

HAZARDOUS MATERIALS AWARENESS



2019

PREFACE

Welcome to the Hazardous Materials - Awareness certification course. This course complies with NFPA 472, Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents, 2018 and with NFPA 1072, Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications 2017.

Annual refresher training is required for all graduates of this course in accordance with the code of federal regulations. Refresher training must be of sufficient content and duration to maintain their certification, or the graduate shall demonstrate competency in those areas at least yearly (i.e. HazMat exercise, multimedia training, classroom training, or participating in an actual HazMat emergency response). This is a mandatory employer requirement to comply with the law (29 CFR 1910.120-q-6)

The State Emergency Response Commission requires 4 hours per year of continuous education to retain certification per year (i.e. HazMat exercise, multimedia training, classroom training, WMD training or participating in an actual HazMat emergency response).

**Hazardous Materials
for First Responders
Fifth Edition**


**Chapter 1 — Introduction to
Hazardous Materials**

HAZARDOUS MATERIALS
FOR FIRST RESPONDERS
FIFTH EDITION

IIFSTA

Learning Objective 1

Define a hazardous materials incident.

1-1 


Hazardous materials are substances that possess harmful characteristics.

United States

Hazardous Materials (Hazmat)

Canada

Dangerous Goods


1-2 

WMDs have the potential to cause mass casualties and damage.

WMD = Weapons of Mass Destruction

CBRNE

- Chemical
- Biological
- Radiological
- Nuclear
- Explosive

1-3 


Hazmat/WMD incidents pose unreasonable risks.

A hazardous materials/WMD incident is an emergency involving substances that pose unreasonable risk to

People


Environment

Property

1-4 

Hazmat incidents have many potential causes.

Potential Causes of Hazmat Incidents	Human error
	Mechanical breakdowns or malfunctions
	Container failures
	Transportation accidents
	Deliberate acts
	Chemical suicides WMD incidents

1-5 

Container failure is one way that a hazmat incident may occur.



Courtesy of Berry Lumber

1-6



Hazmat incidents are often more complex than other types of incidents.

Hazmat incidents may

Present a variety of dangers, sometimes in small quantities

Be extremely difficult to contain and/or control

Require specialized equipment, procedures, PPE

Be difficult to detect, requiring sophisticated monitoring equipment

1-7



CAUTION

Hazardous materials incidents are not always clearly defined before first responders arrive. You must be constantly alert to the presence of hazardous materials and their possible effects on the incident. Whether involved or not, the mere presence of hazardous materials may change incident's dynamics.

1-8



REVIEW QUESTION



How are hazardous materials incidents different from other types of emergency incidents?

1-9



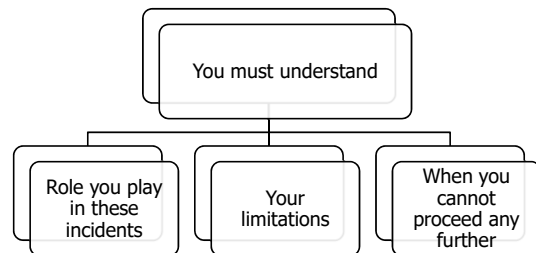
Learning Objective 2

Describe roles and responsibilities of first responders in hazardous materials incidents.

1-10



Hazmat first responders must safely respond to hazmat incidents.



1-11



First responder roles are established by law and NFPA standards.

NFPA Consensus Standards that apply to hazmat responders

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

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*

1-12



NOTE

Individuals who train to meet NFPA 1072 will meet or exceed Occupational Safety Health Administration (OSHA) requirements for Awareness, Operations, and Technician.

1-13



Three training levels are addressed in this manual.



Awareness level personnel perform limited defensive actions

Operations responders perform defensive actions

Operations Mission-Specific responders may be trained to perform additional defensive and limited offensive actions

1-14



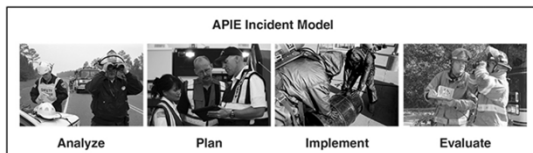
NFPA also identifies response personnel who perform more complex operations at hazmat incidents.

- Hazardous Materials Technician
- Hazardous Materials Technician Specialist
- Hazardous Materials Incident Commander
- Hazardous Materials Officer
- Hazardous Materials Safety Officer
- Specialists

1-15



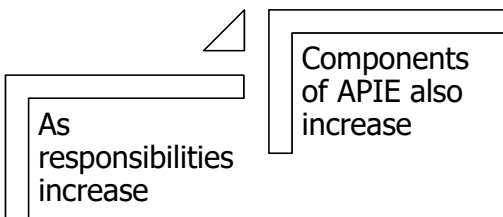
APIE can help responders devise a 4-step response to any hazmat incident.



1-16



Not all aspects of APIE are addressed at the Awareness level.



1-17



Awareness level personnel might be first to arrive at a hazmat incident.



1-18



Awareness level personnel should transmit, protect, and isolate.



1-19



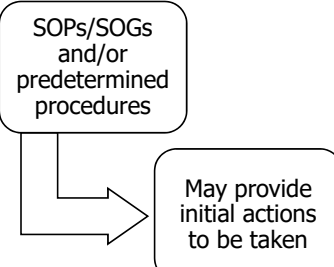
Awareness level responders must be aware of clues to help them recognize hazardous materials.

- Clues that may indicate the presence of hazardous materials**
- Location
 - Container shape
 - Transportation or facility markings
 - Metering devices
 - Sensory input such as odor, taste, appearance

1-20



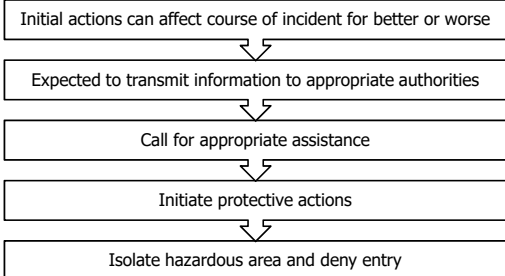
Awareness responders are not responsible for planning the response to a hazmat incident.



1-21



Awareness personnel play an important role at hazmat incident.



1-22



Ops level personnel respond to hazmat releases as part of their normal duties.

