



General Approach to a Hazmat Incident

GENERAL APPROACH TO A HAZMAT INCIDENT

Hazardous materials incidents are different from fire suppression or other usual emergency operations. The nature of the hazard requires different protective equipment, operational approaches, skills and attitudes. The rules are changed. Getting in and making a fast attack is not the order of the day. A slower methodical approach is called for, as well as the need to follow federal and state law.

REGULATORY CONSIDERATIONS

The HAZWOPER standard (29CFR 1910.120) requires an **Incident Command System (ICS)** as well as a **Site Safety Plan** and a **Safety Officer**. Remember, OSHA regulations are law while standards such as NFPA 471 and 472 are recommendations, which may or may not be adopted by a jurisdiction. Emergency services have been heavily fined for not following OSHA regulations.

The **Superfund Amendments and Reauthorization Act** of 1986 (SARA), which required OSHA to create and implement the HAZWOPER standard, directs OSHA to protect all employees responding to emergencies without specifying their location. Section 126 (d)(4) of SARA states, "Standards shall set forth requirements for training of workers who are responsible for responding to hazardous emergency situations who may be exposed to toxic substances in carrying out their responsibilities."

First Responders such as fire departments, emergency medical services, and police departments, if they accept jurisdiction for hazardous materials incidents, are each normally required to have an **emergency response plan** which addresses personnel roles, lines of authority, training, and communication [29CFR 1910.120(q)(2)]. However, a community could have a comprehensive plan addressing these issues for all employees. The amount of **training** must be based on the duties and functions to be performed by each responder. To safely respond to a hazardous materials incident, an individual must be both trained and mentally prepared. **What you don't know can kill you.**

BACKGROUND

A **Hazardous Material** is any substance (gas, liquid, or solid) capable of causing harm to people, property, or the environment. There are thousands of different materials in use in the world today. Most are shipped as part of normal commerce. All substances in large enough amounts are poisonous to humans and all chemical exposures should be avoided. Some substances, even in very small quantities, may rapidly cause death. Except for materials known to cause cancer in humans, only acute health effects have been considered in this book. A **Hazmat Incident** involves the actual or potential unplanned/uncontrolled release of a hazardous material.

A **First Responder** is an individual who may arrive first on the scene of a Hazmat Incident with the responsibility to act, regardless of what agency they represent. A **general response scheme** for the initial phases of a response is shown on the outside of the back cover of this book. When

approaching the scene, slow down and **approach cautiously**, from an uphill and upwind direction if possible. That is, move downhill with the wind at your back. Be alert for visible signs such as smoke, vapor clouds, fire, or the sound of explosions. Look for discoloration of grass or trees, dead birds, or other animals. Check flags, smokestacks or vapor clouds for wind direction. Dispatch should call the **Weather Bureau** for the current temperature, wind speed and humidity as well as the general forecast for the next several hours. Having this information while en route will assist in the initial assessment of the incident. Agencies must develop the capability to measure the wind speed and direction at the site of the incident for greater accuracy.

When setting up the command post and determining the evacuation sectors, keep in mind the possibility of shifting winds. Park vehicles pointed away from the scene to allow for a rapid exit if necessary. Keep the staging area a safe distance from the release area since vehicles can be an ignition source. By OSHA law you must limit the number of people in the **Hot Zone**.

The following sections provide some general information about Hazmat actions for those trained at the **Awareness and Operational Levels**. These individuals respond in a **defensive fashion**. Under OSHA 1910.120, both Awareness and Operational Levels cannot perform offensive actions within the Hot Zone. **Rescue** or other aggressive actions are generally not appropriate for individuals trained at these levels. Failure to heed this limitation of action can easily lead to the death or serious injury of the responder. **Be part of the solution; don't become part of the problem!**

TRAINING SPECIFIC RESPONSES

Awareness Level Response

First Responders at the Awareness Level are expected to recognize the presence of hazardous materials, protect themselves appropriately, call for help, and secure the area.

