



# Hazardous Materials Incidents

*Guidance for State, Local, Tribal, Territorial, and  
Private Sector Partners*

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FEMA

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# Introduction

## Purpose

This document provides state, local, tribal, and territorial officials with information and resources to improve resilience to hazardous materials incidents. Resilience is the backbone of emergency management. The Nation's ability to weather storms and disasters without experiencing loss significantly reduces our risk. In 2018, through the Threat and Hazard Identification and Risk Assessment (THIRA) process and Stakeholder Preparedness Review (SPR), 50% of states and territories and 40% of tribal participants identified chemical and radiological hazardous material releases as a hazard of concern. This represents the most frequent technological hazard identified by the respondents; 27% identified radiological hazardous materials, the second highest technological hazard of concern.<sup>1</sup> This document compiles information on existing resources and training developed by FEMA and other Federal and whole community partners. It is intended to provide basic, high-level guidance and identifies additional resources and trainings from widely accepted authoritative sources on hazardous materials incidents. This guide provides an overview of:

- Hazardous materials characteristics;
- Hazardous materials incident response;
- Planning for hazardous materials incidents; and
- Practices to mitigate further damage to communities from hazardous materials.

## Background

Hazardous materials can be found in every community. They are in almost every home and in most hospitals and factories. Hazardous materials are shipped every day via land, air, and sea pathways and are frequently used to inspect pipelines

If released, hazardous materials may cause harm to people, the environment, critical infrastructure, and property. Their potential for harm exists regardless of whether hazardous materials are released by accident, malicious actor, fire, or weather-related event.

Hazardous material incidents affect a range of stakeholders in the whole community. Workers in facilities who regularly use or handle hazardous materials, transportation carriers, nearby residents and students, first responders, and first receivers<sup>2</sup> are all at risk of health impacts from hazardous materials.

Communities can increase their resilience to a hazardous materials incident in several ways, including reducing the likelihood of a release, being prepared to respond to a potential release, and effectively responding if a release does occur.

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<sup>1</sup> Comprehensive Preparedness Guide (CPG) 201: THIRA and SPR: <https://www.fema.gov/threat-and-hazard-identification-and-risk-assessment>.

<sup>2</sup> First receivers are healthcare workers at risk to exposure of hazardous materials when healthcare facilities receive contaminated individuals during emergency response activities.

# Hazardous Materials Overview

According to the National Fire Protection Association (NFPA) 472: Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents, a hazardous material is defined as “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, 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 are categorized in several ways. The Department of Transportation (DOT) organizes substances into nine classes, listed in the callout to the right. Another system, outlined in NFPA 704: Standard System for the Identification of the Hazards of Materials for Emergency Response,<sup>3</sup> identifies hazards by the severity of the hazard in three principal categories (health, flammability, and instability).

## U.S. Department of Transportation Hazard Classification System

The hazard class of dangerous goods is indicated either by its class number or name.

- Class 1 – Explosives
- Class 2 – Gases
- Class 3 – Flammable liquids (and combustible liquids)
- Class 4 – Flammable solids; Substances liable to spontaneous combustion; Substances which, on contact with water, emit flammable gases
- Class 5 – Oxidizing substances and Organic peroxides
- Class 6 – Toxic (poisonous) substances
- Class 7 – Radioactive materials
- Class 8 – Corrosive substances
- Class 9 – Miscellaneous dangerous goods/hazardous materials and articles

## Health Risks Posed by Hazardous Materials

Hazardous materials vary greatly in the types of health risks they pose to humans. Emergency responders contend with the following potential health risks<sup>4</sup> from hazardous materials. Thermal, Radiological, Asphyxiation, Chemical, Etiological, or Mechanical (TRACEM). The following sections briefly discuss each type of health risk.

### Thermal Harm

Thermal harm results from exposure to temperature extremes. Thermal injuries can be external (from contacting, or being in close proximity to, a fire or other heat source) or internal (from inhaling fumes or heated air). Thermal injuries can also include frostbite from contact with low-temperature hazardous materials.

### Radiological Harm

Radiological harm, perhaps the most misunderstood type of harm in the TRACEM model, results from exposure to radioactive materials. The most harmful types of radiation cannot be seen, felt or

<sup>3</sup> NFPA 704 can be found at: <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=704>.

<sup>4</sup> NOTE: This document addresses only acute health risks. It does not cover health hazards from chronic or repeated long-term exposure to hazardous materials.

smelled. Special detection devices are required to monitor and measure levels of radiation, and these devices are becoming more available to emergency responders.

Different types of radiation have different energy levels, and not all types are dangerous. For example, non-ionizing radiation (from sources such as fluorescent lights, radio waves, and microwaves) has enough energy to move atoms but not enough to alter them chemically.

The radiation that poses a threat to humans is ionizing radiation, which can remove electrons from atoms and cause damage to living cells and DNA. Examples of ionizing radiation sources include medical isotopes used for diagnostic and therapeutic purposes, X-rays for imaging (medical and industrial), and some survey equipment.

### **Asphyxiation**

Asphyxiation results from exposure to materials that reduce oxygen to levels that may cause suffocation. Asphyxiation typically occurs in confined spaces or with extremely concentrated forms of simple asphyxiants. Asphyxiants displace so much oxygen from the ambient atmosphere that the lungs can't supply enough fully oxygenate the tissues and the victim slowly suffocates. Many asphyxiants (e.g., carbon dioxide, methane) are odorless and tasteless (unless odorants are added), so that you could become unconscious without realizing an asphyxiants gas is present.

### **Chemical Harm**

Chemical harm results from exposure to chemicals, including poisons and corrosives. Injuries and illness vary by material. Chemical agents are classified according to the potential severity of their effects. More information on the categories listed below is on the Department of Health and Human Services (HHS) Chemical Hazards Emergency Medical Management (CHEMM) website.<sup>5</sup>

- [Anticholinergic Agents](#)
- Biotoxins
- [Blister Agents/Vesicants](#)
- [Blood/Systemic Agents](#)
- [Caustics \(Acids\)](#)
- [Choking/Lung/Pulmonary Agents](#)
- [Convulsants](#)
- [Long-Acting Anticoagulants](#)
- Metals
- [Opioids](#)
- [Organophosphorus Pesticides and Nerve Agents](#)
- [Organic Solvents](#)
- [Riot Control Agents/Tear Gas](#)
- Toxic Alcohols
- Vomiting Agents.

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<sup>5</sup>For more on CHEMM visit: <https://chemm.nlm.nih.gov/agentcategories.htm>.

### Etiological (Biological) Harm

Etiological (or biological) harm results from exposure to biological materials, which include bacteria, viruses, and biological toxins. Symptoms of etiological harm are often delayed, because the pathogens often require time to multiply sufficiently to cause illness in the person carrying the pathogen.

### Mechanical Harm

Mechanical harm results from exposure to, or contact with, fragmentation or debris scattered because of a pressure release, explosion, or boiling liquid expanding vapor explosion (BLEVE).<sup>6</sup> Certain, predictable reactions occur during and immediately after an explosion, which routinely injure or kill anyone in close proximity. The degree of harm is closely related to the size of the explosion and proximity to the device. Sources of injury include:

- **Fragmentation and flying debris** – the most common sources of injury from an explosion. Harm may include impaled objects, bone and skull fracture, and evisceration.
- **Blast overpressure** – a rapid increase in air pressure caused by rapid gas expansion. Human harm includes ruptures to the eardrums, blood vessels, and organs, torn organs, and lung collapse.
- **Secondary blast injuries** – when a victim is thrown by the blast overpressure into other objects. Harm may include spinal injuries, bone, and skull fractures.