- Operations level responders must be able to**
- ID potential hazards
 - ID response options
 - Implement planned response to mitigate or control release
 - Evaluate progress of actions taken

1-23



Ops level responders are expected to identify potential hazards.

- Type of container involved
- Hazardous material involved
- Hazards presented by material
- Potential behavior of material

1-24



Ops responders should determine where the release has occurred.



Courtesy of Berry Labby

1-25



Ops responders do not plan the actual response.

- Operations responders must be able to**
- _____ ID response options
 - _____ Understand tasks they may be assigned
 - _____ Protect themselves
 - _____ Safety precautions
 - _____ Suitability of PPE
 - _____ Emergency decon needs

1-26



Operations responders help implement the response.

- Operations responders are expected to**
- _____ Establish Incident Management System
 - _____ Establish scene control
 - _____ Implement protective actions such as evacuation
 - _____ Follow safety procedures
 - _____ Use PPE in proper manner
 - _____ Avoid hazards and complete assignments
 - _____ Perform emergency decontamination
 - _____ ID and preserve potential evidence if crime suspected

1-27



Operations level personnel may be trained beyond core competencies.

- Mission-specific specialized competencies
- PPE
 - Mass decon
 - Technical decon
 - Evidence preservation and sampling
 - Product control
 - Air monitoring and sampling
 - Victim rescue and recovery
 - Response to illicit laboratory incidents

1-28



Operations Mission-Specific training may include using specialized PPE.



1-29



REVIEW QUESTION



What are the three levels of hazmat responders and what are their responsibilities?

1-30



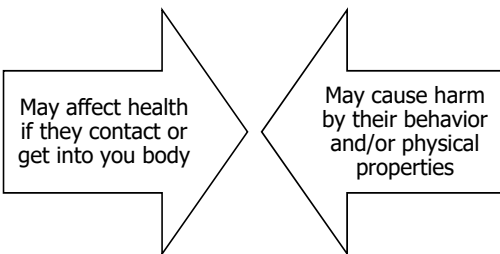
Learning Objective 3

Recognize the ways that hazardous materials harm people.

1-31



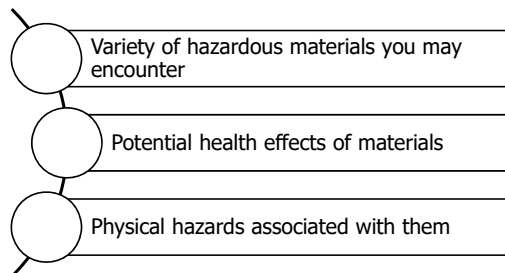
Hazardous materials can hurt you in various ways.



1-32



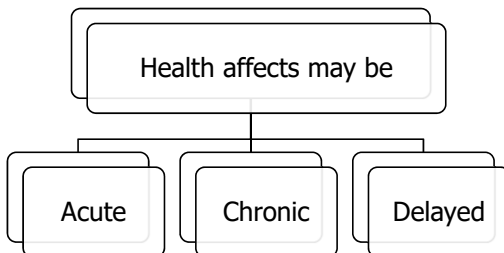
You must understand hazmat incidents to safely mitigate them.



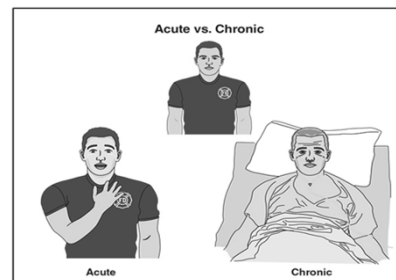
1-33



Many hazardous materials have potential health effects.



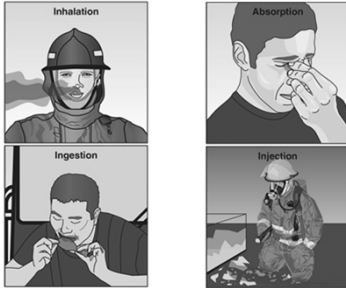
1-34



1-35



Hazardous materials can enter the body in multiple ways.



1-36



Inhalation is the most common exposure route.

Inhalation

Breathing hazardous materials in through your nose or mouth



1-37



Poor hygiene can lead to accidental ingestion.

Ingestion

Eating or swallowing hazardous materials through your mouth



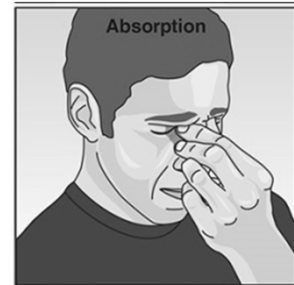
1-38



Some materials easily pass through skin and mucous membranes.

Absorption

Taking in materials through your skin or eyes



1-39



Sharp objects can cut or puncture your skin.

Injection

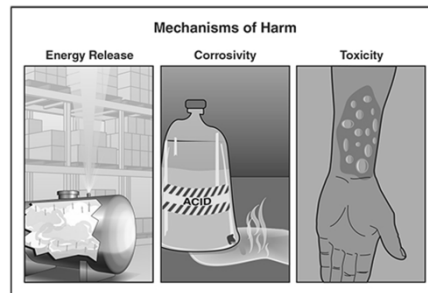
Taking in materials through a puncture in your skin



1-40



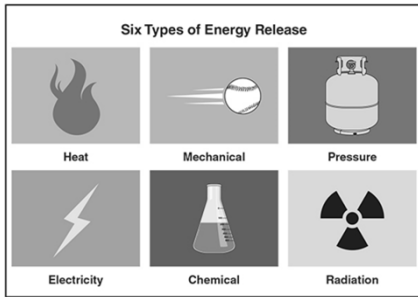
Hazardous materials can harm you in three ways.



1-41



Energy release at hazmat incidents presents the greatest threat.



1-42



Heat (thermal) hazards are common at hazmat incidents.

- Hazardous material can cause temperature extremes
- Fires, explosions, burns
- Environmental factors can cause heat illness, complicate hazmat operations
- Lack of heat can also cause harm

1-43



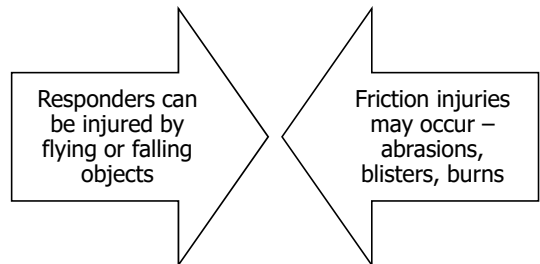
Heat and lack of heat can both cause harm.