Several clues can provide assistance in establishing the presence and identity of a hazardous material. Use your senses, but with caution. Many hazardous materials have **odors** or produce visible clouds. Even though the presence of some materials can be detected by smell at very low and even nontoxic levels, this is not a reliable indicator of potential toxicity. Other materials can be fatal without any detectable odor. If an odor is detectable, you may already be too close and need to retreat.

Another clue is the **nature of the site** of the incident. Anticipate the presence of certain kinds of materials in certain types of buildings. For example, a burning barn or hardware store is likely to contain pesticides and should be dealt with accordingly. Manufacturing facilities are likely to have a variety of solvents. Tank farms will probably contain petroleum products. Other types of structures may provide clues about the hazardous materials they might contain.

If containers are involved, the **shape** may provide a clue to the contents. Silhouettes of **rail cars, tank trucks**, and fixed

site **tanks** used to carry or store materials are shown on pages 527 through 545. While not likely to identify the specific chemical name, the silhouette guide may identify the general type of material involved.

Markings on containers, buildings, or facilities may also provide material identification information. Under **DOT regulations**, some **rail cars** must be labeled with the name of the material they contain (see Railroad Tank Car Marking System, page 526). The **NFPA 704 placard** system (see Table 1, page 550) is widely used on container labels and fixed facilities. This system provides valuable information about the risks associated with the material(s) in the facility. Other marking systems exist which are similar to the NFPA 704 system. **DOT placards** (see page 521) on vehicles may provide an additional clue to the nature of the contents. These placards on vehicles may include or be found above an identification number. This number is the **UN Number** for the material contained in the vehicle and can be used to identify the material or class of material by using this book or the North American Emergency Response Guide. DOT symbols may also be used as labels on containers of material in commerce. All markings on vehicles, buildings, and rail cars should be observed from the greatest distance possible. First Responders should carry a pair of good binoculars.

First Responders may have access to papers describing the contents of shipments (shipping papers, bills of lading, etc.) and/or the hazards associated with these materials. At a fixed facility **MSDS** (Material Safety Data Sheets), which will identify the specific material(s) and associated hazards, should be available. Shipping papers, which identify the chemical or chemicals present, are usually located in the cabs of trucks, the first engine of freight trains, on the bridge of ships and in a marked tube-like container on the deck of a barge. Frequently during transportation accidents shipping papers are inaccessible and identifying the involved materials becomes part of the overall problem. Until the material is identified, it should be treated as if it were extremely hazardous.

Securing the area around a hazardous materials incident is a vitally important action of the First Responder. It may not be immediately apparent what area to secure, particularly if the hazardous substance and/or quantity are unknown. It is usually wise to secure a wide area, particularly if the material is known to be highly toxic. In general, keep **ignition sources**, such as sparks and flares, out of the secured area until you know that there is no flammability or explosion risk.

For large releases of flammable, explosive or toxic gases, the First Responder must **alert inhabitants** of the surrounding area. This is particularly true for heavier-than-air gases or vapors, which will not disperse as they spread. Do not expose yourself to the material by entering areas downwind or below grade. Evacuation, with all of its difficulties, will be necessary for some materials and situations. For others, the best option is to **shelter in place** - that is, move people inside, close doors and windows, and shut down air intake distribution systems - until the gas or vapor has moved past or dispersed.

Remember that **wind directions may change** during an incident, so the at-risk populations or areas need to be continually reevaluated with on-site wind direction information.

Remember that a dead or injured First Responder is of no help to anyone. **Protect yourself!** Do not enter the contaminated area. Do not attempt to rescue victims who have been contaminated with highly toxic or dangerous materials. **Fire fighting gear is not chemical protective clothing.** Many chemicals call for specialized personal protective clothing and expertise that is above the capability of Awareness or Operational level personnel.

