a well site, including site selection and preparation, well construction, completions, and production.

HAZARDS AND RISKS

Issues related to an incident from exploration through production operations can include human casualty, property damage, and environmental considerations that are unique to this category of threat. Hazards may include flammable, toxic, and/or corrosive hazardous materials; confined spaces and elevated worker positions; large and heavy machinery

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and rotating or reciprocating equipment; container breaches; automatic controls; geophysical deterioration of the well site and surrounding area; and nontraditional fire-fighting requirements. In some operations, explosives and radioactive sources may also be encountered.

Oil and gas well emergencies can produce significant risks to emergency responders. Operational risks and challenges of well site emergencies can include the following:

- Liquid fires and emanations of unpredictable hazardous materials involving surface equipment, the wellhead and its equipment, and other well site components. Container breaches and large surface fires can result. Incidents involving the wellhead and its equipment cannot be closed in, extinguished, or neutralized by first responders. Aggressive, offensive tactics and a lack of awareness of the unique category of risk can place first responders and others at risk of serious injury or death.
- Many emergencies involving just surface equipment may be resolved quickly, but well control emergencies are usually long-term events involving specialized preparations, equipment, and tactics. Bringing the incident to a safe outcome requires the assistance of technical specialists, including the operator of the well and/or a well control specialist, often from outside the local community.
- Responsible well operators will have a Well Control Emergency Response Plan (WCERP) that will contain valuable information for the fire incident commander, emergency management, and law enforcement. Many responders, however, are not aware of this resource.
- Oil and gas wells operate under very high pressure.
- Oil and gas well fires generate significant radiant heat and can injure first responders at significant distances from the point source.
- Some wells and related storage vessels may variably and unpredictably generate toxic hydrogen sulfide (H_2S) gas along with other materials and present risks to immediate and downwind exposures, potentially requiring public protective actions (i.e., sheltering or evacuation) in populated areas.
- Well sites typically have limited access, and rural well sites are often serviced by only one road that is rarely a paved road. Some well sites are considerable distances from a public road, making egress an issue for both site access and emergency escape.
- Water supplies for exposure protection can be a problem due to limited egress and remote access. Well sites are not equipped with fire hydrants and typically require the use of fire department tankers, industry water haulers, stationary "frac tanks" and water impoundment basins to maintain a consistent and reliable fire flow. However, containment ponds near well sites should be used only if safe; these often contain well wastes that, if used to control a fire, may worsen the environmental effects of the incident.

As an emergency responder, using a risk-based response approach at these emergencies is critical to the safety of workers, responders, and the public. The size-up process should consider whether the problem involves the well itself or auxiliary surface equipment that will also be found on the well site. Consider the following points:

- First, dealing with a well control emergency is extremely dangerous, technically complex, and beyond the capabilities of most public safety responders. This scenario will require the expertise of both well control and environmental protection specialists. On the other hand, surface emergencies that do not involve the well are often similar to hazardous materials incidents elsewhere; the primary risk to the responder is lack of familiarity with well site operations and proximity to heavy machinery. Establishing unified command with the company supervisor (also known as the "company man" in the oil and gas industry) or his or her designee will be critical in determining what emergency response strategies and tactics may be implemented, and the additional, specialized resources that may be required.
- Second, remember the basics — establish a hot zone, account for all personnel, and identify the nature of the problem, especially if the well itself is involved. Knowledge of what is causing the problem in a well control situation will be important to the well control specialists who will respond to the situation. The cause will be communicated to them by the operator of the well.

KEY RESPONSE PRINCIPLE

The actions of emergency responders cannot make the "downhole" or subsurface problems go away. Responders should focus on public safety activities and hazards occurring at the surface that are unrelated to the well proper, and leave the well control and subsurface issues and concerns to the well control specialists.

WELL SITE ACCESS

First responders may not be able to see the well site from the main road. Typically, when a drilling rig is in the area, the drilling company places a rig sign at the intersection of the main road and the turn-off to the lease road. If there are multiple turns in the road, numerous signs will be used to identify the rig location.

Often the roads to some well sites are unimproved and can be more difficult to travel in inclement weather. Many well sites are at clearings in forests or in an area with

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minimal room to operate. A well site may have a restricted right-of-way that further limits access. Responders may also encounter locked gates, livestock, and other obstacles.

When taking a 911 call, it is important to know which specific rig is the call-out objective. Dispatchers should try to get the exact geographic coordinates (latitude and longitude) of the well site from the caller. For example, a drilling company may have two or more rigs working near each other. Rig signs will usually depict a rig name or number (e.g., XYZ Rig #24) so that first responders know which rig is involved in the incident.

In some remote areas of the world, local first responders may not even have over-the-road access to well sites — the only means of access may be by helicopter, barge, or other methods. In these cases, emergency response is typically beyond the capabilities of local responders and requires specialized emergency response contractors for even the initial response. It is critical that emergency responders be aware of these operations; an incident will most likely have logistical effects on the community in postincident medical care, and staging, feeding, and housing emergency response crews.

APPROACH AND POSITIONING

When responding, be aware of the weather, wind direction, and wind speed, along with risks to aircraft overflight. On arrival at a well site incident, *do not block the road* or rig access with your vehicle(s). Responders should always consider the need for access and egress of other emergency vehicles such as ambulances, mobile water supplies, and special response units. Try to avoid scene congestion with unnecessary vehicles on site; staging should be established as soon as possible. Implement proper environmental monitoring to establish recon safely. Once you reach the site, turn onto the pad and get well out of the way so that other emergency response vehicles can access or egress the site. Position your vehicle so that it points in the direction of an escape pathway in case an emergency withdrawal from the site is required.

MAKING FIRST CONTACT ON SITE

In addition to the site supervisor or company man, there may be contractors, vendors, or suppliers at the well site, depending on the nature of the well site operation (e.g., exploration vs. production). During non-drilling or operational hours, there may be only contract security on a well site. It is not uncommon for there to be no personnel on-site during the production phase or if the well is capped until its use at a future date.

Locating the site supervisor will help determine the nature of the problem. The supervisor usually can be found in the office in the trailer near the main entrance to the well site pad if this area is safe. The site supervisor will be familiar with and have a copy of the WCERP. Ideally, when wells are being drilled the WCERP should be provided to the authority having jurisdiction (AHJ), as access during the event may be difficult. Similarly, the AHJ or incident commander should request a copy of the WCERP, ideally before an incident occurs.

If the site supervisor is a victim or is not available on-site, responders may have to seek guidance from third parties that are knowledgeable about the type of drilling or well site operations at the site and the hazards involved. In documented cases responders have become victims by entering a well site in haste without doing a thorough size-up and being burned by flash fires or overcome by toxic vapors or substances.

WELL BLOWOUTS

During drilling, pressure control of the well is maintained using compressed air or precisely concocted drilling mud, which balances out the pressure at the bottom of the well. In the event of a sudden kick from a high-pressure pocket of gas that cannot be controlled with standard well control techniques, the well can blowout and ignite. The absence of fire does *not* indicate a safe situation. If the situation involves fire, emergency responders should not attempt to kill a blowout or extinguish the well fire. Dealing with a blowout is extremely dangerous, technically complex, and beyond the capabilities of most public safety responders. This scenario will require the expertise of well control specialists.

