

Introduction to Hazardous Materials/WMD

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This chapter provides knowledge items for the following NFPA Standard 472 requirements. For more detail, see the Knowledge Correlations on p. xxxvi.

Awareness	Operations	Product Control
4.1.1	5.1.1	6.6.1
4.2.1	5.2.2	
4.4.1	5.4.3	

OBJECTIVES

Upon completion of the chapter, you should be able to do the following:

- Describe the difference between hazmat/WMD incidents and other emergencies.
- Identify different locations through which hazardous materials are either stored or shipped.
- Describe the capabilities and limitations of the operations-level responder at a hazmat/WMD incident.
- Describe the impact hazardous materials laws and regulations have on emergency responses.
- Describe how the local emergency response plan (LERP) and department SOPs guide the operations-level responder at a hazmat/WMD incident.
- Define commonly used hazardous materials terminology as covered in this chapter.
- List the three main phases of a hazardous materials/WMD response.

INTRODUCTION

As discussed in chapter 3, Fire Department Organization, the fire service has evolved over the years into an all-hazards organization. Simply put, if it endangers the public, the fire department typically plays some role in the response. Along those lines, in most communities it is the responsibility of the fire department to handle the release of hazardous materials (fig. 22–1). In most cases these incidents are unintentional and the result of human error or container failure. In some cases, however, we encounter situations where the release is intentional and is classified as a criminal or terrorist incident. In either case, it is important that firefighters handle the response at the level their training allows. Because hazardous materials are used in or transported through every community, proper training prevents unnecessary and potentially dangerous exposures to these materials (fig. 22–2). Additionally, training is required by OSHA 1910.120, which states that employees who participate—or are expected to participate—in emergency responses be given training in hazardous materials.



Fig. 22–1. Fire departments are expected to handle all types of emergencies, including those involving hazardous materials. (Courtesy Tom Lenart)



Fig. 22–2. Hazardous materials are transported through every community. (Courtesy Emergency Training Solutions)

Historically, firefighters tend to be less comfortable handling hazmat responses than structural fires, rescue, or EMS runs, primarily because of the potential complexity of these incidents. The focus of the next four chapters in this text is to address the responsibilities of firefighters operating at the hazmat operations level and provide a clear picture about how to handle these types of incidents. The material is covered using the same simple and systematic approach that is employed on scene. The basic steps include analyzing the incident, developing the response plan, and then implementing the plan. These concepts can be applied to any hazmat scenario and will ensure an effective and orderly response, especially when multiple response agencies are involved.

HAZMAT/WMD INCIDENTS VS. OTHER EMERGENCIES

Hazardous materials/weapons of mass destruction incidents are different from other emergencies because they can be far more pervasive and severe than, say, a large structure fire. A release of a hazardous material can endanger responders and the public as well as the environment and property if proper actions are not taken to control or stop the release. Also, depending on the material, a release can affect a much larger geographical area, which increases the potential for injury or death. Depending on the scale, these incidents can become more complex than standard emergency responses and may require specially equipped and trained personnel to respond (fig. 22–3). The potential for long-term effects on people, the environment, and property should also be considered. Incidents involving terrorist activity also bring the additional danger of secondary attacks and armed resistance coupled with the fact that these releases are often designed to inflict the greatest amount of damage (fig. 22–4). Terrorist incidents also require that crime scene management, evidence preservation, and unified command be employed to work closely with the needs of law enforcement.



Fig. 22–3. Hazmat incidents are often more complicated than standard emergency responses. (Courtesy U.S. Air Force)



Fig. 22–4. Terrorist incidents such as the Oklahoma City bombing are designed to inflict great damage. (Courtesy U.S. Department of Defense)

COMMON HAZARDOUS MATERIALS LOCATIONS

As mentioned, hazardous materials are used, stored, and transported in every community. It is important that responders recognize both the obvious and not-so-obvious locations where these materials may be found. Some response districts have facilities from which hazardous materials are produced and shipped (fig. 22–5). Others may use the materials in manufacturing facilities, and some may deal only in consumer quantities and vehicles that travel on their roadways and railways (fig. 22–6). The bottom line is that no matter how small the community, it is always possible to encounter a hazardous material.