- Thermal Energy Hazards**
- _____ Elevated temperature materials
 - _____ Exothermic reactions
 - _____ Fires and explosions
 - _____ Hot weather
 - _____ Cryogenic liquids and gases
 - _____ Cold temperatures

1-44



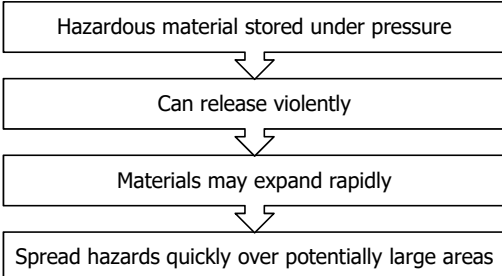
Objects possess mechanical energy due to their position or motion.



1-45



Pressurized materials can release violently.



1-46



Electrical hazards and electricity may be present at hazmat incidents.

- Electrical sources include**
- _____ Utilities
 - _____ Energized containers
 - _____ Electrical equipment _____ Portable generators
 - _____ Power tools

1-47



Chemical energy is released when materials undergo chemical reactions.

- Chemical energy hazards**
- Flames or explosion
 - Release heat
 - Use heat
 - Create new hazardous materials with new/different hazards

1-48



Potential for radiation exposure exists at different types of incidents.

- Potential for radiation exposure**
- Medical centers
 - Industrial operations
 - Nuclear power plants
 - Research facilities
 - Terrorist attacks

1-49



Corrosives are chemicals that destroy or burn living tissues.



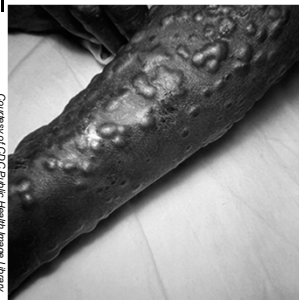
Corrosive materials

- Can hurt if they contact skin or body
- May damage tools and equipment

1-50



Toxic substances cause damage on the molecular scale.



Courtesy of CDC/Pradeep Health Image Library

Effects may be

- Fast-acting, acute
- Chronic, not manifested for many years

Smallpox virus can cause harm. 1-51



REVIEW QUESTIONS



What are the four main routes of entry through which hazardous materials can enter the body and cause harm?

What are the three main mechanisms by which hazardous materials can cause bodily harm?

1-52



Learning Objective 4

List hazardous materials regulations, definitions, and statistics.

1-53



Many deadly incidents have affected the emergency response community.



Courtesy of Moore Memorial Library, Texas City, TX

More than 500 people were killed and over 3,000 injured when a ship carrying ammonium nitrate fertilizer exploded at a dock.

1-54



Four main U.S. federal agencies are involved in the regulation of hazmat.

- Department of Transportation (DOT)
- Environmental Protection Agency (EPA)
- Department of Labor (DOL)
- Nuclear Regulatory Commission (NRC)

1-55



The DOT issues transportation regulations.



Courtesy of Ray EB&R

DOT regulations regarding placards were changed after an unmarked trailer containing 50,000 pounds of ammonium nitrate exploded in Kansas City killing six firefighters.

1-56



The EPA sets national standards for environmental programs.



Courtesy of U.S. Environmental Protection Agency

The resulting health problems from Love Canal led to the passage of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

1-57



Divisions of the DOL regulate worker safety, hazardous household products, and radioactive materials.

- OSHA** Occupational Safety and Health Administration
 - Worker safety
 - Hazardous chemicals, hazardous substances, highly hazardous chemicals
- CPSC** Consumer Product Safety Commission
 - Hazardous household products
 - Chemical products intended for consumers
- NRC** Nuclear Regulatory Commission
 - Radioactive materials
 - Use, storage, and transfer

1-58



Several other U.S. agencies are also involved in the regulation of hazardous materials.

- Department of Energy
- Department of Homeland Security
- Consumer Product Safety Commission
- Department of Defense Explosives Safety Board (DDESB), Department of Defense (DOD)
- Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), Department of Treasury
- Department of Justice

1-59



In Canada, four main agencies regulate hazardous materials.

- Transport Canada (TC)
- Environment Canada
- Health Canada
- Canadian Nuclear Safety Commission (CNSC)

1-60



Three main Mexican agencies regulate hazmat.

- Secretaría de Comunicaciones y Transportes (SCT) – Ministry of Communications and Transport
- Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) – Ministry of Environment and Natural Resources
- Secretaría del Trabajo y Prevision Social (STPS) – Ministry of Labor and Social Welfare

1-61



All first responders will likely have to deal with a hazmat incident.

- Most hazmat incidents involve**
- _____ Flammable/combustible liquids
 - _____ Corrosives
 - _____ Anhydrous ammonia
 - _____ Chlorine
 - _____

1-62



Transportation hazmat incidents are common.



Statistics indicate that most transportation incidents occur while materials are being transported by highway rather than air, rail, or water.

1-63



REVIEW QUESTION



Why are there so many regulations involving hazardous materials?