Operational Level Response

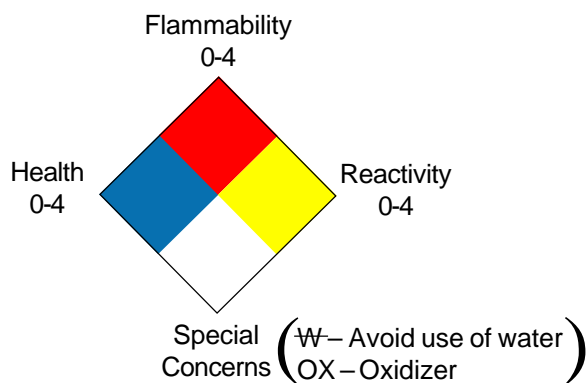
First Responders at the **Operational Level**, in addition to carrying out the actions of the Awareness Level Responder, may take **defensive actions** from a safe distance which will **control the release** and keep it from spreading. These actions are intended to protect nearby persons, property, and the environment from the effects of the release. Generally, First Responders at the **Operational Level** are not trained to enter the **Hot zone** and should not do so unless they have had specific training in dealing with the material and situation present.

In situations where there is only a release and no fire, Operational Level personnel should consider **diking** or diverting liquid **runoff** to prevent contamination of sewers or waterways. This must be done well ahead of the runoff to prevent personnel exposure and should only be attempted if it can be done safely. For release of gases it may be possible to suppress vapor clouds with fog lines or other agents using unattended monitors. For large releases, particularly of toxic gases, consider the **evacuation** or **sheltering in place** of populations downhill or downwind of the release. Remember that wind direction may shift during an incident and on-site **wind direction monitoring** is essential. You may be able to **shut off a release** from a safe distance. Do this only if the material is identified and the shutoff is outside the Hot zone.

If a fire is present in addition to a release, the incident is considerably more complicated. All of the tasks discussed previously must be considered and a decision must be made whether to fight the fire, and if so how. It is generally best to **let a gas-fed fire burn** unless you can stop the flow of gas by closing a valve at some distant point outside of the Hot Zone. Keep in mind that after you close a distant valve there will still be some gas in the line(s). Use fog lines to keep the area cooled and let the fire burn itself out. There may be an incident where it is necessary to extinguish a gas-fed fire in order to get to a valve to shut off the flow. Large amounts of fog may be used to cool down the area. Dry chemical or carbon dioxide extinguishers may be used to extinguish the fire. **Extinguishing the fire without stopping the flow of gas is dangerous.** The gas and air may form an explosive mixture. If the surrounding area is still hot it may provide an ignition source and cause an explosion. The explosion may cause more injuries and more property damage than the original fire.

Table 1
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
Fire Diamonds

Identification of Health Hazard Color Code: BLUE		Identification of Flammability Color Code: RED		Identification of Reactivity Color Code: YELLOW	
Type of Possible Injury		Susceptibility of Materials to Burning		Susceptibility to Release of Energy	
Signal		Signal		Signal	
4	Materials that on very short exposure could cause death or major residual injury.	4	Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature, or that are readily dispersed in air and that will burn readily.	4	Materials that in themselves are readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
3	Materials that on short exposure could cause serious temporary or residual injury.	3	Liquids and solids that can be ignited under almost all ambient temperature conditions.	3	Materials that in themselves are capable of detonation or explosive decomposition but require a strong initiating source or which must be heated under confinement before initiation or which react explosively with water.
2	Materials that on intense or continued but not chronic exposure could cause temporary incapacitation or possible residual injury.	2	Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.	2	Materials that readily undergo violent chemical change at elevated temperatures and pressures or which react violently with water or which may form explosive mixtures with water.
1	Materials that on exposure would cause irritation but only minor residual injury.	1	Material that must be preheated before ignition can occur.	1	Materials that in themselves are normally stable, but which become unstable at elevated temperatures and pressures.
0	Materials that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material.	0	Materials that will not burn.	0	Materials that in themselves are normally stable, even under fire exposure conditions, and which are not reactive with water.



If the products of combustion are less of a hazard than the leaking chemical, the best course of action may be to protect exposures and **let the chemical burn itself out**. The location of the incident will influence your decision. If you are in a rural area that is sparsely populated, the decision to let a fire burn will be much easier than if you are in the central business district of a major city. There may be pressure on the **Incident Commander (IC)** to extinguish the fire in order to minimize inconvenience to the local population. You must weigh all of your options and choose the course that presents the least risk to your personnel and the general public. **The potential for harm is always more important than convenience**. In some circumstances, if the identity of the material(s) is not known it may be better to let the material burn and concentrate on protecting life and surrounding property.