SURFACE EQUIPMENT INCIDENTS

During drilling, drilling fluid, or “mud,” circulates from the wellbore and into surface tanks, or mud pits. Equipment mounted on or beside the mud pits is used to recondition the mud before it is pumped downhole again. The absence of fire does *not* indicate a safe situation. Hydrogen sulfide (H_2S), corrosive mud chemicals, and diesel fuel are common hazards found at many well site locations. Tanks on the well site may contain other drilling wastes or by-products and can develop internal pressures that, if not properly addressed, may pose hazards to responders and workers on the well site. If the situation involves a surface equipment fire, emergency responders should be extremely cautious and attempt to extinguish the fire only if they have the training and equipment to do so without undue risk to themselves or others. Depending on the location, fuel sources used to supply drilling rigs may include diesel fuel, liquefied natural gas, and natural gas supplied by nearby pipelines.

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EMERGENCY RESPONDER OBJECTIVES

The following well site emergency response objectives may fall within the scope of what can be achieved safely to support the oil or gas operator during an emergency.

- *Scene safety*. Assess the scene thoroughly for primary and secondary threats and hazards, and evaluate immediate risks to lives and property.
- *Accountability of personnel on-site*. Emergency responders must check in with the site supervisor, if available, on arrival to determine the total number of personnel on site that day. Most drilling rigs and completion projects underway will have "sign in" and "sign out" procedures so that the number of personnel on-site can be quickly determined if an emergency occurs. Determining a head count, who is missing, and where they were assigned can initially guide search and rescue priorities. If there is no established accountability system in use, responders should initiate one in accordance with their standard operating procedures. Periodic personnel accountability reports should be used to ensure personnel accountability throughout the incident.
- *Problem identification*. Learn if the well involves special considerations such as hydrogen sulfide gas or other toxic gases. Take special precautions to protect personnel and perform air monitoring downwind. Determine whether there are unusual hazards on-site or stored in vehicles, such as explosives or radioactive materials. If so, identify the service company engineer and check with him or her to see what action is recommended.
- *Site management and control*. Implement site management and control procedures as you would in dealing with any hazardous materials emergency. If hydrogen sulfide is involved, public protective action strategies should be implemented with consideration that it may be a long time before the situation is under control. Coordinate information closely with local emergency management and law enforcement agencies. If a railroad crosses the affected area, the railroad should be notified and updated with progress reports. Consider requesting a no-fly zone to prevent secondary casualties and to preserve the three-dimensional safety environment.
- Never access the reserve pit or water impoundment without permission or guidance from the company representative. Some of these impoundments or pits may have water or hydrocarbons in them that could escalate the emergency and contaminate fire-fighting equipment.

WELL SITE RESPONSE STRATEGY

If a response organization is in an area with active or potential well sites, it should develop SOPs/SOGs for responses to those sites and their incident potentials. Agencies should strive to meet with operators and drillers before emergencies to develop positive working relationships and establish contact protocols for use in the event of an emergency. The following documents provide valuable information on risk assessment, necessary responder skills, and developing and managing a response program:

- NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*
- NFPA 475, *Recommended Practice for Organizing, Managing, and Sustaining a Hazardous Materials/Weapons of Mass Destruction Response Program*
- NFPA 1072, *Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications*

The first priority at a well site emergency is the safety of first responders, well site work crews, the public, and others. An accurate size-up and identification of hazardous materials and conditions are required. If possible, search and rescue efforts should be conducted to account for all well site workers and visitors. Development of an incident action plan (IAP) is critical for safe on-scene operations.

After search and rescue, the following are first responder priorities at a well site:

1. *Establish a safe perimeter.* If possible, use remote environmental monitoring instruments to minimize risk to first responders.
2. *Maintain the integrity of access and egress corridors*.
3. ***If possible***, *obtain the WCERP and conduct an initial size-up of the situation and scene.*
4. *Identify and address immediate threats to the public*.
5. *Protect the well site environment*. *Never attempt to extinguish a blowout.* Hoselines and master streams might have some useful application to support rescue and surface fire operations, but they are not effective on a blowout due to the high pressures and temperatures involved. Applying large amounts of water in and around the well site often turns the area into a mud pit, thereby making it more difficult for operators and well control specialists to access the site and perform their well control tasks.
6. *Prevent conflagrations from spreading to nearby wildland and forest areas, buildings, or highways*. Establishing and maintaining a water supply may be difficult at many well sites. Responders will need to establish incident priorities based on available resources.
7. *Protect exposures.* Consider wetting down building roofs, proximate vessels, or flammable areas as a precaution if the water runoff will not affect the well site.

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8. *Protect the environment*. Establish berms, ditches, or surface impoundments to control fire runoff water and other contaminants.

SOURCES FOR INFORMATION

1. NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2018 edition.
2. NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2018 edition.
3. NFPA 475, *Recommended Practice for Organizing, Managing, and Sustaining a Hazardous Materials/Weapons of Mass Destruction Response Program,* 2017 edition.
4. NFPA 497, *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*, 2017 edition.
5. NFPA 1072, *Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications*, 2017 edition.
6. API RP 1174, *Recommended Practice for Onshore Hazardous Liquid Pipeline Emergency Preparedness and Response.*
7. Well Site Emergency First Responder Training Program, Pennsylvania State Fire Academy, Lewistown, PA, October 2010. www.osfc.state.pa.us.
8. CFD Course 002-H2S Alive, Calgary Fire Department, Alberta, Canada.
9. BC Oil & Gas Commission, *Emergency Management Manual.*
10. "Well Control Emergency Response Plan," Travelers Insurance. https://www.Travelers.Com/Iw-Documents/Business-Insurance/Og-Emergency-Resp-Plan-Cp-7529.Pdf
11. "Emergency Response to Well Site Incidents — Casual or Catastrophic?" Patrick Pauly, Mid-Atlantic Safety and Health Alliance, http://mashainc.net/2016Conf/MASHA%202016.Emer.Resp.Well.Site.Incidents.Pauly.pdf

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SUPPLEMENT 2

Fire Protection Research Foundation Project Summaries on Items of Interest to First Responders

This supplement provides an overview of projects from the Fire Protection Research Foundation (FPRF) that will interest first responders. The FPRF plans, manages, and communicates research on a range of fire safety issues in collaboration with scientists and laboratories around the world. A research affiliate of the National Fire Protection Association (NFPA), the FPRF was established in response to a growing need for research to better inform NFPA's expanding body of codes and standards. The FPRF has facilitated major research programs (both domestic and international in scope) that address industry challenges in multiple areas including detection and signaling, hazardous materials, electrical safety, fire suppression, storage of commodities, fire fighter protective clothing and equipment, and other issues. For more information visit: www.nfpa.org/foundation.