1-64



Chapter 1: Introduction to Hazardous Materials Answers

Key Terms

1. **Hazardous Material (11)** – Any substance or material that poses an unreasonable risk to health, safety, property, and/or the environment if it is not properly controlled during handling, storage, manufacture, processing, packaging, use, disposal, or transportation.
2. **Dangerous Goods (11)** – Any product, substance, or organism included by its nature or by regulation in any of the nine United Nations classifications of hazardous materials. (2) Alternate term used in Canada and other countries for hazardous materials. (3) Term used in the U.S. and Canada for hazardous materials aboard aircraft.
3. **Weapon of Mass Destruction (WMD) (11)** – Any weapon or device that is intended or has the capability to cause death or serious bodily injury to a significant number of people through the release, dissemination, or impact of toxic or poisonous chemicals or their precursors, a disease organism, or radiation or radioactivity; may include chemical, biological, radiological, nuclear, or explosive (CBRNE) type weapons.
4. **Mitigate (12)** – (1) To cause to become less harsh or hostile; to make less severe, intense or painful; to alleviate. (2) Third of three steps (locate, isolate, mitigate) in one method of sizing up an emergency situation.
5. **National Fire Protection Association (NFPA) (13)** – U.S. nonprofit educational and technical association devoted to protecting life and property from fire by developing fire protection standards and educating the public. Located in Quincy, Massachusetts.
6. **Authority Having Jurisdiction (AHJ) (13)** – An organization, office, or individual responsible for enforcing the requirements of a code or standard, or approving equipment, materials, an installation, or a procedure.
7. **Awareness Level (14)** – Lowest level of training established by the National Fire Protection Association® for personnel at hazardous materials incidents.
8. **Operations Level (14)** – Level of training established by the National Fire Protection Association® allowing first responders to take defensive actions at hazardous materials incidents.
9. **Operations Mission-Specific Level (14)** – Level of training established by the National Fire Protection Association® allowing first responders to take additional defensive tasks and limited offensive actions at hazardous materials incidents.
10. **Incident Commander (IC) (16)** – Person in charge of the incident command system and responsible for the management of all incident operations during an emergency.
11. **Situational Awareness (17)** – Perception of the surrounding environment and the ability to anticipate future events.
12. **Standard Operating Procedures (SOPs) (17)** – Standard methods or rules in which an organization or fire department operates to carry out a routine function. Usually these procedures are written in a policies and procedures handbook and all firefighters should be well versed in their content.
13. **Hazard (21)** – Condition, substance, or device that can directly cause injury or loss; the source of a risk.
14. **Acute (21)** – Characterized by sharpness or severity; having rapid onset and a relatively short duration.
15. **Chronic (21)** – Marked by long duration; recurring over a period of time.
16. **Acute Health Effects (21)** – Health effects that occur or develop rapidly after exposure to a hazardous substance.
17. **Chronic Health Effects (21)** – Long-term health effects resulting from exposure to a hazardous substance.
18. **Routes of Entry (23)** – Pathways by which hazardous materials get into (or affect) the human body.
19. **Heat (26)** – Form of energy associated with the motion of atoms or molecules in solids or liquids that is transferred from one body to another as a result of a temperature difference between the bodies, such as from the sun to the earth. To signify its intensity, it is measured in degrees of temperature.
20. **Mechanical Energy (26)** – Energy possessed by objects due to their position or motion, the sum of potential and kinetic energy.

21. **Pressure (26)** – Force per unit area exerted by a liquid or gas measured in pounds per square inch (psi) or kilopascals (kPa).
22. **Electricity (27)** – Form of energy resulting from the presence and flow of charged particles.
23. **Chemical Energy (27)** – Potential energy stored in the internal structure of a material that may be released during a chemical reaction or transformation.
24. **Radiation (27)** – Energy from a radioactive source emitted in the form of waves or particles, as a result of the decay of an atomic nucleus; process known as *radioactivity*.
25. **Corrosive (27)** – Capable of causing damage by gradually eroding, rusting, or destroying a material.
26. **Toxic (27)** – Poisonous.
27. **Virus (27)** – Simplest type of microorganism that can only replicate itself in the living cells of its hosts. Viruses are unaffected by antibiotics.
28. **Bacteria (28)** – Microscopic, single-celled organisms.
29. **Toxin (28)** – Substance that has the capability of being poisonous.

**Hazardous Materials
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**Chapter 2 — Analyzing the Incident:
Recognizing and Identifying the
Presence of Hazardous Materials**

HAZARDOUS MATERIALS
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FIFTH EDITION

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Learning Objective 1

Restate the seven clues to the presence
of hazardous materials.

2-1

**Moving closer to a hazardous
material increases risk.**

Increased Risk with Higher Clue Numbers

2-2

**There are seven clues to the
presence of hazardous materials.**

- Occupancy types, locations, preincident surveys
- Container shapes
- Transportation placards, labels, and markings
- Other markings and colors (nontransportation)
- Written resources
- Senses
- Monitoring and detection devices

2-3

**Mixed loads in transportation may
not be marked at all.**

2-4

REVIEW QUESTION

List the seven clues to the presence of
hazardous materials.

2-5

Learning Objective 2

Explain how preincident plans, occupancy types, and locations may indicate the presence of hazardous materials.

2-6



Preincident plans can simplify and reduce on-site decisions.

Preincident surveys identify	Exposures
	Hazmat types, quantities, dangers, locations
	Building features such as location of fixed fire suppression systems
	Site characteristics
	Possible access/egress difficulties
	Inherent limitations of response organizations when trying to control certain types of hazmat emergencies
	24-hour telephone numbers of responsible parties and site experts
	Site or occupancy response capability

2-7



Certain occupancies are likely to have hazardous materials.

Fuel storage facilities	Gas/service stations and convenience stores	Paint supply stores	Plant nurseries, garden centers, agricultural facilities
Pest control, lawn care companies	Medical facilities	Photo processing laboratories	Dry cleaners
Plastics and high-technology factories	Metal-plating businesses	Mercantile concerns	Laboratories in educational facilities

(Cont.)

2-8



Certain occupancies are likely to have hazardous materials.

Lumberyards	Feed/farm stores	Veterinary clinics	Print shops
Warehouses	Industrial and utility plants	Port shipping facilities	Treatment storage disposal (TSD) facilities
Abandoned facilities	Big box retail stores	Shipping depots	Military installations

2-9



Feed/farm stores are likely to have hazardous materials in stock.

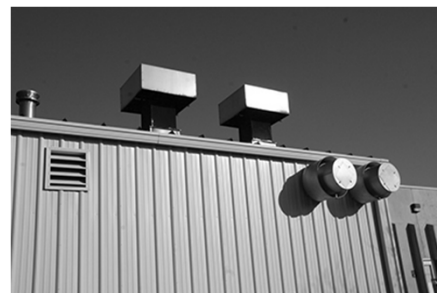


Courtesy of Rich Mahoney

2-10



The presence of fume hood exhaust stacks indicates a laboratory.