Foam can be very effective at **vapor suppression** and extinguishing many flammable liquids. Some materials, such as alcohols and amines, are water soluble and break down ordinary foam. You will see a listing “consider the application of **alcohol based foam**” for materials that are water soluble. Alcohol based foam is designed for these materials. If alcohol based foam is not available, regular foam may be helpful but may be required in higher application rates. Check your foam supplier and the container label for the uses and limitations of the foam you have. Keep in mind that 6% foam is 94% water. The use of foam on materials that are water reactive may not be desirable. The reaction may be so great that it will outweigh the benefits of using foam. If you are going to attack a fire with foam BE SURE you have enough foam at the scene before you begin your attack. If you start without enough agent to finish the job, the fire will rekindle and destroy the foam blanket you have applied and you will lose any advantage you may have gained.

Carbon dioxide (CO₂) and **dry chemical** are effective on many products. The limiting factor is the method of application. Generally, these agents come in **handheld extinguishers** requiring you to get within a few feet of the fire. With most hazardous materials, that is too close for personnel at the Operational Level. Handheld equipment is meant for first aid fire fighting and is designed for use on small fires. Some facilities have special extinguishers on wheels or vehicles containing **dry chemical** or CO₂. Many large fire departments also have this equipment. If you have these kinds of resources you may be better able to fight larger fires. CO₂ and **Halon** gases, are more effective at fighting fires in confined spaces - but they also present a significant asphyxiation risk to responders under these circumstances. Fires involving combustible metals usually require dry powder (not the same as dry chemical) extinguishers.

If water is the correct agent to use, it is usually applied in the form of **fog** and applied in **large volumes**. **Solid streams** will cause powders and other materials to be spread about in an uncontrolled manner. Solid streams directed into burning liquids will splash the burning materials and may spread the fire. If you are operating at a fixed facilities, you should know

in advance how much water you have available for fire fighting. At a transportation incident you may not have the volumes of water needed to safely attack a fire. “**Back Off and Protect the Exposures**” may be your best option. You don’t attack a tank (military version) with a 22 caliber handgun. “**If you don’t have the water don’t go to war.**”

Fog streams from **unattended monitors** or even large volume handlines that are tied off, can be effective in **knocking down or suppressing vapors**. Be aware that the mist that is falling back to the ground is now contaminated and must be managed. This may be done by **diking or damming** well ahead of the material runoff. Care must be taken to keep personnel out of danger from contamination or contact with the material. **Pits** may be dug to contain the runoff. With some chemicals, diluting the runoff water in the pit may reduce the hazard to a more manageable level. There may be times when it is desirable to knock down the vapors from a product that is water reactive. Under these circumstances, care must be taken to not let the water fall back onto the material. Set up your monitors well ahead of the material and be aware of changes in the wind direction or speed.

Many liquid containers, when heated, may **explode or BLEVE**. In a BLEVE large pieces of the tank may rocket great distances. The directions in which these pieces will travel is unpredictable and depends on the section of the tank that ruptures and on the tank supports. Tanks involved in a fire should be approached with great caution because of the risk of explosion or BLEVE.

Information about all of these concerns is provided in the material specific sections of this guide. The First Responder Strategy Using the NFPA 704 Placard provided on the back inside cover of this book can be used as a guide to fighting fires if only the NFPA 704 designations are known. Remember that this table only applies to materials designated with NFPA reactivity (yellow box) 0 or 1. For more reactive materials, maintain a purely defensive posture toward the fire.

Material Safety Data Sheets (MSDS), if they are available, are one of the best sources of information about materials. As part of your planning process get the MSDSs for major products in your jurisdiction. If you are dealing with a fixed facility, check with the **Facility Emergency Coordinator (FEC)**. This person is required by SARA Title III to be the individual who has worked with the **Local Emergency Planning Committee (LEPC)** in the development of the community response plan as it relates to that facility. Make this person part of your **Unified Command Staff**. The FEC knows that facility and the materials involved better than you do. Listen to the advice you get, but keep in mind that the objectives of plant personnel may sometimes be different than yours. They may think first of the plant, while you must think first of the community. When there is a difference, you must make the decision keeping the good of the community in mind.