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<sup>6</sup> A BLEVE is an explosion caused by the rupture of a vessel containing a pressurized liquid that has reached temperatures above its boiling point.



# Hazardous Materials Response

In the event of a hazardous materials release or incident, first responders, transportation carriers, facility staff, and medical personnel use defined processes, treatment protocols, and equipment to contain and resolve the issue.

## Risk-Based Response

### Risk-Based Response Process

First responders use a risk-based response process<sup>7</sup> known as APIE, which stands for “Analyze, Plan, Implement, and Evaluate,” when responding to an incident. This process allows responders to break a complex and potentially overwhelming response down into pieces to aid decision making. The goal is to ensure responder health and safety while mitigating emergencies. The APIE process helps responders analyze the clues upon approaching the scene, determine a plan to improve the situation, implement the planned response actions to stabilize the incident, and evaluate the progress.

### Hazardous Material Identification and Response Resources

First responders use several resources to identify hazardous materials and respond appropriately:

- The Emergency Response Guidebook<sup>8</sup> (ERG), issued by DOT, aids in the rapid identification of the specific or generic hazards of the material(s) involved in a transportation incident.
- Safety Data Sheets<sup>9</sup> at facilities provide information on the properties of each chemical; the physical, health, and environmental hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical.
- Additional resources include the National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards,<sup>10</sup> CHEMTREC,<sup>11</sup> and the Wireless Information System for Emergency Responders.<sup>12</sup>

Appendix A contains links to all these resources.

## Medical Treatment

The CHEMM<sup>13</sup> website and application, developed by HHS, enable first responders, first receivers, other healthcare providers, and planners to plan for, respond to, recover from, and

<sup>7</sup> The Risk-Based Response Process is outlined in NFPA 472 – Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents: <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=472>.

<sup>8</sup> ERG: <https://www.phmsa.dot.gov/hazmat/erg/emergency-response-guidebook-erg>.

<sup>9</sup> Safety Data Sheets: <https://www.osha.gov/Publications/OSHA3514.html>.

<sup>10</sup> NIOSH Pocket Guide to Chemical Hazards: <https://www.cdc.gov/niosh/npg/default.html>.

<sup>11</sup> CHEMTREC: <https://www.chemtrec.com/resources>.

<sup>12</sup> Wireless Information System for Emergency Responders: <https://wiser.nlm.nih.gov/>.

<sup>13</sup> CHEMM Home Page: <https://chemm.nlm.nih.gov/>.

mitigate the effects of mass-casualty incidents involving chemicals. The site includes best practices, information, and guidelines on patient management; what to do in the first minutes; and initial on-site activities.

Similarly, the Radiation Emergency Medical Management (REMM)<sup>14</sup> website and application provide guidance for healthcare providers, primarily physicians, about clinical diagnosis and treatment of radiation injuries during radiological and nuclear emergencies.

## Hazardous Materials Handling and Response Equipment

The type of equipment needed to handle, store, or deal with hazardous materials varies based on the type of material/substance and the situation. First responders, employees at facilities that store hazardous material, and anyone that encounters hazardous materials should read Safety Data Sheets and labels, follow existing procedures, and understand how to equip themselves to ensure their personal safety.

### Personal Protective Equipment (PPE)

PPE is a main source of protection for emergency response and recovery workers. Routes of exposure include inhalation, dermal contact, ingestion, or contact through mucous membranes. Therefore, essential protective equipment includes respirators, eye protection, hearing protection, and protective clothing (e.g., gas masks, gloves, overalls, boots, goggles). Depending on the type and severity of the hazard, the recommendations on the use of protective equipment can change.

NIOSH maintains a website on PPE<sup>15</sup> for emergency responders. This site provides information on properly using protective equipment under different conditions and situations, as well as in-depth information concerning the proper selection and use of respirators.

The Occupational Safety and Health Administration (OSHA) also produced a guide on workplace PPE.<sup>16</sup> This guide helps both employers and employees:

- Understand the types of PPE
- Know the basics of conducting a hazards assessment of the workplace
- Select appropriate PPE for a variety of circumstances
- Understand the training needed to properly use and care for PPE.

### Response Equipment

When responding to hazardous materials incidents, specialized equipment is often necessary. The Interagency Board (IAB) for Emergency Preparedness and Response<sup>17</sup> maintains a list of almost 800 items recommended to Federal, state, local, tribal, and territorial government organizations to prepare for and respond to incidents. The Standardized Equipment List<sup>18</sup> provides generic

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<sup>14</sup> REMM: <https://www.remm.nlm.gov/>.

<sup>15</sup> Emergency Response Resources: Personal Protective Equipment: <https://www.cdc.gov/niosh/topics/emres/ppe.html>.

<sup>16</sup> OSHA 3151-12: Personal Protective Equipment: <https://www.osha.gov/Publications/osha3151.pdf>.

<sup>17</sup> The IAB is a voluntary collaborative panel of emergency preparedness and response practitioners, representing all levels of government and operational, technical, and support organizations.

<sup>18</sup> IAB Standardized Equipment List: <https://www.interagencyboard.org/sel>.

equipment recommendations for 28 missions, organized by mission (e.g., Law Enforcement: Preventive Rad/Nuc Detection) and sublists (e.g., Detection, Decontamination, Medical).

The Standardized Equipment List aligns with the Authorized Equipment List (AEL)<sup>19</sup> produced by FEMA. The AEL provides approved equipment types allowed under FEMA’s preparedness grant programs. The intended audience for this tool includes emergency managers, first responders, and other homeland security professionals.

The AEL consists of 21 equipment categories divided into categories, sub-categories, and individual equipment items (Figure 1). It does not include commercially available products, only equipment types.

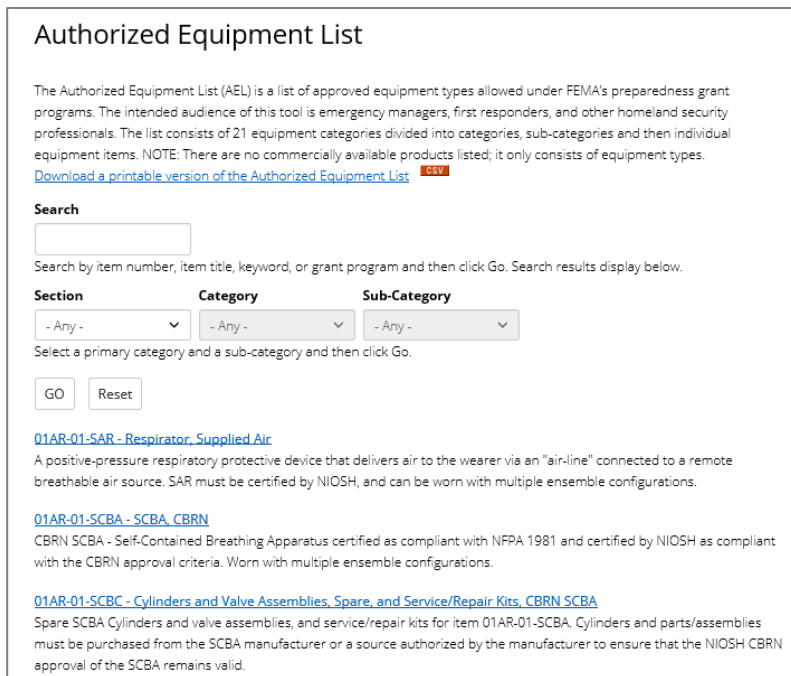


Figure 1: The Authorized Equipment List

### Mutual Aid and Resource Typing

Not all jurisdictions have the resources on hand to address hazardous materials incidents. Communities should use the resource management principles of the National Incident Management System (NIMS) to leverage the resources of neighboring jurisdictions through mutual aid agreements, private sector partnerships, and volunteer organization involvement.