2-11



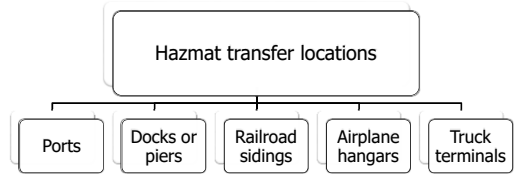
Residential occupancies have many hazardous chemicals.



2-12



Hazmat accidents are more likely to occur during transfer or handling.



2-13



Port facilities are a common location for hazmat incidents.



Courtesy of U.S. Customs and Border Protection, photo by Charles Cassavoy

2-14



Railway bridges and trestles are likely spots for hazmat incidents.



Courtesy of Phil Linder

2-15



Hazardous materials may be released during flooding.



Courtesy of Rich Mahoney

2-16



REVIEW QUESTION



What types of occupancies are most likely to have hazardous materials?

2-17



Learning Objective 3

Identify basic container shapes that indicate the presence and hazards of hazardous materials.

2-18







Containers provide useful information about the materials inside.



2-19



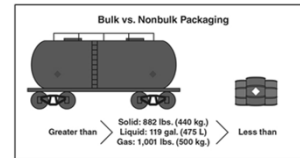
Hazmat containers are sometimes classified by transport mode.

	Highway Highway Cargo Trucks (Cargo Tanks, Tank Trucks)
	Rail Rail Cars (Tank Cars)
	Water Vessel Cargo Carriers (Vessels)
	Multiple Modes Intermodal Containers (Intermodals)

2-20



Containers can also be classified by capacity.



2-21



Bulk packages are loaded with no intermediate form of containment.

Bulk packaging includes	Cargo tanks
	Railcars
	Portable tanks
	Intermediate bulk containers (ICB)
	Intermodal containers (IM)

2-22



Bulk packaging criteria is by volume, mass, or weight.

Liquid

- Maximum capacity > 119 gallons (475 L)

Solid

- Maximum net mass > 882 pounds (440 kg)
- Maximum capacity > 119 gallons (475 L)

Gas

- Capacity ≥ 1,001 pounds (500 kg)

2-23



Nonbulk packaging is smaller than the criteria for bulk packaging.



2-24



Nonbulk packages have some type of intermediate containment.

Nonbulk packaging includes

Drums

Boxes

Carboys

Bags

Composite packages

Combination packages

2-25



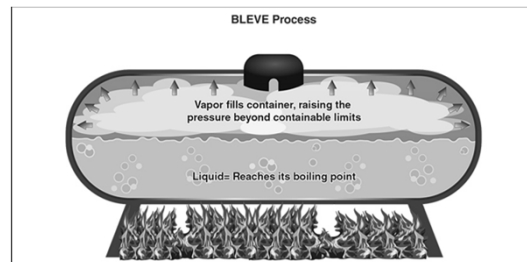
Compressed gas cylinders are a familiar type of pressure container.



2-26



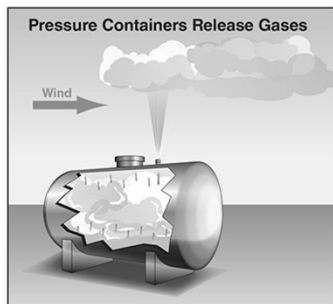
Pressure containers can rupture violently due to internal pressure.



2-27



A pressurized gas will expand rapidly if released into the environment.



2-28



WARNING

STOP!!! Products stored in pressure containers may kill you! As a responder, your job is to stop and stop others! Isolate and deny entry.

When damaged or stressed by heat or flames, pressure containers may explode! Keep your distance!

2-29



WARNING

Contents of pressure containers may ignite easily and will expand quickly if released! Keep your distance upwind, uphill, and upstream! Remove ignition sources if it can be done safely!

2-30



WARNING

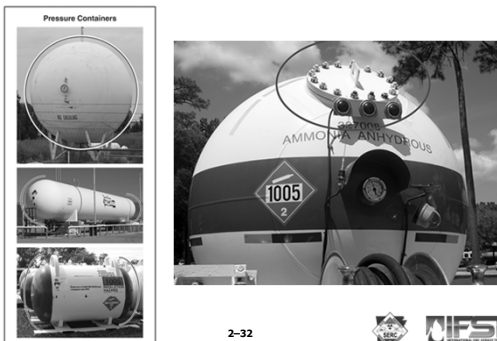
Contents of pressure containers may be extremely toxic and will expand quickly if released! Keep your distance upwind, uphill, and upstream!

Contents of pressure containers may be corrosive and will expand quickly if released! Keep your distance upwind, uphill, and upstream.

2-31



Pressure containers may have rounded, spherical ends or bolted manways.



2-32



Pressure containers may have bolted protective housings.



2-33



Pressure containers may have pressure relief devices.



2-34



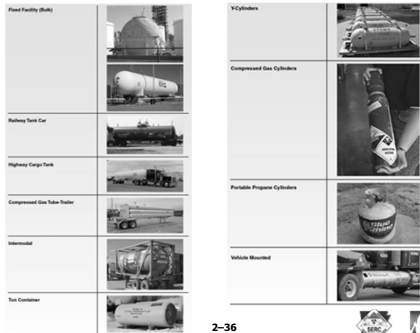
Pressure containers may have pressure gauges.



2-35



Pressure containers vary.



2-36



Cryogenic containers store and transport cryogenics.

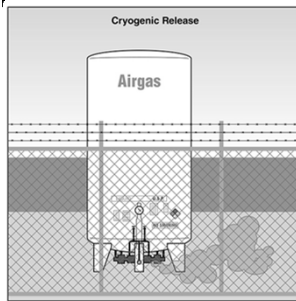
Cryogen

- Sometimes called refrigerated liquefied gas
- Gas that turns into a liquid
 - At or below -130° F (-90° C)
 - At 14.7 psi (101 kpa) {1.01 bar}

2-37



Cryogenics may change rapidly from a liquid to a vapor when released.



Vapor clouds may be flammable, toxic, corrosive, or an oxidizer

Vapors may be extremely cold, potentially causing freezing burns

2-38



WARNING

Cryogenics can displace oxygen and cause asphyxiation!

Cryogenics are extremely cold and can severely injure you if contacted!

2-39



CAUTION

Immediately remove any clothing saturated with a cryogenic material.

2-40



Contents are a clue to cryogenic containers.