Some hard decisions are going to have to be made when it comes to **rescuing victims** in the Hot zone - decisions that in most cases can only be made by the IC at the time of the

incident. The authors have attempted to offer some guidance, but the final decision will be yours. In the Awareness and Operational Level Training Response section of the chemical specific pages you may see the statement “**Do not attempt rescue**”. This statement is used when the hazards to the would-be rescuer are so great that serious injury or death may result. Remember that under most conditions, **if you are not trained at the Technician Level you cannot legally go into the Hot zone**. In many cases normal fire fighting gear doesn't provide the protection you need to safely handle people in the area of contamination. In some situations it is possible that you might be able to rescue someone without putting yourself in danger. Danger is a relative term and the IC must determine the degree of danger present. In addition, the IC must then decide the level of danger that is acceptable for the rescue personnel. **We do not trade rescue personnel for victims**. Injury to emergency service personnel to effect a rescue is not acceptable in any community.

SPECIAL SITUATIONS

HazMat incidents occur under a wide variety of conditions. For some of these situations there are special considerations and concerns. Listed below are some of these considerations and concerns for Hazmat incidents involving highway transport, rail transport, marine transport, fixed facilities, pipelines, radioactive materials, cryogenic tanks, chemical and biological terrorism and illegal or clandestine drug laboratories.

Highway Transport: Accidents on highways involving trucks carrying hazardous materials are perhaps the most common cause of Hazmat incidents. Many of these incidents occur in heavily populated areas and may involve large quantities of hazardous materials. Shipping papers are kept in the truck cab, which may be inaccessible if there is a leak or fire. Shipping papers will include a contact telephone number for emergency information. DOT placards provide information on the nature of the cargo. Unfortunately, some trucks containing hazardous materials may not have placards, either in violation of DOT regulations or because the quantities of material being transported do not require a placard. Placards don't always tell the whole story. Trucks can carry dangerous amounts of hazardous materials and still be under the legal amount required to have a placard. Many UN Numbers, which may appear on or below the placard, represent a variety of compounds which may pose varying risks. If the shipper and truck numbers are known, CHEMTREC® (1-800-424-9300) can often identify the cargo. Any truck or van should be assumed to contain hazardous materials. Until the cargo is identified all action should be undertaken from a safe distance. Tank trucks, in particular, often contain materials which may explode or BLEVE. If it is possible, cool tank trucks exposed to heat with water from an unattended monitor. This should only be considered if an adequate water supply is available and enough trained personnel are quickly on the scene.

Rail Transport: Hazmat incidents involving trains are often complicated by the large amounts and numbers of materials

found on a single train. These materials may chemically interact if they come in contact with one another. This creates a major risk of personal injury or property damage, further compounding the problem. Train incidents also may occur in relatively remote areas, which may limit the availability of personnel, equipment, and water. Shipping papers on trains are found with the engineer in the first engine. Initial assessment should be done from a safe distance through binoculars without approaching a train. There may be sufficient information on the outside of the rail cars to identify the materials they contain. The silhouette information on pages 527 through 545 may also be helpful in identifying different types of cars and their possible cargoes. Many materials shipped by rail will BLEVE if their tanks are heated by fire. These tanks may travel several thousand feet. It is generally best to maintain a safe distance until trained personnel and equipment arrive. Remember, if there is a fire stay away from the sides of cars and the train because of the risk of a BLEVE.