HIGH HAZARD FLAMMABLE TRAINS: ON-SCENE INCIDENT COMMANDER FIELD GUIDE

Executive Summary

This guide provides tactical guidance and information for the on-scene incident commander responsible for the management of bulk flammable liquid emergencies involving high-hazard flammable trains (HHFT), with a focus on petroleum crude oil and ethanol. The application and use of a risk-based response (RBR) methodology for both planning and response purposes are critical success factors in the successful management of an HHFT incident.

To employ risk-based processes at HHFT incidents safely and effectively, emergency responders initially must be qualified at first responder–operations and on-scene incident commander levels, and have an understanding of the following:

- Physical (i.e., how it will behave) properties and chemical (i.e., how it will harm) properties of the materials involved
- Design and construction of the DOT-111/CPC-1232 and DOT-117 specification tank cars and their potential behaviors in an emergency
- Knowledge of strategic and tactical considerations to be evaluated at a hazardous materials incident
- Selection, application, and use of large-flow water and fire-fighting foam streams at train derailments involving Class B fuels

Among the key factors that incident commanders operating at HHFT incidents must know are the following:

- HHFT incidents are large, complex, and lengthy response scenarios that will generate many response issues beyond those normally seen by most local-level response agencies. Although emergency response operations may be limited to less than 24 hours, postresponse cleanup and recovery operations may continue for weeks.
- Unified command will be critical for the successful management of the incident.
- The initial container stress/breach/release behaviors are influenced directly by the speed of the train, the kinetic energy associated with the derailment, and the properties of the commodities being transported. After the initial mechanical stress caused by derailment forces, subsequent container stress/breach/release behaviors will be thermal or fire focused.
- Incident growth will generally follow the following process:
  - (a) Thermal stress from the initial fire on the tank cars. The level of thermal stress will be influenced by the presence and integrity of thermal blanket protection.
  - (b) Subsequent activation of tank car pressure relief devices.
  - (c) Continued thermal stress on adjoining tank cars from a combination of both pool fires and pressure-fed fires from pressure relief devices (PRDs).
  - (d) Increasing probability of container failures through heat-induced tears (HITs).
  - (e) Subsequent fire and radiant heat exposures on surrounding exposures when explosive release events occur.

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- HITs have been observed on tank cars containing both crude oil and ethanol. Tank car failures can occur at any time. Heat induced tearing has occurred within 20 minutes of the derailment and as long as 10 or more hours following the initial derailment.
- Based on an analysis of about 25 HHFT incidents, there is a very limited window of opportunity in the early stages of an incident for implementing offensive fire control strategies. There is a higher probability that response options will be limited to defensive strategies (e.g., exposure protection) to minimize the spread of the problem or nonintervention strategies (i.e., no actions) until equilibrium is achieved. Using an RBR process will be critical for this reassessment process.
- Fires will continue to burn off the available flammable liquid fuel until such time that the incident achieves a level of equilibrium and is no longer growing in size or scope. An analysis of historical incidents shows that equilibrium at a major incident may not occur for about 8–12 hours. There is a lower probability of additional HITs or tank car breaches once equilibrium is achieved.
- Once the equilibrium phase is achieved, responders may choose to switch to an offensive fire control strategy.

Additional Information

The final report can be found on the FPRF web site at www.nfpa.org/hazmatic.

REFERENCE

G. Noll and M. Hildebrand, "High Hazard Flammable Train (HHFT) On-Scene Incident Commander Field Guide," FPRF Report, FPRF-2016-12, July 2016.

LIQUID PETROLEUM PIPELINE EMERGENCIES: ON-SCENE INCIDENT COMMANDER FIELD GUIDE

Executive Summary

This guide provides tactical guidance and information for the on-scene incident commander responsible for the management of pipeline emergencies involving flammable liquids, including crude oil and refined petroleum products. The application and use of an RBR methodology for both planning and response purposes are critical success factors in the successful management of these pipeline incidents.

To use risk-based processes at pipeline emergencies safely and effectively, emergency responders must initially be qualified at the first responder–operations and on-scene incident commander levels, and have an understanding of the following:

- Physical (i.e., how it will behave) properties and chemical (i.e., how it will harm) properties of the materials involved.
- Basic design, construction, and operations of liquid petroleum product pipelines, and their potential behavior in an emergency scenario.
- Knowledge of the strategic and tactical considerations to be evaluated at a hazardous materials incident.
- Selection, application, and use of large-flow fire-fighting foam streams at pipeline emergencies involving Class B fuels.

Among the key factors that incident commanders operating at flammable liquid pipeline emergencies must know are the following:

- Flammable liquid pipeline incidents are often large, complex, and lengthy response scenarios that will generate many response issues beyond those normally seen by most local-level response agencies. Although emergency response operations may be limited to less than 24 hours, postresponse cleanup and recovery operations may continue for weeks.
- Unified command will be critical for the successful management of the incident.
- Proactive relationships and joint planning, training, and exercises conducted before an incident between emergency responders, communities, and pipeline operators have been beneficial in the safe and effective management of pipeline emergencies.
- Analysis of past pipeline incidents shows that communication in the first critical minutes between emergency responders and pipeline operators is critical to determining the outcome. Incomplete, inadequate, or unclear communications can result in a delayed response and can contribute to increased levels of product loss and damage.
- Flammable and combustible liquids are the most common products transported by liquid transmission pipelines. These include refined products such as gasoline, aviation gas and jet fuel, and distillates, such as home heating and diesel fuels. Intermediate products (i.e., not completely refined), such as naphtha or gas oil, may also be shipped by pipeline between refineries for final processing.
- Liquid petroleum pipeline systems can transport different grades or types of petroleum products through the same pipeline at different times in batches or through a batch system.
- Pipeline flows and conditions are monitored through computerized pipeline monitoring systems at the pipeline control center (PCC). These include supervisory control and data acquisition systems (SCADA) and

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volume balance systems that monitor the status of gates and valves, product flow, pressures, and other operating characteristics. Monitoring systems allow pipeline personnel to monitor pipeline operations and initiate emergency shutdown procedures in the event of a pipeline release.

- Emergency responders should know the following about pipelines:
  - The locations of pipelines in the response area and potential high-risk areas.
  - The name of the pipeline operator and how to contact them.
  - Product(s) transported by the pipeline.
  - Shut-off valve locations. They help emergency responders to determine how quickly the release can be stopped. **CAUTION:** Emergency responders must NEVER attempt to isolate pipeline valves on transmission pipelines unless under the direction of pipeline operations personnel.
  - The worst-case discharge or scenario.
- Depending on the pipeline, the PCC can control the pipeline flow remotely and actuate remote pipeline valves in the event of a pipeline release.
  - Even with actions taken by the PCC to isolate the pipeline flow, depending on the spacing between shutoff valves, a significant backflow of product may continue from the pipeline breach.
  - When dealing with transmission pipelines, the backflow may continue for several hours. Critical variables will include the location of the pipeline release, surrounding topography, and the proximity of both automatic and manually activated valves and pump stations to the incident location.
  - The incident commander must verify, through pipeline industry technical specialists, that the closest automatic and manually operated valves are isolated.
- While the exact incident time line will vary based on local and regional resources and response times, key incident management benchmarks within hour 1 will include the following:
  - Conducting an incident size-up, identification of critical incident factors, and development of initial incident objectives
  - Establishment of command and an incident command post (ICP)
  - Establishment of a unified command organization
- When contacting the pipeline operator, provide the following information:
  - Your name, location, organization name, and phone number
  - Location of the incident
  - Presence of smoke, fire, or spill
  - Extent of damage
  - Topography
  - Weather conditions
- Structural fire-fighting clothing (SFC) and positive-pressure, self-contained breathing apparatus (SCBA) should be the initial level of personal protective equipment (PPE) selected. For scenarios that have a low probability of fire, such as spill control and clean-up activities including decontamination, chemical splash protective clothing and a compatible NIOSH-approved respirator may be required, depending on the concentrations and properties of the contaminant.
- Spill Control Priorities. If product is being released from a liquid petroleum pipeline:
  1. Keep it confined to a specific land area if safely possible.
  2. Keep the product out of the water.
  3. If the product is in the water, protect downstream water intakes and sensitive areas.