Fig. 22–5. Some communities have facilities that manufacture hazardous materials.



Fig. 22–6. Hazardous materials are transported by rail through some communities. (Courtesy Emergency Training Solutions)

Response personnel should conduct preplans of those facilities in their response area that utilize hazardous materials in quantity. Table 22–1 lists some of the locations where responders should expect to see hazardous materials.

Table 22–1. Locations where hazardous materials are found

Methods of Transportation	
Roadways	Railways
Waterways	Pipelines
Airways	
Fixed Facility Locations	
Large manufacturing or storage plants	Photo processing laboratories
Service stations	Fuel storage facilities
Doctors' offices	Agricultural stores
Hardware stores	Tank farms
Dry cleaners	Weapons depots
Paint supply stores	Warehouses
School laboratories	Laboratories
Farms	Maintenance facilities
Residences	Flight line areas
Pool supply stores	
Transportation Terminal Locations	
Docks or piers	Airplane hangers
Railroad stations	Truck terminals

HAZMAT RESPONDER LEVELS AND RESPONSIBILITIES

As discussed in the introduction, responders must operate within their level of training and never above it. To do so would put both first responders and the public at risk. The **National Fire Protection Association (NFPA)** and the **Occupational Safety and Health Administration (OSHA)** both recognize the following levels of training and responsibility as they relate to hazardous materials incidents.

Awareness-level responder

Awareness-level responders are expected to recognize the presence of hazardous materials, secure the area, protect themselves and others, and request the response of appropriately trained personnel to the scene (fig. 22–7). These responders include those individuals who may arrive first on the scene of a hazmat incident in the normal course of their duties. This group includes law enforcement, emergency medical service (EMS) providers, and security personnel. Awareness-level responders do not typically train to play an active role in offensive or defensive operations. Their duties generally stop at protecting others from further harm and requesting the appropriate assistance needed such as fire, EMS, and law enforcement. These actions need to be performed in a manner consistent with departmental SOPs and the LERP.



Fig. 22–7. EMS personnel typically operate at the hazmat awareness level.

Operations-level responder

Operations-level responders operate above the awareness level and are expected to respond to a hazmat incident in order to protect people, the environment, and property from the effects of the release. This response is carried out using a defensive approach to control the release from a safe distance and to prevent it from spreading. Operations-level responders are trained to act in a defensive manner only, without attempting to stop the release of the material at its source unless it can be done from a remote location (fig. 22–8). The role of the personnel operating at this level is based on the department's SOPs as well as the community's LERP.

Table 22–1. Important elements and their symbols

Element	Symbol	Element	Symbol
Hydrogen	H	Helium	He
Lithium	Li	Beryllium	Be
Boron	B	Carbon	C
Nitrogen	N	Oxygen	O
Fluorine	F	Sodium	Na
Magnesium	Mg	Neon	Ne
Aluminum	Al	Silicon	Si
Phosphorus	P	Sulfur	S
Chlorine	Cl	Argon	Ar
Potassium	K	Calcium	Ca
Arsenic	As	Selenium	Se
Bromine	Br	Krypton	Kr
Rubidium	Rb	Strontium	Sr
Iodine	I	Xenon	Xe
Cesium	Cs	Barium	Ba
Radon	Rn	Chromium	Cr
Manganese	Mn	Iron	Fe
Cadmium	Cd	Nickel	Ni
Copper	Cu	Zinc	Zn
Germanium	Ge	Cobalt	Co
Bismuth	Bi	Tin	Sn
Antimony	Sb	Mercury	Hg
Lead	Pb	Radium	Ra
Uranium	U	Plutonium	Pu