Marine Transport: Shipboard incidents in which land based responders are involved usually occur in heavily populated port areas. The quantities of hazardous materials involved can be very large, creating huge potential risks to adjacent populations and property. Cargos may also contain multiple chemicals with the possibility of chemical reaction. Most ships and barges will not be labeled or placarded. Shipping papers or manifests for cargo are usually located with the first officer on the bridge of a ship. On a barge, shipping papers are in a tube-like container or mailbox on the deck. The Coast Guard Captain of the Port is responsible for dealing with releases and fires. Frequently land based responders are called upon to assist in the incident response. Land based responders in port areas need to be familiar with the various jurisdictions and issues relating to both shipboard fires and waterway pollution. All ships and most towboats have crews who are trained to deal with releases and fires. They also will have varying amounts of on-board fire fighting equipment. Towboats may not have adequate equipment to fight on-board fires. Barges do not have adequate equipment to fight on-board fires or control releases. Fire companies responding to marine incidents should be equipped with **International Shore Connection fittings** to permit the pumping of water from shore into the firefighting system on board ship.

Fixed Facilities: Fixed facilities include both open facilities such as bulk liquid terminals and open processing areas, and closed facilities such as manufacturing or processing plants, laboratories, warehouses, and retail establishments. In general, the quantity of material in fixed facility incidents has the potential to be very large, particularly if there are large storage containers on site. There are also likely to be several hazardous materials at any given site. Identification of the materials at a site may be made from labeling, **MSDS** provided by facility personnel or from community inventories provided under SARA Title III. NFPA 704 placards may provide general information about the nature of the hazards in a particular facility or building (see Table 1, page 550). The NFPA 704 designations indicate the most severe risks associated with all of the materials in the building or facility.

Be aware that buildings or containers may have inaccurate placards. Fixed facilities are often in industrial zones and may have other hazardous materials sites located in close proximity. There may also be many people working on or close to the site.

First Responder actions at a fixed facility HazMat incident should be defensive in nature. After rapidly assessing the situation, notify the appropriate authorities and support services. **Deny entry** to the building or facility and consider evacuation. If a multi-story structure is involved and the released material is a gas that is heavier than air, it may not be desirable to evacuate the upper floors of the building. A decision can be made to shut down the heating, ventilating, and air conditioning (HVAC) system in a building if the risk of evacuating and dispersing a gaseous material appears greater than the explosion or flammability risk of leaving it contained in a portion of the building. Refer to this guide or other sources of information for aid in making that decision. If the HVAC is left on, it may also be possible to increase dispersion by leaving other building doors and windows open. For liquid releases from storage tanks it may be possible to prevent spread by diking or damming. This must be done well ahead of the liquid to prevent exposure of personnel and should only be attempted if it can be done safely.

If there is a fire, it may be preferable not to extinguish it until the nature of the material(s) is known and adequate resources are assembled. For some materials, allowing them to burn poses much less risk to the responder and surrounding areas than trying to extinguish them. It may be possible to protect surrounding structures or storage tanks by the use of a cooling fog stream, preferably from an unattended monitor. For some materials, fog streams can be used to suppress or disperse vapor releases. Information on all of these approaches will be found in the material specific sections of this book. Liquid chemical tanks exposed to flame impingement may explode or BLEVE, so maintain a safe distance if a fire is present. Many fixed facilities may have firefighting capabilities, including sprinkler systems and/or special suppressing or extinguishing agents. These may help to suppress fires. They may also suggest what firefighting agent is appropriate for the materials involved.

Pipelines: Pipelines carry many hazardous materials. If a pipeline breaks, very large quantities of materials can be released over a short period of time. Depending upon the material, this means that the cloud, fire, or release could be very large and will continue to grow until the flow stops. The key is to minimize the release by cutting off the flow at the pumping station or other shutoff. This will generally be done by pipeline personnel. **Do not fight the fire or approach the scene until the flow has been stopped.**

Radioactive Materials: There are many radioactive materials in commerce, usually in small quantities. Larger quantities may be encountered at fixed facilities. All containers, including packages, vehicles, and rail cars, containing radioactive material are required to carry a warning label or placard. Buildings or containers at fixed facilities

containing radioactive material should also carry appropriate warning labels. If such a label is present at the scene of an accident, First Responders should generally back off until trained personnel and appropriate equipment are available to assess the situation.