Class B foam agents are the recommended extinguishing agents for flammable liquid fires. These can include aqueous film-forming foams (AFFF) for use on hydrocarbons (e.g., crude oil, refined products) and alcohol-resistant AFFF concentrates for use on both hydrocarbons and polar solvents (e.g., ethanol).

Additional Information

The final report can be found on the FPRF web site at www.nfpa.org/hazmatic.

REFERENCE

G. Noll and M. Hildebrand, "Liquid Petroleum Pipeline Emergencies On-Scene Incident Commander Field Guide," FPRF Report, FPRF-2016-13, July 2016.

FOAM APPLICATION RATES FOR HIGH HAZARD FLAMMABLE TRAIN FIRES

Executive Summary

There has been a rising number of large-scale fires involving high-hazard flammable trains (HHFTs), some with catastrophic consequences. HHFT fires are typically complex scenarios consisting of flowing fuel, pools, and saturated substrates. HHFT events have the potential to evolve into major conflagrations in which heat from initial fires can produce cascading effects due to increased thermal stress on surrounding railcars, leading to HITs, pressure relief venting, and additional breaches.

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Class B fire-fighting foams, more specifically alcohol-resistant aqueous film-forming foams (AR-AFFFs), are the industry standard for mitigating and combatting flammable liquid pool fire-type hazards. First responders currently default to using an area-based method defined in NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, for calculating foam application rates and quantities needed to fight HHFT fires. The values determined using NFPA 11 may not be accurate when considering the complex, three-dimensional, and potentially highly obstructed and limited access nature of these fires. Specifically, three-dimensional flowing fuel fires are extremely challenging to extinguish using solely Class B foams. In any case, the values determined using the area-based method from NFPA 11 need to be verified through comparison with actual incident data and applicable research.

The FPRF initiated this program to develop a database of HHFT derailments and the associated understanding of the foam application rates and total foam quantities needed to mitigate these incidents effectively. The information was gathered for the responder community to clarify the requirements and may ultimately be used for planning purposes and guidance for combating these fires.

HHFT incidents are a relatively new problem facing the first responder community. In addition to increased production, transporting by rail allows for greater geographic flexibility than pipelines and therefore allows the ability to shift product destinations quickly in response to market needs. Because of this factor alone, it is likely that transport of crude oil and ethanol by rail will continue to play a key role in the industry.

A literature review was conducted on foam application during HHFT events and focused on incident reports, professional articles, and academic publications. On completion of the literature review, it was determined that there was insufficient data regarding foam usage during HHFT events to develop guidance for first responders, and thus an alternate approach was required.

The data package includes detailed information on the following 12 representative HHFT derailment incidents. The data includes incidents involving ethanol, crude oil, petroleum, denatured alcohol, and/or a combination of fuels. During these incidents, between 7 to 39 cars derailed. The incidents cover a range of weather conditions from severe cold to extreme heat. The foam concentrate usage ranged from zero to 2,520 gallons. The water usage ranged from zero to 2,200,000 gallons.

During the 10 representative incidents, effective foam usage occurred only during the equilibrium phase. During 50 percent of these incidents, less than 100 gallons of foam concentrate was used (which equals about 3300 gallons of foam solution). During the remaining 50 percent, approximately 300 gallons of foam concentrate was used (which equals about 10,000 gallons of foam solution). On average, about 50 percent of the foam discharged during the equilibrium phase was applied directly into the burning cars (about 14 gallons per car) to suppress and extinguish the fires within the car. The remainder was used to extinguish pool and spill fires and to seal fuel vapors during overhaul.

The foam use values from the incident data were then compared to the analytical values (area method) determined using NFPA 11. The analytical values were typically about five times that actually used during the event. With this said, the empirical values may be skewed to the lower end of the range due to the extensive experience of the first responders. The data illustrated that water usage (for cooling) is equally important as foam usage when mitigating these types of incidents. The amount of water used during these scenarios was typically on the order of hundreds of thousands of gallons and about two orders of magnitude greater than the amount foam solution (foam concentrate/water solution) discharged during the event.

In addition to water and foam usage, information was also gathered and assessed on variables such as arrival time, fuel type, railroad substrate, weather, railcar construction (i.e., jacket tank cars) and first responder tactics. In general, arrival time, fuel type, railroad substrate, weather, and railcar construction all had minimal effects on the incident. However, tactics were shown to play a major role in the outcome. Inexperienced first responders tend to use foam ineffectively and can prolong the overall duration of the incident. Resources such as the *On-Scene Incident Commander Field Guide* and Transport Canada's *Competency Guidelines for Responders to Incidents of Flammable Liquids in Transport, High-Hazard Flammable Trains* provide crucial knowledge and assist responders in making appropriate response decisions. The time line and associated variables developed during this program provide a high-level overview of the recommended tactics for combatting HHFT fires.

Since water usage for cooling purposes is equally as important as foam usage when mitigating these types of events, optimized cooling agents and techniques may be worth considering in areas of limited water supply or availability.

The information documented during this program helps to bracket the overall amount of foam concentrate needed to respond to an HHFT incident. During the 10 incidents documented in this report, about 300 gallons of foam concentrate or less was sufficient to suppress and extinguish these fires. This was the quantity used by a group of well-trained, experienced fire fighters and may need to be adjusted based on the expected level of training and experience of first responders. The main lessoned learned from the review of data and discussions with SRS centers around using foam only after railcars have been cooled properly and after a car can be responded to with an individual tactical plan. Parallel to foam application, the use of cooling water serves as a vital pre-emptive step to any offensive response.

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Increased knowledge more than any amount of available foam concentrate will affect the overall outcome, duration, and severity of an HHFT incident. With proper knowledge of HHFT derailments and the accompanied training, first responders in areas near railroads carrying high-hazard flammable liquids will be more prepared and able to respond to an accident should it occur.

Additional Information

The final report can be found on the FPRF web site at http://www.nfpa.org/news-and-research/fire-statistics-and-reports/research-reports.