**Fig. 22–8.** Operations-level personnel can operate in a defensive manner only.

Although NFPA 1001 requires that operations-level training be part of the Firefighter I curriculum, there are numerous other reasons to be trained to this level. Although hazmat responses do not typically make up the bulk of runs for a fire department, hazardous materials are used in or transported through every community, which means there is always an opportunity to respond to that type of incident. Operations-level training prevents unnecessary and potentially dangerous exposures to response personnel and civilians alike. Lastly, OSHA 29 CFR 1910.120 requires this level of training for responders conducting defensive operations at a hazmat incident. The responsibilities of operations-level responders include analyzing the incident, planning a response, and then implementing the planned response. These actions are conducted with the guidance of a technician-level responder, an allied professional, or departmental SOPs. Per the NFPA 472 standard (2008 ed.), operations-level responders must receive additional training to perform any of the following mission specific operations: personal protective equipment (PPE), mass decontamination, technical decontamination, evidence preservation and sampling, product control, air monitoring and sampling, victim rescue and recovery, and responses to illicit laboratory incidents. In addition to the core competencies for the operations level, this text covers PPE and product control.

Technician-level responder

Technician-level responders are trained to a greater level and operate using offensive tactics to control and stop the flow of the hazardous material at its source. They utilize equipment and techniques that are above the level of the operations-level responder to enter the hot zone or area of release to complete this task (fig. 22–9). It is important to note, however, that operations-level personnel play an important support role for technician-level responses. They often staff the technical decontamination portion of the incident and assist with the donning and doffing of PPE. In addition, they can assist by collecting information and conducting research.



Fig. 22–9. Technician-level responders operate with a higher level of training and equipment. (Courtesy U.S. Navy)

HAZARDOUS MATERIALS LAWS AND REGULATIONS

There are numerous federal laws that are related to hazardous materials response, planning, and operations. It is key that the emergency response community understands these laws and the requirements set for them. Federal laws are created by the U.S. Congress, while rules and regulations are created by federal or other governing bodies to provide for ease of interpretation and compliance. The following is a synopsis of the laws and their basic requirements.

OSHA HAZWOPER

- In states that have OSHA plans, the **Hazardous Waste Operations and Emergency Response (HAZWOPER; 29CFR1910.120)** regulations are enforced by OSHA compliance officers. In the remaining states, these same regulations have been adopted by the federal **Environmental Protection Agency (EPA)** under 40CFR311. This law with its

accompanying regulations applies to all emergency responders whether public or private and includes hazmat teams, police officers, firefighters, and industrial emergency responders. For emergency responders, this law contains the following levels of competency: awareness, operational, technician, specialist, and on-scene incident commander. It also includes requirements for skilled support personnel (e.g., heavy equipment operators) and specialist employees (e.g., an on-site scientist in a research facility). In fixed facilities, one may find emergency response teams that are trained to the various levels of competency along with skilled support personnel and specialist employees. During pre-incident planning of fixed facilities, it is imperative that fire departments, hazmat teams, and other emergency response agencies seek out these groups and understand their roles during a site emergency.

Comprehensive Environmental Response Compensation and Liability Act

- **The Comprehensive Environmental Response Compensation and Liability Act (CERCLA)**, also known as the Superfund, covers unattended, abandoned, or inactive hazardous waste disposal sites. This law also requires that the “responsible party” (who caused the hazmat release) be held liable and must contact the National Response Center upon release of a “reportable quantity.”

Superfund Amendments and Reauthorization Act

- **The Superfund Amendments and Reauthorization Act (SARA-1986)** amended CERCLA and also added sections on planning, preparedness, training, and response, which in turn had the most influence on “the way we do business” of most laws pertaining to hazmat. This law, in turn, led to the development of OSHA 1910.120 HAZWOPER. In addition, SARA Title III (Emergency Planning and Community Right to Know Act) led to the development of state and local emergency planning committees known as SERCs and LEPCs, respectively.
- **The Resource Conservation and Recovery Act (RCRA)** requires the proper management and disposal of hazardous waste in treatment, storage, and disposal facilities and establishes installation,

leak prevention, and notification requirements for underground storage tanks. Most large industrial facilities have storage areas for their waste, known as RCRA pads, which may or may not have fire protection.