There are several types of radiation hazards. Different radioactive materials produce different types of radioactivity. The most common radioactive materials in commerce produce alpha (α) and beta (β) particles. Other materials may produce x-rays, gamma (γ) rays or neutron particles. While all of these can potentially damage human tissue, alpha and beta particles do not penetrate the skin, so will not cause damage unless the actual material emitting these particles gets into the body by swallowing it, breathing it in, or getting it into an open wound. Avoiding physical contact with the material prevents these potential injuries. X-rays, gamma rays, and neutron particles do penetrate clothing and skin and can cause damage if the amount of radiation is sufficient. Exposure to these forms of radiation is only prevented by using a heavy metal shield. As with alpha and beta particle producers, contact with the material must be avoided. Injury caused by radiation may not develop for many days or even years after exposure.

Radioactivity is not destroyed by fire. In fact fire, explosion, and water dispersion as part of a fire may make a radioactive material incident worse by spreading radiation-emitting material over a large area. **Remember if you see a radioactive warning label or placard: Back off until the experts arrive.**

Cryogenic Gases: Cryogenic gases are gases shipped and stored refrigerated and under pressure. Tank shape and a visible vapor cloud upon release should alert the First Responder to the presence of a cryogenic gas. Tank shapes can be found on pages 527 through 545. When cooled to very low temperatures (less than -150°F) and/or placed under pressure, these gases become liquids that take up less space for storage and shipment. These gases, some of which are extremely flammable (hydrogen and LNG) or toxic (chlorine), pose a major risk to the first responder. All of these gases are released from storage vessels at temperatures so low that they will instantly freeze unprotected tissues like skin and eyes. The release of even small amounts of gas can produce large amounts of vapor. **Leaking cryogenic containers should not be approached.** Trained personnel and appropriate equipment are required to stop the leak. Materials on fire should be allowed to burn until the release can be stopped. It is important not to put water, fog, or foam on cryogenic tanks or pools of cryogenic liquids, whether or not they are burning. The water will act as a heater, increasing evaporation or burning. **Water, foam, and fog cannot extinguish a cryogenic fire.** The cold vapors rising from a pool of cryogenic liquid almost always hug the ground and drift downwind without rapid dispersion.

Chemical and Biological Terrorism: Chemicals have been used in organized warfare since World War I. While biologi-

cal agents such as highly infectious and toxic bacteria (“germ agents”), have been researched as potential war agents since the 1930’s, they have never been used on a large scale. In recent years, fears have mounted that both chemical and biological agents could be used in terrorist actions against either civilian or military targets. In fact, chemical agents have now been used in such a fashion.

For this reason it is important that first responders become familiar with possible chemical agents involved in these incidents and how to appropriately respond. While biological agents, like germ agents, could be used in terrorist attacks, they would most likely unfold as an outbreak of a disease. It is unlikely that first responders will find themselves involved in these kinds of incidents because identification and response would then be provided primarily by public health authorities. Nuclear terrorism is also a possibility, however, response to nuclear accidents or events is beyond the scope of this book and the scope of training of most First Responders.

While we tend to think of chemicals used in terrorist attacks as highly specialized substances designed for war, in fact, many common industrial chemicals have similar properties and toxic potential. Chlorine gas, for example, has been used as a war gas. Many experts in terrorism think it is more likely that terrorists would use these easily available chemicals instead of the more exotic agents designed for war. Terrorist incidents might well involve the sabotage of industrial complexes near densely populated areas. Therefore, the technical and response problems posed by such an incident would be almost identical to other scenarios discussed in this book. It is important to remember that if terrorism or sabotage is suspected by the first responder appropriate law enforcement personnel should be notified and, to the extent possible, attempts should be made not to disturb or destroy potential evidence. Concern for evidence should not, however, prevent the first responder from carrying out actions appropriate for the chemicals involved. It is also important to remember that terrorists may booby-trap a scene in order to hinder response and produce additional casualties. First responders must remain alert for such possibilities. Secondary explosives for instance can be set to be detonated by radio signals transmitted from approaching response vehicles.

Table 2 on page 555 lists the kinds of chemical agents which have been used or proposed for use in terrorist attacks. The physical properties and symptoms they can produce in exposed individuals are also listed. Important information on all of these chemical agents can be found in this book, either in the Specific Materials Guides or in the Materials Summary Response Table. First responders should be familiar with the common physical symptoms caused by each kind of agent. These symptoms are likely to be the first clue that one of these agents is involved in an incident.