REFERENCE

B. Gillespie, G. G. Back, and B. Breed, "Foam Application for High Hazard Flammable Train (HHFT) Fires," Fire Protection Research Foundation Report, FPRF-2017-09, August 2017.

FIRE HAZARD OF FLAMMABLE REFRIGERANTS

Summary

In October 2016, the gavel fell on a landmark climate change agreement, reached in Kigali, Rwanda, to phase out a specific family of synthetic chemicals used in air conditioners and refrigerators. While eliminating these chemicals, called hydrofluorocarbons (HFCs), makes sense for the environment, the alternatives that have been offered have the fire protection community on alert.

Unlike last year's Paris Agreement and other efforts to cut back on carbon dioxide from the use of fossil fuels, the new Kigali Agreement is a legally binding accord focused on the reduction of a single family of chemicals. Government representatives from more than 170 nations worked together to forge the agreement, with the ultimate goal of reducing the warming of the planet by at least half a degree centigrade by the end of this century — the United Nations' target to prevent dire environmental climate-change consequences.

HFCs are a prime target for those hoping to make a dent in the climate change problem because, while the overall volumes of HFCs are much less than other greenhouse gases such as carbon dioxide, they have dramatically greater heat-trapping characteristics. That's become more of an issue as HFCs have become the heat transfer fluid of choice in air-conditioners and refrigerators over the past several decades, mainly because they have superior performance characteristics, including minimal fire danger. But that may not be the case as alternatives are sought.

This will be a significant challenge. Because of the widespread use of refrigeration systems and products, a change to HFC alternatives with flammable characteristics means we need to recalibrate our fire protection approaches for anticipated new hazards.

The fire protection community is no stranger to this sort of problem. The Kigali Agreement was the result of the twenty-eighth meeting of the Parties to the Montreal Protocol, a landmark treaty first signed in 1987 by the United States and 23 other countries and since expanded to much of the world. At that first Montreal Protocol meeting, participants agreed to unprecedented trade restrictions to phase out the production of the family of Halon chemicals, considered the primary culprits of the growing hole in Earth's stratospheric ozone layer, a climatological disaster in the making.

As a result, the fire protection community engaged with environmentalists and world governments to coordinate and assist with the phase-out of Halon produced for fire protection. Automatic suppression systems using Halon 1301 for computer rooms and similar applications needed to find alternatives, and the search led to the development of NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, and other efforts.

Although the required action today with HFCs is different, the spirit of need and importance on the world scene is similar to the path we traveled in the 1980s with Halon 1301. Three decades ago, the fire protection community responded nobly to the consequences of an important world treaty protecting tomorrow's world, presently on loan to us from future generations. The environmental community is stepping forward through world governments to make our world a better and safer place. This rings true with NFPA and other stakeholders in the fire protection community, who likewise are dedicated to making our world a better and safer place.

FPRF is analyzing the fire hazard of propane (R-290) refrigerants in commercial retail and kitchen settings. The project, currently underway, includes a literature review of past research, computer simulations, and full-scale testing of propane refrigerants under various circumstances.

Additional Information

More information can be found in the FPRF web site at www.nfpa.org/refrigerants.

REFERENCES

- C. Grant, "Global Stewards: Eliminating a Greenhouse Gas Threat Means Dealing with Potentially Hazardous Alternatives," January–February 2017.
- J. Roman, "Freezer Burn: A phase-out of environmentally damaging chemicals means that most refrigerators, freezers, and air conditioners may soon be using flammable refrigerants," *NFPA Journal*, May–June 2017.

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SUPPLEMENT

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Synopsis of White Paper on Risk-Based Selection of Chemical Protective Clothing

***Editor's Note:** The material in this supplement is a summary of a larger, more detailed white paper on risk-based selection of chemical protective clothing available from NFPA. This information was prepared by Jeffrey O. Stull and Grace C. Stull of International Personnel Protection, Inc., and Christina M. Baxter of Emergency Response TIPS, LLC.*

INTRODUCTION

Hazardous material emergencies can occur anywhere, involve any number of substances, and result in a diverse set of environmental and operational conditions. In these situations, when action is needed to save lives and protect property, personal protective equipment (PPE) is the only viable protection for responders who may be exposed to hazardous substances.

Today, emergency services end users and protective clothing manufacturers depend on the standards developed by NFPA to help define the appropriate PPE for hazardous materials and other related emergency incidents. These standards have become the benchmarks for establishing protective clothing and equipment minimum design and performance requirements. Thus, when a first responder or other operator dons a certified ensemble, NFPA standards provide assurance that the ensemble and its component parts have been designed and tested to meet a specific hazardous environment. Specific benefits of NFPA standards include:

- Uniform product testing and evaluation
- Criteria based on specific end user needs
- Minimum requirements for clothing design, performance, documentation, and labeling
- Required third-party certification for both initial product qualification and continued review of manufacturer compliance and quality

NFPA STANDARDS

To take advantage of the benefits associated with the NFPA standards, some understanding is needed on the different performance characteristics and features that form the basis of the standards. In addition, the history of how standards have evolved to establish the protection levels today is fundamental to selecting the correct ensemble based on risks associated with a given response environment and circumstances.

Organization and Content of NFPA Standards

Each NFPA standard consists of a series of requirements that does the following:

- Describes the product covered by the standard and the protection intended by the ensemble
- Details procedures for independent certification of the product
- Requires product labeling and user information
- Contains specific criteria for design of the ensemble
- Specifies minimum performance levels for the ensemble, its materials, and components evaluated using standardized tests

A key distinction that the standards provided was the association of vapor protection with EPA Level A totally encapsulating chemical protective suits and liquid-splash protection with EPA Level B (and C) chemical splash suits,

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with specific tests for demonstrating vapor and liquid protection for whole suits and suit materials.

Relevance of Performance Testing in NFPA Standards

An essential component of the NFPA PPE standards is the operational relevance of the testing that is applied to the different ensembles. In developing the NFPA standards, specific test methods and validated criteria for establishing acceptable performance can be summarized in answers to the following questions:

- Question 1: Do NFPA ensembles prevent the penetration of specific chemicals and other substances into the ensemble that may be encountered during emergency operations?
- Question 2: Do the materials used in the construction of NFPA ensembles resist permeation and penetration of hazardous substances adequately under relevant exposure conditions?
- Question 3: Does the ensemble have the durability and physical properties necessary for the expected use?
- Question 4: Will ensemble materials contribute to wearer injury in the event of an accidental short-term exposure to severe hazards such as flame, flash fire, or liquefied gases?
- Question 5: Will the ensemble limit user functionality and user's ability to complete required missions and response activity?

Value of Applying NFPA Standards for PPE

NFPA standards are developed through a voluntary consensus process accredited by the American National Standards Institute. The process ensures the balanced participation of users, enforcers, labor, research and testing organizations, consumers, manufacturers, and special experts. No single interest category may constitute more than one-third of the committee's voting membership. Standards are developed in an open and transparent way, with specific stages for public input and comment.