Clean Air Act

- The **Clean Air Act (CAA)** was enacted to control airborne emissions to protect the environment. When amended in 1990, it addressed emergency response planning at certain facilities that produce highly hazardous or toxic materials. In addition, it authorized the creation of the Chemical Safety and Hazard Investigation Board, which is now known as the **Chemical Safety Board (CSB)** and operates similarly to the **National Transportation Safety Board (NTSB)**. The CSB is dispatched to major chemical incidents, mostly at fixed facilities, to investigate the cause and report back to the federal government.

Oil Pollution Act

- The **Oil Pollution Act (OPA)** amended the original federal Water Pollution Control Act. It covers fixed facilities and carriers (barges, tankers, railcars, deep-water terminals, vessels, pipelines) and requires emergency plans, drills, exercises, and the verification of spill response contractors and their capabilities. Where a coastal zone may be affected, area committees and **area contingency plans (ACPs)** are required.

Community Emergency Planning Regulations (40CFR 301–303)

- These regulations were developed for SARA Title III, and they require that state and local emergency planning groups develop and/or review hazardous materials response plans (fig. 22–10). The SERCs do this on the state level, and the LEPCs do it on a local level. LEPCs typically include the local fire department, law enforcement, emergency medical service, government representatives, health department, nonprofit assistance agencies, and perhaps local industry.



Fig. 22–10. Local officials and emergency responders play a vital role in the LEPC.

HAZARDOUS MATERIALS RESPONSE GUIDELINES

Two valuable resources to hazmat responders are the LERP and department SOPs. These documents can provide valuable guidance on how to handle a hazardous materials release in the community.

Local Emergency Response Plan (LERP)

A good place for the responder to learn about hazardous materials/WMD response is the local incident response plan. Your community likely has an emergency response plan already developed. Many times an annex specific to hazardous materials is included in that plan. Plans for terrorism events are also annexed in local emergency response plans, as the personnel responding to these types of incidents must have the same training as a hazardous materials responder.

The LERP addresses how the local response will occur, and, if necessary, how that response becomes elevated to the state and even the federal level. The LERP is usually maintained in the local communications center or the 9-1-1 center. A copy should be located in each station so that department members can become familiar with its contents.

Standard operating procedures

Progressive departments have standard operating procedures (SOPs) or standard operating guidelines (SOGs) for all types of department operations, including

hazardous materials responses. These documents are designed to give responders guidance on how to handle different types of incidents they may encounter in the field. Responders should be familiar with and know how to access their department's SOPs or SOGs. A copy of these documents should be provided in each station.

COMMON TERMINOLOGY

It is important that all hazmat responders be familiar with basic terms that are referenced in hazmat standards and responses. This familiarity enables responders from various backgrounds to speak the same "language" at the scene. It is important to understand that, although all of these substances fall into the general classification of hazardous materials, there are several terms used based on which agency created the definition.

Hazardous materials definitions

A **hazardous material** is defined by the U.S. Department of Transportation (DOT) as any substance or material capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. In Canada the term used for these materials is **dangerous goods**.

Hazardous substance

A **hazardous substance** is a substance designated under the CERCLA as posing a threat to waterways and the environment if released. In OSHA 29 CFR 1910.120 the term is used to describe all the chemicals that are regulated by the EPA as hazardous substances and by the DOT as hazardous materials.

Hazardous chemical

A **hazardous chemical** is defined in OSHA 29 CFR 1910.120 as any chemical that poses a physical or health hazard.