Resource typing is a key activity of resource management—defining and categorizing incident resources by capability to establish a common language for discussing resources. The Resource Typing Library Tool (RTLTL) is an online catalog of NIMS resource typing definitions and job titles/position qualifications that communities can use to manage any incident, including those involving hazardous materials. The RTLTL and all NIMS resource typing definitions and job titles/position qualifications released by FEMA are at <https://rtlt.preptoolkit.org>. Use the following NIMS resource types (in the RTLTL) to manage hazardous materials incidents:

- Hazardous Materials Research Specialist
- Hazardous Materials Response Team
- Hazardous Materials Response Team Leader
- Hazardous Materials Technician

Information on creating mutual aid agreements is in the NIMS Guideline for Mutual Aid.<sup>20</sup>

<sup>19</sup> Authorized Equipment List: <https://www.fema.gov/authorized-equipment-list>.

<sup>20</sup> NIMS Guideline for Mutual Aid: <https://www.fema.gov/media-library/assets/documents/151799>.

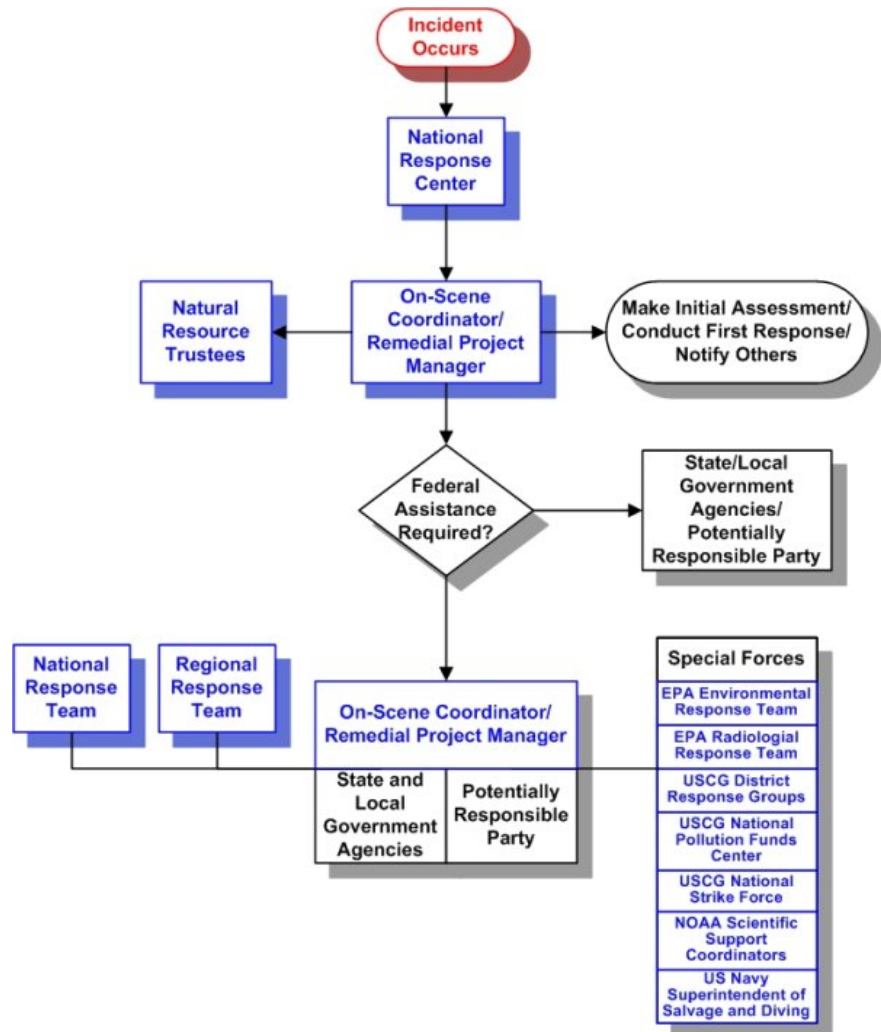
## Federal Response to Hazardous Materials Incidents

The National Response System<sup>21</sup> (Figure 2) is the mechanism the Federal government uses to respond to a wide range of hazardous materials releases.

When a release or spill of oil or a regulated hazardous material exceeds a specified trigger,<sup>22</sup> the organization responsible for the release or spill is required by law to notify the National Response Center at 1-800-424-8802. This center is run 24 hours a day by the Coast Guard.

Once a report is made, the National Response Center immediately notifies a designated On-Scene Coordinator in the region, as well as state, local, tribal, and territorial emergency personnel. The On-Scene Coordinator coordinates with the state, tribe, or territory, other personnel on site, and the Potentially Responsible Party (responsible for the release or spill) to determine the status of the response.

The On-Scene Coordinator determines whether, or how much, Federal involvement is necessary and deploys the needed resources. The On-Scene Coordinator also ensures that the cleanup, whether accomplished by industry or Federal, state, local, tribal, or territorial officials, is appropriate, timely, and minimizes human and environmental damage.



**Figure 2: National Response System Flowchart**

<sup>21</sup> The National Response System is part of the National Oil and Hazardous Substances Pollution Contingency Plan, commonly called the National Contingency Plan. More information can be found at: <https://www.epa.gov/emergency-response/national-oil-and-hazardous-substances-pollution-contingency-plan-ncp-overview>.

<sup>22</sup> Information on reporting requirements is available at: <https://www.epa.gov/emergency-response/when-are-you-required-report-oil-spill-and-hazardous-substance-release>.

# Hazardous Materials Incident Planning

Planning for hazardous materials incidents and releases occurs at all levels of government and within the private sector. Many of these plans are required by regulations or as a requirement to receive Federal grant assistance.

## Benefits of Coordinated, Integrated Planning

Coordinating and integrating planning efforts and plans allows organizations to know their roles, understand how plans fit together, identify and address gaps, execute their plans, and coordinate activities in the event of an incident. Organizations must integrate plans vertically and horizontally.

- **Vertical integration** incorporates planning across various scales within a specific function. For example, industry plans should vertically integrate with local emergency response plans.
- **Horizontal integration** incorporates planning across various organizations and jurisdictions. For example, neighboring jurisdictions should horizontally integrate their plans.