NFPA standards are minimum performance specifications. For example, minimum sizing requirements are specified in each standard. Manufacturers can and do exceed the established criteria. End user organizations can specify higher limits or set additional criteria to meet their intended protection applications. Manufacturers provide a technical data package that consists of detailed descriptions of all ensemble parts and components and includes the performance data that demonstrates compliance of the ensemble with the respective standard.

The NFPA product certification process requires the following:

- All ensembles must meet all criteria in the standard to be considered compliant. No partial certifications are allowed.
- Each standard includes an independent, third-party certification, minimum manufacturer quality assurance (including manufacturer ISO 9001 quality standard registration), and annual recertification.
- Certifying organizations use unannounced visits to audit manufacturer products for compliance with the applicable standard. Follow-on testing is conducted to ensure products remain compliant.
- The criteria for third-party certification in all three standards exceed industry practices applied in other PPE specifications and standards used in the chemical protection industry, including requirements for a recall or safety alerts, if necessary.

NFPA standards are by no means all inclusive; they are not a substitute for user education and appropriate training as covered in NFPA 472. Many response organizations consider these standards to be overly rigorous and producing expensive products. Nevertheless, NFPA standards do provide a baseline performance that has spurred the development of chemical-protective garments for improved wearer protection. When used in conjunction with user experience, the process for selecting a chemical protective suit can become much easier.

A RISK-BASED APPROACH TO SELECTING PPE

The selection of PPE must be based first on completing a risk assessment. Two types of risk assessments will aid in selecting PPE for purchase or for use: 1) those performed on the general, expected situations that response teams encounter, and 2) assessments that are performed for a specific hazard. In each case, the risk assessment should consist of the following steps:

- Identifying the hazards present or likely to be present
- Estimating the likelihood of exposure
- Understanding the consequences of exposure
- Determining the risk

General Risk Assessment

Risk is determined by multiplying the exposure likelihood by the exposure consequences. In this way, risks associated with specific hazards can be determined and ranked to ascertain protection and clothing performance needs.

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Evaluation of Design Features

How the ensemble is designed affects wearer function, fit, and comfort; these factors are difficult to measure and are often the most subjective of all evaluations, but are an important part of the selection process. The best way to evaluate suit design is through trial wearing or field testing of prospective ensembles. These trials need to include tasks that replicate the types of movements and stresses that would be placed on suits during use. Through this type of evaluation, users can determine how the suit affects their ability to perform work.

Service Life Assessment

In general, most users perceive inexpensive, lightweight plastic-based products as less durable and disposable, and relatively more expensive, heavy, rubber-based products as reusable. The service life of a product is based on its life cycle cost, durability, and ease of decontamination. Life cycle cost includes all costs associated with the use of the product including the initial purchase, maintenance, decontamination, storage, and disposal costs. There are also costs for putting clothing back into use and ensuring that it is safe. While purchase costs may be the principal cost for product use, disposal costs are taking on greater significance.

Cost Calculation

The issue of cost cannot be dismissed. In an ideal world, the "best" suit in the marketplace would be purchased. But the fact is, organization resources for multiple forms of protective ensembles are limited. While some organizations have been able to set up programs to recoup PPE costs from those responsible for the incident, this form of chemical-protective suit reimbursement cannot be relied on. Response organizations want the optimum number and types of protective ensembles in their inventory to minimize selection decisions and obtain the best protection for their team members.

Specific Selection Approach

The selection process follows the hazard and risk information and an understanding of the NFPA standards and product features through a series of decisions to determine the type of ensemble that provides the needed minimum protection.

REFERENCES

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, National Fire Protection Association, 2013.

NFPA 1986, *Standard on Respiratory Protection Equipment for Tactical and Technical Operations*, National Fire Protection Association, 2017.

NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies and CBRN Terrorism Incidents*, National Fire Protection Association, 2016.

NFPA 1992, *Standard on Liquid Splash–Protective Ensembles and Clothing for Hazardous Materials Emergencies*, National Fire Protection Association, 2018.

NFPA 1994, *Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents*, National Fire Protection Association, 2018.

NFPA 1999, *Standard on Protective Clothing and Ensembles for Emergency Medical Operations*, National Fire Protection Association, 2018.

Title 29, Code of Federal Regulations, OSHA Parts 1910.120 and 1910.1030, U.S. Government Publishing Office, Washington, DC.

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SUPPLEMENT

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Fire Service Cancer: NFPA Is On It!

Editor's Note: *It has been some time in coming, but the time is here. The leading fire service organizations in North America are realizing that contaminants produced as part of the combustion process can cause long-term illness and certain forms of cancer. The campaigns are aggressive to give the first responder enough information to make informed decisions about the way they don and doff their personal protective equipment (PPE) and, more importantly, offer avenues for personal hygiene after a fire incident.*

NFPA is also playing an active role in research and information dissemination. NFPA has developed this Fact Sheet: Cancer Risk in Firefighting, which has information pertinent to contaminant exposure and risk. Hyperlinks to other, related information also serve those in the fire service.

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FACT SHEET: Cancer Risk in Firefighting

WITHIN THE FIRE SERVICE, not using SCBA and wearing soiled PPE were long considered badges of fire fighter toughness and bravery. For many fire fighters, those perceptions have been costly, and in some cases deadly. Fire fighters who for years didn't regularly wear SCBA or clean their personal protective equipment (PPE) after returning from fire fighting incidents have developed various forms of cancer, including lung cancer, and other long-term illnesses. There are even cases of young fire fighters with far fewer years of contaminant exposure who have received cancer diagnoses as well.

Minimizing Contaminant Risk and Exposure (ON BACK) ▶

Recommended Resource

- *"Healthy In, Healthy Out: Best Practices for Reducing Firefighter Risk of Exposures to Carcinogens"* is a comprehensive resource developed with funding and support provided by the State of Washington, Department of Labor & Industries, Safety & Health Investment Projects. Visit www.wscff.org

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The leading information and knowledge resource on fire, electrical and related hazards

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FACT SHEET: Cancer Risk in Firefighting *(continued)*

Minimizing Contaminant Exposure and Risk

Fire service organizations and individual fire departments have become increasingly aware of the health and safety hazards posed by contaminant exposure, and have been working to educate the fire service about ways to reduce those risks.

At the Fire Protection Research Foundation – the research affiliate of the National Fire Protection Association (NFPA) - three major initiatives are under way to address fire fighter exposure to contaminants on the fireground and beyond:

How Clean is Clean: While general PPE cleaning procedures have evolved as best practices, scientifically established methods for removing toxic chemicals, biological pathogens and other hazardous substances from PPE is lacking. "Validation of Cleaning Procedures for Fire Fighter PPE" (a three-year study due in late 2018) works to identify the contaminants found on PPE and the disinfection/sanitization procedures required to remove them.
(See nfpa.org/ppecleaning)

Contamination Control and Beyond: It's quickly becoming recognized that contaminants found on fire fighter PPE are also present far from the fire ground: on hand tools, fire hose, apparatus, stations, and beyond - sometimes even into private vehicles and the homes of fire fighters. The "Campaign for Fire Service Contamination Control" (a one year- study due in late 2017) aims to educate the fire service about the health and safety risks of contaminant exposure in all these locations, and to provide steps for controlling contaminants' spread. Go to nfpa.org/contamination for more information.