Dangerous goods

Dangerous goods, as defined by the Canadian Transport Commission (CTC), describes any product, substance, or organism included by its nature or by the regulation in any of the United Nations (UN) classes of hazardous materials.

Hazardous waste

A **hazardous waste**, as defined by the DOT, includes any material that is subject to the hazardous waste manifest requirements of the EPA listed in 40 CFR, part 262.

Weapons of mass destruction

A **weapon of mass destruction (WMD)** is a material or device designed to inflict great harm on people or property. It can be an explosive device, a toxic or poisonous chemical, a disease organism, or radioactive device (fig. 22–11).



Fig. 22–11. Explosive devices are considered weapons of mass destruction.

MANAGING HAZMAT/WMD INCIDENTS

Due to the potential complexity of a hazmat/WMD incident, it is important that responders follow a logical and standardized course of action to ensure that all response objectives are met and the safety of the responders and civilians alike is addressed. The following steps are used to guide response personnel through the response.

Analyze the incident

Like a standard emergency response, this phase begins the moment the emergency is dispatched. The information given to the responder from the dispatcher on the initial assignment, as well as updates given en route, will be used to make initial decisions about how to approach the scene (fig. 22–12). Information such as the location and, if possible, the materials involved provides a solid base to build upon. Additional information collected will be used to further analyze the incident and to plan and

implement the response. The key steps in this process are to survey the scene, collect hazard and response information, and determine the likely behavior of the material. During this response phase, personnel isolate the area and deny entry to prevent any additional exposures as they collect information (fig. 22–13).



Fig. 22–12. Size-up begins with the information provided by the dispatcher. (Courtesy J. Rains)



Fig. 22–13. The collection of information is used to plan the appropriate response.

Plan the response

After the data on the material(s) involved is collected and analyzed, it is used to plan the proper response. It may be determined that the resources currently on scene are appropriate or that more advanced equipment and training is required. Issues such as scene control and safety are considered closely based on the material(s) involved. The incident command system branches and divisions are filled out in order to support the options chosen. The response objectives are defined along with the means by which to accomplish those objectives, including selection of PPE (fig. 22–14).



Fig. 22–14. The information collected in the initial phase of the response is used to determine the level of PPE required.

Implementing the response

During this phase, the chosen response objectives are implemented and product control or rescue operations are conducted (fig. 22–15). This phase should be continuously evaluated to ensure that the objectives are being met, and adjustments should be made if they are not. Personnel should be decontaminated at the end of this phase to ensure that there is no potential for the material to spread outside of the containment area.



Fig. 22–15. The response objectives are implemented during the response phase of the operation.

INTRODUCTION SUMMARY

The modern fire service includes hazardous materials incidents in the many types of incidents they are responsible for. These incidents are often more involved than a standard emergency response and require special training and equipment. Hazardous materials can be found in any community, regardless of its size, in households, commercial and industry facilities, or in transportation. Response personnel trained to the operations level are tasked with taking a defensive approach to handling a hazardous materials release in any of those locations (fig. 22–16). There are many laws that govern the use and accidental release of hazardous materials to which responders can look for guidance. Additionally, the LERP or department SOPs provide direction to emergency responders handling the incident. Responders should remember the three major phases of a hazmat response when managing the scene of a hazmat release:

- Analyzing the incident
- Planning the response
- Implementing the response



Fig. 22–16. Operations-level personnel are tasked with taking a defensive approach only.

QUESTIONS

1. Which training level has the primary duties of protecting others from harm and requesting assistance?

2. How are hazmat incidents different from other emergencies?

3. What type of hazardous materials location would a photo processor be?

4. What are the three levels of training recognized by NFPA and OSHA related to hazardous materials incidents? _____
5. Which NFPA Standard applies to a hazmat response? _____
6. Name three federal laws that relate to a hazardous materials response.

7. Community Emergency Planning Regulations call for each state to form what type of group, and what is the group's primary responsibility?

8. What are the three steps to ensuring all hazmat response objectives are met?