This integration builds a common understanding of relevant capabilities, relationships, objectives, and resource requirements.

## Planning Landscape

A variety of plans are developed by facilities, by state, local, tribal, and territorial governments, and by the Federal government to help prepare for hazardous materials incidents. All these plans

### Risk-Based Planning

Planning efforts for hazardous materials incidents should be risk-based and use the THIRA process and SPR<sup>21</sup>. In the THIRA process, communities consider the following questions:

- What are the hazardous material accident risks of transportation and facilities in the community, and how are they being prevented?<sup>22</sup>
- Are commodity flow studies<sup>23</sup> included as part of analyzing transportation risks?
- Based upon the identified risks, what are the plans and capabilities of the response organizations and the community should an accident occur?
- What are the roles and responsibilities of all community members (i.e., public and private sector partners) during a hazardous materials incident?
- What capability gaps exist, and what plans might be put in place to fill those gaps, based on community priorities?

<sup>23</sup> Comprehensive Preparedness Guide (CPG) 201: Threat and Hazard Identification and Risk Assessment and Stakeholder Preparedness Review: <https://www.fema.gov/threat-and-hazard-identification-and-risk-assessment>.

<sup>24</sup> The National Response Center Database can identify previously reported incidents. The search form is at <http://www.rtk.net/erns/search.php>.

<sup>25</sup> Commodity flow studies are a special kind of transportation analysis to identify the types and amounts of hazardous materials transported through a specified geographic area. Information on conducting one is in the Guidebook for Conducting Local Hazardous Materials Commodity Flow Studies at <https://www.nap.edu/download/14559>.

are most effective when a wide range of stakeholders are involved in the planning process and the plans are coordinated and integrated. Below are some of the plans that should be developed:

### **Industry Risk Management Plans**

Facilities holding more than a threshold quantity<sup>26</sup> of a regulated substance in a process are required by Section 112(r) of the Clean Air Act Amendments to develop and submit a Risk Management Plan (RMP) to the Environmental Protection Agency (EPA) that includes:

- A hazard assessment detailing the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases;
- A prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and
- An emergency response program that details emergency health care, employee training measures, and procedures for informing the public and response agencies (e.g., the fire department) should an accident occur.

### **First Responder Site-Specific Plans**

First responders conduct site-specific pre-incident planning to help understand the potential hazards they may face at a given facility (e.g., commercial, industrial, recreational). Pre-planning site visits allow responders to:

- Recognize and identify the hazardous materials at each facility;
- See what each facility manufactures, how supplies are stored, and what equipment is used;
- Obtain specific data on each potentially hazardous material; and
- Review the facility's emergency plans.

### **State/Tribal/Territorial Emergency Operations Plans (EOPs)**

States, tribes, and territories receiving emergency preparedness grant assistance from FEMA are required to develop EOPs and update them at least once every two years. These plans are community-based, risk-informed, and all-hazard.

Comprehensive Preparedness Guide (CPG) 101: Developing and Maintaining Emergency Operations Plans<sup>27</sup> outlines a process for developing EOPs.

### **Local Emergency Planning Committee Response Planning**

The Emergency Planning and Community Right-to-Know Act<sup>28</sup> (EPCRA), also known as Title III of the Superfund Amendments and Reauthorization Act, created a new relationship among all levels of government, business and community leaders, environmental and other public-interest organizations, and individual citizens. EPCRA required state governors to designate State Emergency Response Commissions (SERCs). SERCs, in turn, designated over 3,500 local emergency planning districts and appointed Local Emergency Planning Committees (LEPCs) for

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<sup>26</sup> RMP Applicability Guidance: <https://www.epa.gov/rmp/general-rmp-guidance-chapter-1-general-applicability>.

<sup>27</sup> CPG 101: <https://www.fema.gov/media-library/assets/documents/25975>.

<sup>28</sup> EPCRA: <https://www.epa.gov/epcra>.

each district. LEPCs form partnerships with governments and industries as a resource for enhancing hazardous materials preparedness.

Local governments are responsible for integrating hazardous materials planning and response within their jurisdictions. This includes:

- Ensuring the local hazard analysis adequately addresses hazardous materials incidents;
- Incorporating planning for hazardous materials incidents into the local and tribal emergency plan and annexes;
- Assessing developing hazardous materials response capability using local resources, mutual aid and contractors;
- Training responders; and
- Exercising the plan.

Similar to state responsibilities, the CEO of a tribe appoints the Tribal Emergency Response Commission (TERCs). TERCs have the same responsibilities as SERCs. TERCs designate Tribal Emergency Planning Committees with the same responsibilities as LEPCs.

#### Required Elements of LEPC and TEPC Emergency Response Plans

LEPCs/TEPCs must develop plans with the following elements (or ensure that other local plans such as EOPs incorporate them).

- Identify facilities containing, and transportation routes carrying, extremely hazardous substances
- Describe emergency response procedures, on and off site
- Designate a community coordinator and facility emergency coordinator(s) to implement the plan
- Outline emergency notification procedures
- Describe how to determine the probable affected area and population by releases
- Describe local emergency equipment and facilities and persons responsible for them
- Outline evacuation plans
- Outline a training program for emergency responders (including schedules)
- Establish methods and schedules for exercising emergency response plans

### Area, Regional, and National Contingency Plans

The National Oil and Hazardous Substances Pollution Contingency Plan (the National Contingency Plan) is the Federal Government's blueprint to respond to oil spills and hazardous substance releases. This plan establishes the National Response Team, the National Response System, and 13 Regional Response Teams.

Each Regional Response Team develops a Regional Contingency Plan to coordinate effective regional response. Additionally, 36 Coastal and 13 Inland Areas have Area Contingency Plans.

### Federal Interagency Operational Plans (FIOPs)

FIOPs describe roles and responsibilities, specify critical tasks, and identify Federal resourcing requirements to deliver national preparedness core capabilities for all hazards. Three annexes to the Response and Recovery FIOPs specify the organizations and processes the Federal government uses to respond to and recover from major hazardous materials incidents:

- [Oil/Chemical Incident Annex to the Response and Recovery FIOPs](#)<sup>29</sup>

<sup>29</sup> Oil/Chemical Incident Annex: <https://www.fema.gov/media-library/assets/documents/154962>.

- [Biological Incident Annex to the Response and Recovery FIOPs](#)<sup>30</sup>
- [Nuclear/Radiological Incident Annex to the Response and Recovery FIOPs](#).<sup>31</sup>

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<sup>30</sup> Biological Incident Annex: <https://www.fema.gov/media-library/assets/documents/152894>.

<sup>31</sup> Nuclear/Radiological Incident Annex: <https://www.fema.gov/media-library/assets/documents/25554>.



# Effective Practices

Communities can increase their resilience to hazardous materials incidents in many ways. This section outlines several practices that communities can use to reduce the likelihood of an incident and limit the consequences if an incident does occur.

## Land Use Policies

The location of hazardous materials facilities is a critical factor in mitigating risk. Proximity of these facilities to residential areas and businesses creates the potential for devastating impacts should a release or explosion occur. Jurisdictions should consider zoning and regulations to ensure that hazardous facilities are not located near residents, schools, and businesses and that future development is restricted within a certain distance of facilities that store hazardous materials.