Long-term Cancer Study: Medical doctors and others don't fully understand which exposures are responsible for cancer in fire fighters, the mechanisms by which exposures cause cancer, nor the most effective means of reducing exposures. The "Fire Fighter Cancer Cohort Study" is a long-term (30-year) information collection effort led by the University of Arizona to fully address these questions. Updates will be provided at intervals throughout the study's duration. Go to www.ffccs.org for more information.

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Hazardous Materials/Weapons of Mass Destruction Handbook

In this Edition

This 2018 edition of the *Hazardous Materials/Weapons of Mass Destruction Handbook* contains the full text of 4 NFPA documents. Commentary is provided throughout this handbook to further explain the code requirements or clarify the intent of the technical committee. The documents included in this handbook are as follows:

NFPA 472: *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents* (2018 edition)

NFPA 473: *Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents* (2018 edition)

NFPA 475: *Recommended Practice for Organizing, Managing, and Sustaining a Hazardous Materials/ Weapons of Mass Destruction Response Program* (2017 edition)

NFPA 1072: *Standard for Hazardous Materials/ Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications* (2017 edition)

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NFPA 472

Mandatory code text is shown in black.

require that both Type B and Type C packaging be marked with a trefoil symbol to ensure that the package can be positively identified as carrying radioactive material. The trefoil symbol must be resistant to the effects of both fire and water so that it is likely to survive a severe accident and serve as a warning to emergency responders.

The performance requirements for Type C packaging include those applicable to Type B packaging with enhancements on some tests that are significantly more stringent than those for Type B packaging. For example, a 200 mph (321.8 km/hr) impact onto an unyielding target is required instead of the 30 ft (9.1 m) drop test required of a Type B packaging; a 60-minute fire test is required instead of the 30-minute test for Type B packaging; and a puncture/tearing test is required. These stringent tests are expected to result in packaging designs that will survive more severe aircraft accidents than Type B packaging designs.

3.3.11 Contaminant. A hazardous material, or the hazardous component of a weapon of mass destruction (WMD), 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.

Commentary text is presented in a color screen to distinguish it from the text of standard.

Containment often involves plugging or patching a container to stop a leak. Committing personnel to this type of operation must be carefully considered and must take into account the level of training they have received. Many, if not most, containment activities can be considered to be "offensive" in nature, involve a higher risk of exposure, and typically require training to the technician or the specialist employee A level (see Exhibit I.3.1).

The tabs show which code is being covered in this section of the handbook.

EXHIBIT I.3.1

A technician or private sector specialist employee with Level A training and appropriate personal protective equipment (PPE) can enter the hot zone for assessment and initial rescue. (Courtesy of endopack/iStock/ Thinkstock)

Commentary includes exhibits to further illustrate code concepts.

3.3.12 Contamination. The process of transferring a hazardous material, or the hazardous component of a weapon of mass destruction (WMD), from its source to people, animals, the environment, or equipment, that can act as a carrier.

The term *contamination* is one of the most important considerations for emergency responders from a health and safety standpoint. The importance of determining whether personnel or equipment have been contaminated cannot be overemphasized. Because personnel are often unaware that contamination has occurred, procedures must be established ahead of time to ensure proper monitoring and decontamination procedures are in place and followed at each incident scene.

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

2018 Hazardous Materials/Weapons of Mass Destruction Response Personnel Handbook

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Flip to the inside back cover for an overview of understanding the code changes.

Throughout the handbook there are "Closer Look" features that highlight critical information to better understand the code requirements.

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Closer Look

Radioactive Materials Containers

The strength and reliability of radioactive materials packaging are especially important in transportation because of the possibility of devastating incidents and the potential harm that could result from released radioactive material. At least four groups in the United States promulgate rules governing the transport of radioactive material, including the U.S. DOT, U.S. Nuclear Regulatory Commission, U.S. Department of Energy, and U.S. Postal Service. DOT regulations are generally more detailed in 49 CFR 173, Subpart I, "Class 7 Radioactive Materials" [3]. The Canadian Nuclear Safety Commission (CNSC) is the regulatory authority in Canada.

Regulations cannot eliminate accidents in transportation, so their emphasis is on ensuring safety in routine handling situations for minimally hazardous material and ensuring integrity under all circumstances for highly dangerous materials.

These goals of containment and safety focus on the package and its ability in the following three areas:

1. Contain the material (prevent leaks)
2. Prevent unusual occurrences (such as criticality)
3. Reduce external radiation to safe levels through shielding

Excepted packages are for materials with extremely low levels of radioactivity. Due to the very limited hazard of the contents, packaging requirements include ease of handling as well as reasonable strength for transportation. Packaging can range from a fiberboard box to a sturdy wooden or steel crate. Packages are not identified as such by package markings or on shipping papers. Excepted packages are used for transporting limited quantities of radioactive material that would pose very low hazard if released in an accident.

Industrial packages are intended for materials with a low concentration of radioactivity that poses a limited hazard to the public and the environment. The radioactive material can be liquid or can be solidified in such materials as concrete or glass. Industrial packages are not identified as such by package markings or on shipping papers. The following three categories are based on strength:

1. IP-I packages must meet the same design requirements as excepted packaging.
2. IP-2 packages must pass the same tests as Type A for free-drop and stacking.
3. IP-3 packages must pass IP-2 tests and the water spray and penetration tests for Type A shipment of solid contents.

Type A packages are used to transport radioactive material with higher concentrations of radioactivity than those allowed in excepted and industrial packages. They often have an inner containment vessel made of glass, plastic, or metal surrounded by packaging material of polyethylene, rubber, vermiculite, or wood. The packaging might be an absorbent in a fiberboard, wood, or metal outer container. This packaging must be able to withstand heavy rain equivalent to 2 in. (5.1 cm) per hour, free-dropping from 4 ft (1.22 m), stacking (compression equal to the weight of the package for at least 24 hours), vibration [1 hour, strong enough to raise the package 0.063 in. (1.6 cm)], and penetration by a dropped weight [1.25 in. (3.18 cm) in diameter and 13.2 lb (5.99 kg) dropped from 40 in. (1.02 m)].

Type B protects materials with higher radioactivity levels, including spent nuclear fuel, so it is substantially constructed to retain the contents under normal transport conditions and under severe accident conditions. Sizes range from small handheld radiography cameras to small drums [55 gal (208 L)] to heavily shielded steel casks that can weigh more than 100 tons (101.6 kilotons). This packaging must be strong enough to withstand tests for dropping 30 ft (9.1 m) so that the package's weakest point is hit; puncture, dropped 40 in. (1.02 m) onto a 6 in. (15.2 cm) diameter steel rod 8 in. (20.3 cm) high, again hitting the package's weakest point; heat, 1475°F (802°C) for 30 min; crush, for some lightweight packages, a drop of 1,100 lb (499 kg) mass 30 ft (9.1 m) onto the package, and immersion under 50 ft (15.2 m) of water. Packages are identified as Type B by markings on the package and shipping papers. Examples of Type A and Type B packaging are shown below.