Cryogenic contents include

- Liquid oxygen (LOX)
- Nitrogen
- Helium
- Hydrogen
- Argon
- Liquefied natural gas (LNG)

2-41



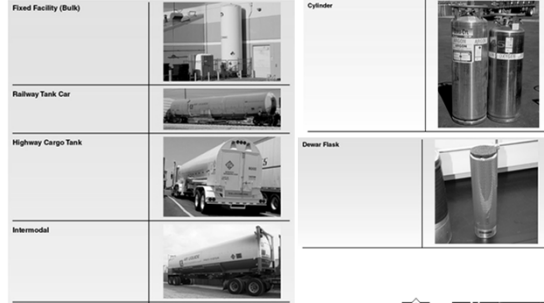
Box-like loading and unloading stations attached to transportation containers indicate a cryogenic container.



2-42



Cryogenic containers vary.



2-43



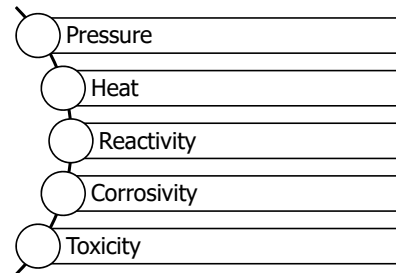
There are many types of liquid containers.

- Liquid containers include**
- _____ Bottles
 - _____ Gasoline containers
 - _____ Paint pails
 - _____ Drums
 - _____ Fixed facility containers

2-44



Liquid containers may hold contents that have a variety of hazards.



2-45



WARNING

STOP!!!! Products in liquid containers may kill you! Your job as a responder is to stop and to stop others! Isolate and deny entry.

Liquid containers may explode when damaged or stressed by heat or flames. Keep your distance!

2-46



CAUTION

Many liquid containers will have low amounts of pressure. When released, this pressure may cause contents to splash or spray.

Liquid containers may hold toxics, corrosives, or materials with a variety of potential heat hazards. Do not come in contact!

2-47



There are clues to liquid containers.

Flat (or less rounded) ends on tanks

Access hatches secured with easily removed latching devices

Low pressure rail tank cars may have multiple fittings visible on top

Intermodal, flexible intermediate bulk containers and rigid intermediate bulk containers designed to be stacked

Flexible bladders filled with fluids

Highway cargo tanks will have oval, upside-down horseshoe-shaped or circular-shaped ends with less rounding than pressure tanks

2-48



Know the clues to liquid containers.



Highway cargo tanks will have oval, upside-down horseshoe-shaped, or circular shaped ends with less rounding than pressure tanks

Flat ends on tanks

Intermodal, flexible intermediate bulk containers

2-49



Solids containers and hazards vary.

Some solids hazards

May be toxic or corrosive

May release energy

May be reactive

May engulf, suffocate, or crush

Airborne particles may explode

2-50



Solids containers may have systems designed for pneumatic loading and unloading.



2-51



Courtesy of Rich Maloney

Solids containers may have open tops or be covered with tarps or plastic.



Courtesy of David Alexander, Texas Commission on Fire Protection

2-52



WARNING

Dust explosions can kill you!

Solid materials can engulf and kill you!

2-53



Radioactive material is shipped in one of five basic types of containers.

Table 2.4
Radioactive Materials Containers

Industrial	
Excepted	
Type A	
Type B	
Type C	

Retains and protects contents during normal transportation activities

Only used to transport materials with extremely low levels of radioactivity that present no risk to public or environment

Must demonstrate ability to withstand series of tests without releasing contents

Must demonstrate ability to withstand tests simulating normal shipping conditions and severe accident conditions

Very rare packaging used for high-activity materials transported by aircraft

2-54



Type B packages must withstand severe accident conditions.



Courtesy of the National Nuclear Security Administration, Nevada Site Office

2-55



CAUTION

Radiation can travel in all directions for long distances and may pass through materials. It cannot be detected by the five human senses and requires a meter to detect.

2-56



Many hazardous materials are transported in underground pipelines.



Courtesy of Rich Mahoney

2-57



Markers are often the best way to ID pipelines and their contents.



2-58



WARNING

Pipelines can transport high pressure materials and may explode!

Pipelines can transport a variety of very dangerous materials!

2-59



CAUTION

Pipelines may be buried in residential neighborhoods!

2-60



Marine vessels transport over ninety percent of the world's cargo.

Vessel Cargo Carriers

Tankers
(tank vessel)

Transport very large quantities of liquid products

Cargo vessels

Transport liquids or solids

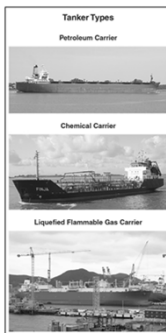
Barges

Can transport anything

2-61



Tankers often carry different products in segregated tanks.



Transport crude or finished petroleum products

Transport many different chemical products

Transport LNG and LPG

2-62



There are four types of cargo vessels.

Bulk carriers

Break bulk carriers

Container vessels

Roll-on/Roll-off vessels

2-63



Container vessels transport cargo in standard intermodal containers.



2-64



Roll-on/roll-off vessels have ramp structures that allow vehicles to be driven on and off the vessel.



2-65



Barges can travel waterways that larger vessels cannot.



2-66



WARNING

Confined spaces in vessels can contain oxygen deficient atmospheres that cause asphyxiation!

2-67



Unit loading devices consolidate air cargo into a single, transportable unit.



2-68



ULDs are containers and aircraft pallets.

Designed and shaped to fit into airplane decks and compartments

In some cases may be stacked

Hazardous materials shipped in ULDs must be appropriately placarded and labeled

2-69



NOTE

Military aircraft or transport vehicles may transport Internal airlift and helicopter Slingable Units (ISUs) that transport everything including hazardous materials.

2-70



REVIEW QUESTION



How can you differentiate pressure, cryogenic, liquid, and solids containers from a distance, and what types of hazardous materials are each likely to contain?

2-71



REVIEW QUESTION



List the five basic types of containers used to transport radioactive materials and briefly explain what these packages are designed to withstand.

2-72



REVIEW QUESTIONS



What types of hazardous materials are transported in pipelines?

What are unit loading devices and can hazardous materials be shipped in them?

2-73



Learning Objective 4

Describe ways that U.S. transportation placards, labels, and markings indicate the presence and hazards of hazardous materials.