Additionally, some jurisdictions require certain types of facilities (e.g., natural gas wells) to coordinate with local first responders and produce emergency plans as part of the permitting process. This prepares facilities for a hazardous materials incident and ensures first responders are aware of and prepared to respond to a new potential facility that contains hazardous materials.



### Case Study: Land Use Policy

On April 17, 2013, an explosion occurred at a facility located in the city of West, Texas, that was storing 30 tons of fertilizer-grade ammonium nitrate. It killed 15 and injured hundreds. Nearby homes and businesses were severely damaged, and many were destroyed.

Lack of effective zoning restrictions was one issue that led to the severity of this incident. The facility in West was built in an area of open fields in 1961, but the area did not have any regulations restricting encroachment. Over the subsequent 50 years, two schools, a playground, an apartment complex, and a nursing home were all built in proximity to the fertilizer facility.

## LEPC Leadership, Support, and Focus

LEPCs must include, at a minimum, local officials, including police, fire, emergency management, public health, transportation, and environmental professionals, as well as representatives of facilities subject to the emergency planning requirements, community groups, and the media. Some communities also include additional members from community water systems, healthcare coalitions, community emergency response teams, and/or school districts.

While LEPCs must plan for chemical hazards, using an all-hazards approach is an excellent whole community resource for all emergency management planning. Strong leadership by the committee chair and strong support by local government are critical elements in an effective LEPC.

## Data-rich Risk Analysis

Facilities are subject to multiple regulations from Federal agencies, and the data provided through compliance with these regulations can enhance planning and preparedness efforts. Sources to consider include:

- Facilities required to submit [Tier II data](#)<sup>32</sup> as part of EPCRA;
- Facilities required to submit through the [Toxic Release Inventory](#)<sup>33</sup> program;
- Facilities that are [Large Quantity Generators](#)<sup>34</sup> of hazardous waste;
- Facilities that are required to submit [RMPs](#)<sup>35</sup> to the EPA; and
- Facilities that are part of the [Chemical Facility Anti-Terrorism Standards](#)<sup>36</sup> program.

## Training and Exercises

Due to effective regulations, the number of “working” hazardous material incidents has decreased in recent decades. While this decrease is a great success, it also means many government officials and first responders have not had the opportunity to develop incident-based experience, which is important to a risk-based response decision making process. First responders are also less familiar and comfortable with PPE, which can significantly affect their performance.

Effective, risk-based training and exercises are critically needed to prepare government officials and first responders to act quickly and effectively during hazardous material release or incidents. Minimum training levels should be based on established industry standards and be assessed with valid, reliable testing that leads to certification by accredited agencies.

## Public Information and Warning

Having a plan in place and pre-identified mechanisms to disseminate information to the public keeps people safe and reduces the burden on the response effort. When a hazardous materials incident occurs, information on the incident and recommended protective actions by the public must be disseminated quickly. The initial intent is to inform the individuals at risk and share the recommended protective actions they should take. This information should be verified and coordinated with the appropriate responding organizations.

### Hazardous Material Spill/ Contamination Exercise Starter Kit

The National Exercise Division within FEMA developed a customizable tabletop exercise to examine the ability of a jurisdiction or organization to respond to and recover from a hazardous material spill/contamination either at a facility or by train derailment.

The exercise starter kit contains a situation manual, facilitator's guide, slide deck, and scene-setter videos. Download it from the Preparedness Toolkit:  
<https://preptoolkit.fema.gov/web/em-toolkits/psp-1/test>. NOTE: Free registration is required to access this section of the Preparedness Toolkit.

<sup>32</sup> Tier II data: <https://www.epa.gov/epcra/tier-ii-forms-and-instructions>.

<sup>33</sup> Toxic Release Inventory: <https://www.epa.gov/toxics-release-inventory-tri-program>.

<sup>34</sup> Hazardous Waste Generator: <https://www.epa.gov/hwgenerators/categories-hazardous-waste-generators>.

<sup>35</sup> RMP Rule: <https://www.epa.gov/rmp>.

<sup>36</sup> Chemical Facility Anti-Terrorism Standards: <https://www.dhs.gov/cisa/chemical-facility-anti-terrorism-standards>.

Integrated Public Alert and Warning System (IPAWS) allows designated Federal, state, local, tribal, and territorial alerting authorities to disseminate location specific alerts and warnings simultaneously through multiple pathways.<sup>37</sup> Designated authorities write their own message to be delivered simultaneously through television, cell phone, home phone, radio, computer, and public signage.

The information should also be accessible to all community members, including individuals with access and functional needs, to include those with disabilities and those who do not speak English or speak it as a second language. FEMA produced a PrepTalk<sup>38</sup> on Modernizing Public Warning Messaging<sup>39</sup> that presents research on how to design and disseminate alerts and warning information to encourage public action.

## Conclusion

Hazardous materials are ubiquitous in every American community. Incidents and releases can and will continue to occur. Hazardous materials incidents are perhaps the most relatable and scalable, from neighborhood to national level incidents with the potential for devastating long term impacts to the environment and the economy. However, communities have information and resources available to help them understand their risks, reduce the likelihood of an incident, and be prepared to effectively respond to and recover from an incident or release that does occur.

Preparing for a hazardous material incident is not a one-time-only activity. Community hazardous materials change, personnel take different positions, and new threats emerge. Therefore, preparedness for hazardous material incidents must be conducted continuously.

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<sup>37</sup> IPAWS: <https://www.fema.gov/integrated-public-alert-warning-system>.

<sup>38</sup> PrepTalks are video presentations by subject-matter experts and thought leaders to spread new ideas, spark conversation, and promote innovative leadership for current and future issues confronting emergency managers. <https://www.fema.gov/preptalks>.

<sup>39</sup> PrepTalks: Modernizing Public Warning Messaging: <https://www.fema.gov/preptalks/mileti>.

# Appendix A: Resources

This appendix contains lists of resources in the following categories:

- Hazardous Materials Regulations and Standards
- Federal Interagency Operational Plans (FIOPs)
- General Hazardous Material Information
- Chemical Incident Information
- Biological Incident Information
- Nuclear/Radiological Incident Information
- Equipment
- Training
- Modeling Resources
- Data Collection and Aggregation Resources

The links on the following resources provide additional information, summaries, or overviews of the regulations and legislation referenced.

## Hazardous Materials Regulations and Standards

- **Atomic Energy Act (1954):** The fundamental U.S. law on both the civilian and military uses of nuclear materials. It addresses the development and regulates the uses of nuclear materials and facilities in the United States. (<https://www.nrc.gov/about-nrc/governing-laws.html>)
- **Chemical Facility Anti-Terrorism Standards (CFATS):** Regulatory program focused specifically on security at high-risk chemical facilities to ensure security measures are in place to reduce the risk of certain hazardous chemicals being weaponized. (<https://www.dhs.gov/cisa/chemical-facility-anti-terrorism-standards>)
- **Clean Air Act (CAA) Section 112(r) (1990):** Required the EPA to publish regulations and guidance for chemical accident prevention at facilities using substances that pose the greatest risk of harm from accidental releases. (<https://www.epa.gov/clean-air-act-overview>)
- **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (1980):** Created a tax on chemical and petroleum industries and provided Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. (<https://www.epa.gov/superfund/superfund-cercla-overview>)
- **Emergency Planning and Community Right-to-Know Act (EPCRA) (1986):** Also known as Title III of the Superfund Amendments and Reauthorization Act. Protects human health and the environment by providing communities and their emergency planners with valuable information on the toxic chemicals present in their communities. (<https://www.epa.gov/epcra>)
- **Hazardous Materials Transportation Act (1975):** Empowered the Secretary of Transportation to designate as hazardous material a “particular quantity or form” of a material

that “may pose an unreasonable risk to health and safety or property.”