Examples of radioactive materials packaging Type A and Type B: Radiopharmaceuticals are commonly transported in Type A packages resembling the ones pictured (left). Type B packages can range from small handheld radiography cameras similar to the one shown (right) to heavily shielded steel casks that weigh well over 100 tons.

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Understanding the Code Changes

REVISION SYMBOLS IDENTIFYING CHANGES FROM THE PREVIOUS EDITION

Text revisions are shaded. A Δ before a section number indicates that words within that section were deleted and a Δ to the left of a table or figure number indicates a revision to an existing table or figure. When a chapter was heavily revised, the entire chapter is marked throughout with the Δ symbol. Where one or more sections were deleted, a • is placed between the remaining sections. Chapters, annexes, sections, figures, and tables that are new are indicated with an *N*.

Note that these indicators are a guide. Rearrangement of sections may not be captured in the markup, but users can view complete revision details in the First and Second Draft Reports located in the archived revision information section of each code at www.nfpa.org/docinfo. Any subsequent changes from the NFPA Technical Meeting, Tentative Interim Amendments, and Errata are also located there.

Shaded text = Revisions Δ = Text deletions and figure/table revisions • = Section deletions *N* = New material

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3.3.13 Control. The procedures, techniques, and methods, used in the mitigation of hazardous materials/weapons of mass destruction (WMD) incidents, including containment, extinguishment, and confinement.

The term *control* can be used interchangeably with the word *mitigation*. Every measure taken to control a hazardous materials incident is part of the mitigation process. Limiting the degree of contamination by whatever means available is also part of the control or mitigation process.

N ***3.3.13.1 Confinement.*** Those procedures taken to keep a material, once released, in a defined or local area.

N ***3.3.13.2 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).

N ***3.3.13.3 Extinguishment.*** To cause to cease burning.

3.3.14* Control Zones. The areas at hazardous materials/weapons of mass destruction (WMD) incidents within an established/controlled perimeter that are designated based upon safety and the degree of hazard.

The choice of basic terms related to control zones such as *hot, warm,* and *cold* is based on the fact that the words are simple and easily understood and that they clearly suggest the nature of the situation one would expect to encounter in any area with such a designation. (See also the definitions of *cold zone, hot* … is shown in Exhibit I.3.2.

New code material

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3.3.14.2 Decontamination Corridor. The area usually located within the warm zone where decontamination is performed.

3.3.14.3 Hot Zone. The control zone immediately surrounding hazardous materials/weapons of mass destruction (WMD) incidents, which extends far enough to prevent adverse effects of hazards to personnel outside the zone and where only personnel who are trained, equipped, and authorized to do the assigned work are permitted to enter.

Revision to the code

The hot zone is the area where the hazmat/WMD release has occurred or could take place. The hot zone may also be referred to as the inner perimeter by law enforcement personnel. It is the area where there is a high potential for exposure or contamination to the materials involved, and where personal protective clothing and equipment are required based on the hazards present.

The boundary between the hot zone and warm zone should be indicated by some physical means such as barrier tape, barricades, or some other marks.

3.3.14.4* Warm Zone. The control zone at hazardous materials/weapons of mass destruction (WMD) incidents where personnel and equipment decontamination and hot zone support takes place.

nfpa.org/472

Visit the NFPA 472 document information page (http://www.nfpa.org/472) for up-to-date, document-specific information, including any issued Tentative Interim Amendments and Errata. The document information page also provides users with the option to register for an "Alert" feature to receive an automatic email notification when new updates and other information are posted regarding the document.

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Connecting the Codes

Chapter 4 Awareness	
NFPA® 1072	**NFPA® 472**
***4.2 Recognition and Identification.**	**4.2.1 Recognizing the Presence of Hazardous Materials/WMD.**
Recognize and identify the hazardous materials/WMD and hazards involved in a hazardous materials/ WMD incident, given a hazardous materials/WMD incident, and approved reference sources, so that the presence of hazardous materials/WMD is recognized and the hazardous materials/WMD and their hazards are identified.	Given a hazardous materials/WMD incident, and approved reference sources, awareness level personnel shall recognize those situations where hazardous materials/WMD are present
4.2 (A) Requisite Knowledge	
What hazardous and WMD materials are	**4.2.1** (1)* Define the terms *hazardous material* (or *dangerous goods*, in Canada) and *WMD*
Basic hazards associated with hazard classes and divisions	**4.2.1** (2) Identify the hazard classes and divisions of hazardous materials/WMD and identify common examples of materials in each hazard class or division

Matrices in the Introduction section show the correlation of chapters in NFPA 472 for awareness, operations, operations mission-specific, technician, and incident commander for hazardous materials/weapons of mass destruction incident response with the job performance qualifications in NFPA 1072.

EXHIBIT I.5.29

A hazmat team conducts training in performing an emergency decontamination. (Courtesy of Hildebrand and Fish, LLC)

NFPA 1072 Notes are shown in blue text to explain how job performance requirements from NFPA 1072 correlate with the specific section within NFPA 472.

◆ NFPA 1072 NOTE

Operations level responders need to understand all types of decontamination. In NFPA 1072, mass and technical decon are listed as types of decontamination in addition to emergency decon. Responders don't need to be able to perform mass and technical decon, but they should be aware that emergency decon is not the only type of decon available. NFPA 472 does not mention mass and technical decon by name, but responders at this level should understand what they are.

Additionally, in Section 5.4, NFPA 1072 requires responders to understand the need for gross decontamination in the field (fireground incidents), and the procedures for performing gross decontamination. Section 5.4 includes performing gross decon as a skill requirement. NFPA 472 does not have a corresponding "demonstrate" competency for gross decon.

Glossary of Terms for NFPA 472, NFPA 473, NFPA 475, and NFPA 1072

The definitions contained in this part of the handbook apply to the terms used in NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*; NFPA 473, *Standard for Competence of EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents*; NFPA 475, *Recommended Practice for Organizing, Managing, and Sustaining a Hazardous Materials/Weapons of Mass Destruction Response Program*; and NFPA 1072, *Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications.*

NFPA Official Definitions.

Approved. Acceptable to the authority having jurisdiction.

Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

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.

Recommended Practice. A document that is similar in content and structure to a code or standard but that contains

Advanced Life Support (ALS). Emergency medical treatment beyond basic life support level as defined by the medical authority having jurisdiction in conjunction with the American Heart Association guidelines.

Emergency Medical Technician — Intermediate (EMT-I). An individual who has completed a course of instruction that includes selected modules of the U.S. Department of Transportation National Standard EMT — Paramedic curriculum and who holds an intermediate level EMT-I or EMT-C certification from the authority having jurisdiction.

Emergency Medical Technician — Paramedic (EMT-P). An individual who has successfully completed a course of instruction that meets or exceeds the requirements of the U.S. Department of Transportation National Standard EMT — Paramedic curriculum and who holds an EMT-P certification from the authority

A comprehensive glossary is provided in Part V to help the user better understand the competencies or qualifications presented throughout the handbook.