2-74



Transportation placards, labels, and markings identify hazmat during transportation in North America.

Placards

Bulk Packaging

Labels

Nonbulk packaging

Some unique labels with no placard equivalent

2-75



The U.N. system designates nine hazard classes.

Class 1: Explosives

Class 2: Gases

Class 3: Flammable Liquids

Class 4: Flammable solids, substances liable to spontaneous combustion, substances that emit flammable gases on contact with water

Class 5: Oxidizing substances and organic peroxides

Class 6: Toxic and infectious substances

Class 7: Radioactive materials

Class 8: Corrosive substances

Class 9: Miscellaneous dangerous substances and articles

2-76



Four-digit UN ID numbers must be displayed on bulk containers.

Sample Displays of 4-Digit UN Identification Numbers



1090

2-77



NOTE

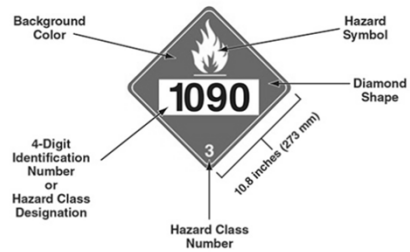
NA numbers (**N**orth **A**merica) also known as DOT numbers, are issued by the United States Department of Transportation and are identical to U.N. numbers, except that some substances with a U.N. number may have an NA number. These additional NA numbers use the range NA8000-NA9999.

2-78



Placards identify a container's contents.

DOT Placard Parts

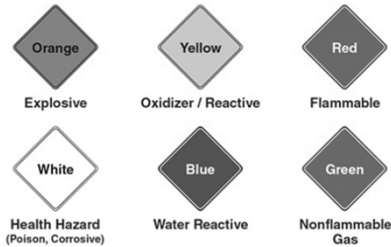


2-79



Placards are color coded by hazard class.

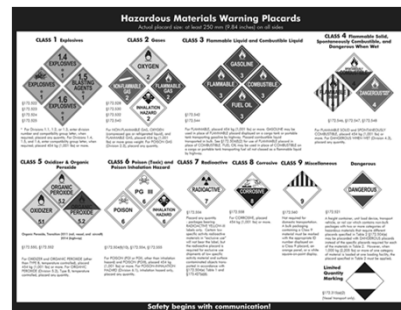
Placard Colors



2-80



More than one placard indicates that more than one hazard or product is present.

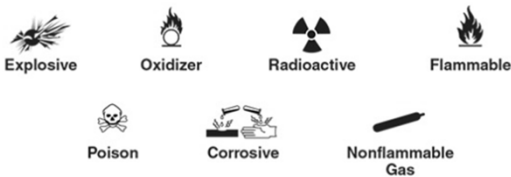


2-81



The placard may also have a hazard symbol.

Hazard Symbols



2-82



The lower corner of a placard displays the hazard class or division number.



2-83



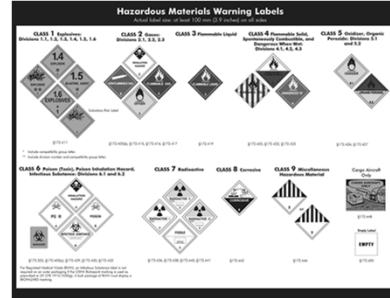
The Dangerous placard is for mixed loads of nonbulk packages.



2-84



Labels are 3.9 inch (100 mm) square-on-point diamonds.



2-85



Packages with more than one label have more than one hazard or product.



Courtesy of Rich Maloney

2-86



Markings provide important information to first responders.



2-87



Elevated temperature materials are marked as "Hot."

Elevated Temperature Material

Liquid phase at a temperature at or above 212° F (100° C)

Liquid phase with a flash point at or above 100° F (38° C) that is intentionally heated and offered for transportation or transported at or above its flash point

Solid phase at a temperature at or above 464° F (240° C)

2-88



Materials marked as "Hot" should be treated as burn hazards.



Courtesy of Rich Maloney

2-89



REVIEW QUESTION



What are the nine hazard classes used by the U.N. to categorize hazardous materials?

2-90



REVIEW QUESTION



How does the U.S. transportation system of placards, labels, and marking indicate the hazards posed by the hazardous materials carried?

2-91



Learning Objective 5

Describe ways that Canadian transportation placards, labels, and markings indicate the presence and hazards of hazardous materials.

2-92



Canadian placards, markings, and labels are also based on U.N. recommendations.

Differences between Canadian and U.S. placards, labels, and markings

Most Canadian transport placards do not have signal words

Labels and markings may be in both English and French

Canada requires a unique placard for anhydrous ammonia and Inhalation Hazards

Radiation placard may have the four-digit U.N. number

2-93



REVIEW QUESTION



How do Canadian placards, markings, and labels differ from the U.S. system?

2-94



Learning Objective 6

Describe ways that Mexican transportation placards, labels, and markings indicate the presence and hazards of hazardous materials.

2-95



Mexican placards, markings, and labels are also based on U.N. recommendations.



2-96



Mexican placards, markings, and labels are almost identical to U.S. and Canadian.

Differences between Mexican and U.S. placards, labels, and markings

Mexico does not recognize inhalation placard

May have text in Spanish

2-97



REVIEW QUESTION



How do Mexican placards, markings, and labels differ from the U.S. system?

2-98



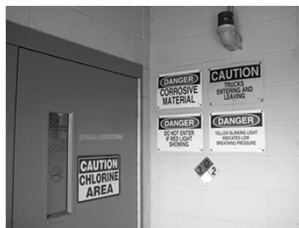
Learning Objective 7

Identify other markings and colors that indicate the presence of hazardous materials.

2-99



Other markings and colors may also indicate the presence of hazmat.

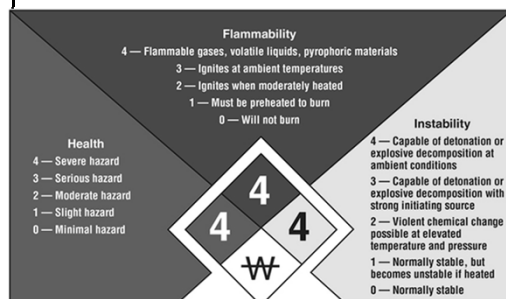


Courtesy of Rich Mahoney

2-100



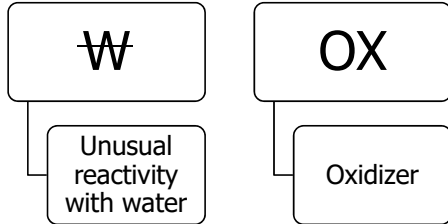
NFPA 704 System can be used in fixed-storage facilities.