Illegal or Clandestine Drug Laboratories: Illegal or clandestine drug laboratories pose a new and often significant

risk for first responders. Such operations may contain a wide variety of chemicals, particularly flammable solvents, which are used in the production of illegal drugs. Unlike most legitimate manufacturing facilities, it will usually be impossible to obtain a listing of the chemicals present. Most of the chemicals commonly used in these laboratories will be found in this book because they are also found in legitimate manufacturing facilities. Some of the drugs usually produced in these laboratories and some of the chemical intermediates with drug-like actions are not included in this book. There have been reports of serious injuries to first responders from exposure to these drugs and chemical intermediates. For this reason, if the presence of an illegal or clandestine drug laboratory is suspected, extreme caution should be exercised by the first responder and exposure to chemicals at the scene should be avoided. Law enforcement personnel should be notified about the laboratory and, to the extent possible, attempts should be made not to disturb or destroy potential evidence.

The chemical specific sections of this book are designed to remind the responder of many of the basics discussed above as well as provide information on what options need to be considered for each specific chemical.

WHERE TO GET HELP

There are a number of sources of information available to the First Responder. Listed in Table 3 on page 556 are several national sources with which the First Responder should be familiar. Local and state sources of information such as health departments, Hazmat teams, industrial aid groups, emergency service agencies, and others should also be considered as valuable resources. Page 562 is provided to record the telephone numbers for your local area.

TABLE 2

CHEMICALS LIKELY INVOLVED IN TERRORIST INCIDENTS				
Kind of Agent	Example of War Agents	Example of Industrial Chemicals	Physical Properties of Chemicals	Early Symptoms of Exposure
Nerve Agents	Sarin Soman Tabun V-Agents	Organophosphate insecticides	Vapors or liquids Odorless to fruity odor	Tearing eyes Sweating Very small pupils Breathing problems Muscle weakness Abdominal pain
Blister Agents	HT Lewisite Mustard gas	Dimethyl sulfate	Oily liquids	Skin and eye burns Breathing problems
Blood Agents		Cyanogen chloride Hydrogen cyanide	Liquids or gases stored as liquids under pressure	Headache Breathing problems Convulsions Sudden death
Choking Agents		Ammonia Chlorine Phosgene	Gases – may be stored as liquids under pressure Irritating odor	Cough Breathing problems
Irritating (Crowd control) Agents	Mace Pepper spray Tear gas	Chloroacetophenone Chloropicrin	Dusts or liquids Irritating odor	Tearing eyes Cough Breathing problems

TABLE 3

NATIONAL AND REGIONAL HAZMAT RESOURCES

(Listed in alphabetical order, not in order of priority)

AGENCY NAME	CONTACT NUMBER	HOURS OF OPERATION	SERVICES PROVIDED
Agency for Toxic Substances Disease Registry (ATSDR)	404-639-0615	24 hours/day	Will assemble an expert team of toxicologists and response experts to provide needed information. Will come on site if needed
CHEMNET	Can access through local industry or CHEMTREC	24 hours/day	Industrial mutual aid network between shippers and manufacturers. Will provide on site assistance
CHEM-TEL, INC.	1-800-255-3924 (Toll-free in the U.S.)	24 hours/day	Will provide information on products as provided in manufacturers MSDS.
CHEMTREC®	1-800-424-9300 (Toll-free in the U.S.) 703-527-3887 (For calls originating elsewhere; collect calls are accepted)	24 hours/day	Will provide information on products as provided in manufacturers MSDS. Can assist in identifying and contacting manufacturer of product or shipment
National Pesticide Telecommunications Network	1-800-858-7378	0930-1930 EST	Will provide information on pesticides
National Response Center (U.S. Coast Guard)	1-800-424-8802	24 hours/day	Notification required by law for many releases. Can give information on all aspects of release management
Regional Poison Control Centers (state-wide resources)	See Local phone book	24 hours/day	Can provide information on the health risks associated with chemicals. May have information on other hazards and appropriate responses