([https://www.osha.gov/SLTC/trucking\\_industry/transportinghazardousmaterials.html](https://www.osha.gov/SLTC/trucking_industry/transportinghazardousmaterials.html))

- **NFPA Codes and Standards:** The NFPA publishes more than 300 consensus codes and standards to minimize the possibility and effects of fire and other risks. Many of them relate directly to hazardous materials, including those listed below. (<https://www.nfpa.org/Codes-and-Standards/All-Codes-and-Standards/List-of-Codes-and-Standards>)
  - NFPA 400: Hazardous Material Code
  - NFPA 471: Recommended Practice for Responding to Hazardous Material Incidents
  - 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
  - NFPA 1072: Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications.
- **Occupational Safety and Health Act (OSHA) (1970):** Requires employers to provide a place of employment free from recognized hazards to safety and health, such as exposure to toxic chemicals, excessive noise levels, mechanical dangers, heat or cold stress, or unsanitary conditions. (<https://www.epa.gov/laws-regulations/summary-occupational-safety-and-health-act>)
- **OSHA – Hazard Communication Standard – 1910.1200:** Requires employers to identify the hazards present in the workplace. Specifically, requires chemical manufacturers and importers to evaluate the hazards of the chemicals they produce or import and document hazard information on labels and safety data sheets. (<https://www.osha.gov/Publications/OSHA3514.html>)
- **OSHA – Hazardous Waste Operations and Emergency Response (HAZWOPER) – 1910.120:** Addresses medical surveillance programs, training, emergency response planning, incident management systems, decontamination procedures, and equipment selection and maintenance. (<https://www.osha.gov/SLTC/emergencypreparedness/hazwoper/index.html>)
- **Price-Anderson Nuclear Industries Indemnity Act (1957):** Covers liability claims of members of the public for personal injury and property damage caused by a commercial nuclear power plant accident. (<https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/nuclear-insurance.html>)
- **Project BioShield Act (2004):** Authorizes expedited procurement, streamlined personnel appointments, expedited peer review, biomedical countermeasures procurement, emergency use of medical countermeasures, and other biodefense activities. (<http://www.astho.org/Programs/Preparedness/Public-Health-Emergency-Law/Emergency-Use-Authorization-Toolkit/Project-BioShield-Act-Fact-Sheet/>)
- **Resource Conservation and Recovery Act (RCRA) (1976):** The primary law governing the disposal of solid and hazardous waste at active and future facilities. (<https://www.epa.gov/rcra/resource-conservation-and-recovery-act-rcra-overview>)

- **Superfund Amendments and Reauthorization Act (SARA) (1986):** Amended CERCLA to address lessons learned and stress the importance of permanent remedies and innovative treatment technologies in cleaning up hazardous waste sites. (<https://www.epa.gov/superfund/superfund-amendments-and-reauthorization-act-sara>)

## Federal Interagency Operational Plans (FIOPs)

FIOPs provide detailed descriptions of roles and responsibilities, specify critical tasks, and identify Federal resourcing requirements for delivering national preparedness core capabilities. (<https://www.fema.gov/federal-interagency-operational-plans>)

- **Response FIOP:** How the Federal Government coordinates its efforts to save lives, protect property and the environment, and meet basic human needs following an emergency or disaster. ([https://www.fema.gov/media-library-data/1471452095112-507e23ad4d85449ff131c2b025743101/Response\\_FIOP\\_2nd.pdf](https://www.fema.gov/media-library-data/1471452095112-507e23ad4d85449ff131c2b025743101/Response_FIOP_2nd.pdf))
- **Recovery FIOP:** The concept of operations for integrating and synchronizing existing national-level Federal capabilities to support state, local, tribal, and territorial recovery. ([https://www.fema.gov/media-library-data/1471451918443-dbbb91fec8ffd1c59fd79f02be5afddd/Recovery\\_FIOP\\_2nd.pdf](https://www.fema.gov/media-library-data/1471451918443-dbbb91fec8ffd1c59fd79f02be5afddd/Recovery_FIOP_2nd.pdf))
- **Biological Incident Annex to the Response and Recovery FIOPs:** Guidance and reference for Federal agency planning efforts involving biological incidents. (<https://www.fema.gov/media-library/assets/documents/152894>)
- **Nuclear/Radiological Incident Annex to the Response and Recovery FIOPs:** The policies, situations, concept of operations, and responsibilities of Federal departments and agencies governing the immediate response and short-term recovery activities for incidents involving the release of radioactive materials. (<https://www.fema.gov/media-library/assets/documents/25554>)
- **Oil/Chemical Incident Annex to the Response and Recovery FIOPs:** The process and organizational constructs that Federal departments and agencies use to respond to threats or incidents causing oil spills or chemical releases, whether resulting from deliberate acts of terrorism or crime, accidents, or natural disasters. (<https://www.fema.gov/media-library/assets/documents/154962>)

## General Hazardous Material Information

- **Emergency Response Guidebook (ERG):** Information for first responders on how to identify and respond to hazardous materials involved in a transportation incident. (<https://www.phmsa.dot.gov/hazmat/erg/emergency-response-guidebook-erg>)
- **Guidebook for Conducting Local Hazardous Materials Commodity Flow Studies:** Developed by the Transportation Research Board; supports risk assessment, emergency response preparedness, resource allocation, and analyses of hazardous commodity flows across jurisdictions. (<https://www.nap.edu/download/14559>. NOTE: Free registration is required to access this)
- **Hazardous Materials Emergency Planning Guide:** Helps communities plan for hazardous materials incidents. ([epa.gov/sites/production/files/2014-09/documents/cleanrt10\\_12\\_distiller\\_complete.pdf](https://epa.gov/sites/production/files/2014-09/documents/cleanrt10_12_distiller_complete.pdf))

- **Pipeline and Hazardous Materials Safety Administration (PHMSA) Outreach and Engagement Program Web-Portal:** A plethora of hazardous material resources, including publications, training, and webinars. (<https://www.phmsa.dot.gov/training/hazmat/hazardous-materials-outreach-engagement>)
- **Ready.gov Hazardous Materials Incidents Webpage:** Information on actions that individuals should take, both to prepare for hazardous materials incidents and if an incident occurs. (<https://www.ready.gov/hazardous-materials-incidents>)
- **Technical Guidance for Hazards Analysis: Emergency Planning for Extremely Hazardous Substances:** Helps facilitate community awareness of the potential risks of chemical releases while helping the community to plan for, respond to, and reduce those risks. ([epa.gov/sites/production/files/2013-08/documents/technical\\_guidance\\_for\\_hazard\\_analysis.pdf](https://epa.gov/sites/production/files/2013-08/documents/technical_guidance_for_hazard_analysis.pdf))
- **Transportation Community Awareness and Emergency Response (TRANSCAER):** Resources and training to help communities prepare for and respond to a possible hazardous material transportation incident. (<https://www.transcaer.com/>)
- **Wireless Information System for Emergency Responders (WISER):** Assists emergency responders in hazardous material incidents. Provides a wide range of information on hazardous substances, including substance identification support, physical characteristics, human health information, and containment and suppression advice. (<https://wiser.nlm.nih.gov/>)

## Chemical Incident Information

- **Chemical Emergency Preparedness and Prevention on Tribal Lands:** Familiarizes tribal leaders with EPCRA and CAA Section 112(r) Risk Management Program requirements and how these laws promote an integrated approach to chemical safety on tribal lands. ([epa.gov/sites/production/files/2016-06/documents/tribal\\_fact\\_sheet\\_06-16-16.pdf](https://epa.gov/sites/production/files/2016-06/documents/tribal_fact_sheet_06-16-16.pdf))
- **Chemical Hazards Emergency Medical Management (CHEMM):** Resources to enable first responders, first receivers, other healthcare providers, and planners to plan for, respond to, recover from, and mitigate the effects of mass-casualty incidents involving chemicals. (<https://chemm.nlm.nih.gov/>)
- **CHEMTREC – American Chemistry Council – Resources:** This web-portal provides approved decal suppliers, fact sheets, and case studies by chemical industry leaders. (<https://www.chemtrec.com/resources>)
- **Computer-Aided Management of Emergency Operations (CAMEO):** Four software applications, developed by the EPA and the National Oceanic and Atmospheric Administration, to plan for and respond to chemical emergencies. (<https://www.epa.gov/cameo/what-cameo-software-suite>):
  - **CAMEO<sub>fm</sub>:** Assists with data management requirements under the Emergency Planning and Community Right-to-Know Act. (<https://www.epa.gov/cameo/cameo-software>)
  - **CAMEO Chemicals:** Contains critical response information for thousands of chemicals. (<https://cameochemicals.noaa.gov/>)
  - **Mapping Application for Response, Planning, and Local Operational Tasks (MARPLOT):** Links to CAMEO<sub>fm</sub> to store information on facilities and display potential

- or actual chemical release scenarios to determine potential impacts and aid decision-making. (<https://www.epa.gov/cameo/marplot-software>)
- **Areal Locations of Hazardous Atmospheres (ALOHA):** This atmospheric dispersion model can be used to evaluate releases of hazardous chemical vapors. (<https://www.epa.gov/cameo/aloha-software>)
  - **Emergency Planning and Community Right-to-Know Act (EPCRA) Web Portal:** Information, training, and planning resources for the requirements of EPCRA. (<https://www.epa.gov/epcra>)
    - **EPCRA Online Training for States, Tribes, and LEPCs** ([https://epawebconferencing-events.acms.com/content/connect/c1/7/en/events/event/private/542791/97171446/event\\_landing.html?sco-id=97166143& charset =utf-8](https://epawebconferencing-events.acms.com/content/connect/c1/7/en/events/event/private/542791/97171446/event_landing.html?sco-id=97166143& charset =utf-8))
  - **NIOSH - Pocket Guide to Chemical Hazards:** A concise source of general industrial hygiene information for workers, employers, and occupational health professionals. (<https://www.cdc.gov/niosh/docs/2005-149/default.html>)
  - **Responsible Care – American Chemistry Council:** Multiple resources from the chemical manufacturing industry’s environmental, health, safety, and security performance initiative. (<https://responsiblecare.americanchemistry.com/default.aspx>)
  - **Toxic Release Inventory (TRI) Database:** Tracks the management of toxic chemicals that may pose a threat to human health and the environment. (<https://www.epa.gov/toxics-release-inventory-tri-program/tri-data-and-tools>)

## Biological Incident Information

- **Preparation and Planning for Bioterrorism Emergencies:** Resources from the Centers for Disease Control and Prevention to plan and prepare for a possible bioterrorism attack. (<https://emergency.cdc.gov/bioterrorism/prep.asp>)

## Nuclear/Radiological Incident Information

- **Radiation Emergency Medical Management (REMM):** Guidance from HHS for health care providers, primarily physicians, about clinical diagnosis and treatment of radiation injuries during radiological and nuclear emergencies. (<https://www.remm.nlm.gov/>)
- **Radiological Emergency Preparedness (REP) Program – Resource Library:** Provides state, local, tribal, and territorial governments with planning, training, and exercise guidance and policies to ensure that adequate capabilities exist to prevent, protect against, mitigate the effects of, respond to, and recover from incidents involving commercial nuclear power plants (NPPs). The Reference Library includes guidance, manuals, regulations and tools for Federal, state, local, tribal and territory government entities. (<https://www.fema.gov/reference-library>)
- **U.S. Department of Energy – Transportation Emergency Preparedness Program:** Provides planning tools, training, and exercises to help first responders effectively respond to accidents of shipments of radioactive material. (<https://www.energy.gov/em/services/waste-management/packaging-and-transportation/transportation-emergency-preparedness>)



- **U.S. Nuclear Regulatory Commission – Emergency Preparedness & Response:** Information on preparing for a radiological incident or emergency. (<https://www.nrc.gov/about-nrc/emerg-preparedness.html>)

## Equipment

- **Authorized Equipment List (AEL):** Identifies approved equipment types allowed under FEMA’s preparedness grant programs. ([fema.gov/authorized-equipment-list](https://www.fema.gov/authorized-equipment-list))
- **NIOSH - Personal Protective Equipment (PPE) Website:** Information on proper use of protective equipment under different conditions and situations and in-depth information on properly selecting and using respirators. (<https://www.cdc.gov/niosh/topics/emres/ppe.html>)
- **OSHA - PPE:** Helps employers and employees understand the types of PPE, know the basics of conducting a workplace hazard assessment, select appropriate PPE for a variety of circumstances, and understand the training to properly use and care for PPE. ([osha.gov/Publications/osha3151.pdf](https://www.osha.gov/Publications/OSHA3151.pdf))
- **Resource Typing - Response Environmental Response/Health and Safety - Hazardous Materials Response Team:** Resource type 508 in the Environmental Response/Health and Safety Core Capability. (<https://rtlt.preptoolkit.fema.gov/Public>)
- **Resource Typing - Response Environmental Response/Health and Safety - Hazardous Materials Technician:** Resource type 509 in the Environmental Response/Health and Safety Core Capability. (<https://rtlt.preptoolkit.fema.gov/Public>)
- **Standardized Equipment List:** Contains almost 800 items recommended to Federal, state, local, tribal, and territorial government organizations to prepare for and respond to incidents. (<https://www.interagencyboard.org/sel>)

## Training

- **FEMA National Training and Education Division:** Prepares state and local first responders to prevent, protect, respond to, and recover from manmade and natural catastrophic events. NTED also provides services to the private sector and the general public. FEMA provides training throughout the year. Relevant hazardous-materials-related courses are included in the table below. To find out more information on the following courses, course eligibility, or registration, visit (<https://www.firstrespondertraining.gov/>)

Course #	Course Title	Delivery
AWR-111-W	Basic Emergency Medical Services (EMS) Concepts for Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) Events	Online/Distance Learning
AWR-160	Standardized Awareness Training	Mobile/Non-Resident, Resident, Indirect
AWR-160-F	Conocimiento Sobre Armas de Destruccion Masiva/Terrorismo para Socorristas (WMD/Terrorism Awareness for Emergency Responders)	Online/Distance Learning

## Hazardous Materials Incidents

Course #	Course Title	Delivery
AWR-160-W	Terrorism Awareness for Emergency First Responders	Online/Distance Learning
AWR-176-W	Disaster Recovery for Information Systems	Online/Distance Learning
MGT-457	On-Scene Crisis Leadership & Decision Making for HazMat Incidents	Mobile/Non-Resident
MGT-458	Building Whole Community Engagement through Local Emergency Planning Committees	Mobile/Non-Resident
MGT-360	Incident Command: Capabilities, Planning and Response Actions for All Hazards	Mobile/Non-Resident, Resident
PER-211	Medical Management of Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) Events	Mobile/Non-Resident
PER-212	Operational Level Response to HazMat/WMD Incidents	Mobile/Non-Resident
PER-261	Hazardous Materials Technologies: Monitoring, Detection, and Sampling	Resident
PER-267	Emergency Medical Operations for CBRNE Incidents	Resident
PER-271	Emergency Medical Response Awareness for CBRNE Incidents	Mobile/Non-Resident, Resident
PER-322	Hazardous Materials Operations	Resident
PER-365	Emergency Response to HazMat Incidents	Resident
PER-902	Hospital Emergency Response Training for Mass Casualty Incidents	Resident
PER-904	Radiological Emergency Response Operations	Mobile/Non-Resident, Resident
PER-905	Advanced Radiological Incident Operations	Resident

- Security and Emergency Response Training Center (SERTC):** A member of the National Domestic Preparedness Consortium, provides training for Hazardous Materials Response to Surface Transportation incidents, relevant to all forms of surface transportation. Example courses are listed below. Example courses are listed below. For more information on SERTC, visit: (<https://sertc.org/>)

Course #	Course Title
PER-290	Tank Car Specialist (TCS)
PER-291	Highway Emergency Response Specialist (HERS)
PER-292	Leadership and Management of Surface Transportation Incidents (LMSTI)

Course #	Course Title
PER-293	HazMat/WMD Technician for Surface Transportation (HWMDTST)
PER-326	Surface Transportation Emergency Preparedness and Security for Freight by Rail or Highway (STEPS Freight)
PER-327	Crude Oil Class 3 Flammable Liquid Emergencies Transported by Rail (FLE-RR)
PER-330	The Surface Transportation Emergency Preparedness and Security for Mass Transit and Passenger Rail (STEPS-PT)
PER-331	Surface Transportation Emergency Preparedness and Security for Senior Officials or Administrators (STEPS Sr.)
PER-367	Tactical Hazardous Materials Operations for Surface Transportation (THMOST)

- **National Fire Academy:** Free training courses and programs. ([usfa.fema.gov/training/nfa](https://usfa.fema.gov/training/nfa))
- **OSHA:** Training opportunities related to hazardous materials. (<https://www.osha.gov/dte/edcenters/>)

## Modeling Resources

Modeling resources visually demonstrate the effects and paths of hazardous materials to aid in community planning and decision making.

- **Areal Locations of Hazardous Atmospheres (ALOHA):** Models chemical releases for emergency responders and planners. Estimates several scenarios (e.g., how a toxic cloud might disperse after a chemical release, fires, explosions). (<https://response.restoration.noaa.gov/oil-and-chemical-spills/chemical-spills/response-tools/aloha.html>)
- **Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT):** A complete system for computing simple air parcel trajectories, as well as complex transport, dispersion, chemical transformation, and deposition simulations. (<https://www.arl.noaa.gov/hysplit/hysplit/>)
- **Interagency Modeling and Atmospheric Assessment Center (IMAAC):** Coordinates and disseminates Federal atmospheric dispersion modeling and hazard prediction products. Models plumes to provide emergency responders with predictions of hazards associated with atmospheric releases. (<https://www.fema.gov/imaac>)
- **National Atmospheric Release Advisory Center (NARAC):** Provides tools and expertise to simulate and map the spread and impacts of hazardous materials accidentally or intentionally released into the atmosphere. (<https://narac.llnl.gov/home>)
- **Radiological Assessment System for Consequence AnaLysis (RASCAL):** A tool for making independent dose and consequence projections during radiological incidents and emergencies. ([https://ramp.nrc-gateway.gov/RASCAL Overview](https://ramp.nrc-gateway.gov/RASCAL%20Overview))

## Data Collection and Aggregation Resources

- **ChemResponder:** Allows users to rapidly collect and share chemical data, gas meter readings, calorimetric results, observations, and situational reports to support faster, more accurate incident characterization and lifesaving decisions. (<http://www.chemresponder.net>)
- **RadResponder:** Provides real-time geo-spatial display of responder locations, fixed monitoring sensor data, and sampling locations. Users can add layers to an event map, such as the radiological dispersal device 10-point monitoring plan, models, and other geographic information system files. Organizations and equipment manufacturers can integrate and telemeter data into RadResponder and provide real-time common operating picture for emergency managers and decision-makers. (<http://www.radresponder.net>)

# Appendix B. Acronyms

AEL	Authorized Equipment List
ALOHA	Areal Locations of Hazardous Atmospheres
APIE	Analyze, Plan, Implement, and Evaluate
BLEVE	Boiling liquid expanding vapor explosion
CAA	Clean Air Act
CAMEO	Computer-Aided Management of Emergency Operations
CBRNE	Chemical, Biological, Radiological, Nuclear, and Explosive
CEO	Chief Executive Officer
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHEMM	Chemical Hazards Emergency Medical Management
CPG	Comprehensive Preparedness Guide
DOT	Department of Transportation
EMS	Emergency Medical Services
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ERG	Emergency Response Guidebook
FEMA	Federal Emergency Management Agency
FIOP	Federal Interagency Operational Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HHS	Department of Health and Human Services
HYSPLIT	Hybrid Single-Particle Lagrangian Integrated Trajectory
IAB	Interagency Board for Emergency Preparedness and Response
IMAAC	Interagency Modeling and Atmospheric Assessment Center
LEPC	Local Emergency Planning Committees
MARPLOT	Mapping Application for Response, Planning, and Local Operational Tasks
NFPA	National Fire Protection Association

NIMS	National Incident Management System
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PHMSA	Pipeline and Hazardous Materials Safety Administration
PPE	Personal Protective Equipment
RCRA	Resource Conservation and Recovery Act
REMM	Radiation Emergency Medical Management
REP	Radiological Emergency Preparedness
RMP	Risk Management Plan
RTL	Resource Typing Library Tool
SARA	Superfund Amendments and Reauthorization Act
TRACEM	Thermal, Radiological, Asphyxiation, Chemical, Etiological, or Mechanical
TRANSCAER	Transportation Community Awareness and Emergency Response
TRI	Toxic Release Inventory
WISER	Wireless Information System for Emergency Responders
WMD	Weapons of Mass Destruction