2-101



There are two special hazards symbols in the NFPA 704 System.



2-102



NOTE

The NFPA 704 system may be used differently in countries outside of North America. For example, NFPA 704 symbols might be used on transportation containers.

2-103



CAUTION

The NFPA 704 diamond will relay the worst hazard level in each category on site. These may not all be from the same material.

2-104



GHS promotes consistent criteria for classifying chemicals.

Globally Harmonized System

Uniform classification of hazardous substances and mixtures

Uniform labeling standards

Uniform SDS content and format

2-105



Universal symbols and pictograms are part of GHS.

Table 2.6
Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Flammables/ Fire Hazard	Oxidizers	Explosives or Explosion Hazard	Corrosives	Compressed Gases
Warnings	Environmental Hazards	Poison/Toxic	Variety of Health Hazards	

2-106



HCS requires employers to ID hazards in the workplace.

Employers must

- Identify hazards in workplace
- Train employees to how to recognize those hazards
- Ensure all hazardous materials containers are labeled, tagged, or marked with identity of the substances and appropriate hazard warnings

2-107



OSHA requires employers to ID hazards in the workplace.



First responders may encounter a variety of different identification systems used by employers in their area.

2-108



HMIS complies with HCS standards.

HMIS Hazardous Materials Information System

Commonly used proprietary system

Developed by American Coating Association

Utilizes numerical rating and color code

2-109



WHMIS is the Canadian workplace hazmat labeling system.

Workplace Hazardous Materials Information Systems

- Requires hazardous products be appropriately labeled and marked
- Spells out requirements for SDS
- Supplier and Workplace labels most commonly used

2-110



Canadian employers will most likely use the Supplier or Workplace label.



2-111



GHS is replacing the old WHMIS system.

Table 2.7
Old WHMIS Symbols and Hazard Classes

Symbol	Hazard Class	Description
	Class A: Compressed Gas	Compressed, under high pressure (under any applicable test when fully charged, or at design pressure, if designed).
	Class B: Flammable and Combustible Material	May catch fire when exposed to heat, spark, or flame; may burn. See Section 2.2.
	Class C: Oxidizing Material	May release the oxidizing effect in contact with water, acids, bases, or other combustible material.
	Class D: Division 1: Poisonous and Injurious Material; irritant and serious toxic effects	Poisonous substances: a single exposure may be fatal or cause serious permanent damage to health.
	Class D: Division 2: Poisonous and Injurious Material; Other toxic effects	Poisonous substances may cause irritant, allergic, or other permanent damage.
	Class D: Division 3: Poisonous and Injurious Material; Reproductive Injurious materials	May cause damage or serious effects; health symptoms may result at death.
	Class E: Corrosive Material	Can cause burns to eyes, skin, or respiratory tract.
	Class F: Highly Reactive Material	May react violently, causing explosion, fire, or release of toxic gases when exposed to light, heat, shock, or ordinary transportation.

Source: HMIS - Canadian Workplace Hazardous Materials Information System. Taken adapted from Canadian Centre for Occupational Health and Safety (CCOHS) and prepared for NIFSTA.

2-112



The Mexican hazard communication system is NOM-018-STPS-2000.

Mexican Hazard Communication System

Essentially adopts NFPA 704

Employers can use alternative systems if they comply with objective and purpose

General caution systems are triangular

2-113



NOTE

Lower categories of classification and unclassified products would not require pictograms or signal words under GHS. The current EPA system includes a third signal word "Caution" with is used in addition to "Warning" and "Danger."

2-120



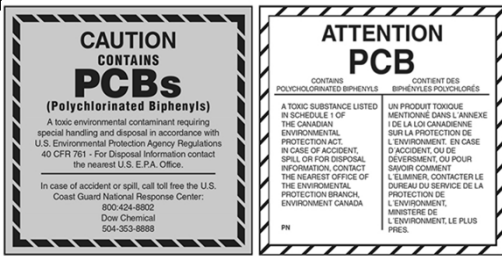
CAUTION

Inert materials in pesticides may be more toxic or flammable than the pesticide itself.

2-121



PCB warning labels may differ by country.



U.S. PCB warning labels are found on containers, transformers, or capacitors that contain PCBs.

There are several different styles of Canadian PCB warning labels.

2-122



ISO symbols are being used more frequently in the US.

The International Organization for Standardization

Standard ISO-3864

Defines design criteria for international safety signs

2-123



First responders should be able to recognize more common ISO symbols.

Table 2.10
Sample ISO-3864 Type Symbols*

Corrosive	Explosive	Flammable	Toxic/ Poisonous
Biological Hazard	Radiation	Oxidizer	Irritant

* ISO = International Organization for Standardization. This table is not comprehensive.

2-124



ANSI Z535.1 defines the safety color code.

Red – Danger or Stop

Orange – Warning

Yellow – Caution

Green – Safety Equipment

Blue – Safety Information

2-125



REVIEW QUESTION



Where might you find other types of markings, marking systems, labels, labeling systems, colors, color-codes, and signs that indicate the presence of hazardous materials?

2-126



REVIEW QUESTION



Describe the color and number system used in NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*.

2-127



REVIEW QUESTIONS



What are the key elements of the Globally Harmonized System?

How do pesticide labels differ from other hazardous materials labeling systems?

2-128



REVIEW QUESTION



Where might you find other symbols and signs for hazardous materials not covered above?

2-129



REVIEW QUESTION



Describe common symbols and colors that indicate the presence of hazardous materials as set forth by ANSI Standard Z535.4.

2-130



Learning Objective 8

Describe ways written resources are used to identify hazardous materials and their hazards.

2-131



Multiple written resources should be available at facility incidents.

- Written resources at facilities include**
- _____ SDS
 - _____ Inventory records
 - _____ Signs, markings, labels
 - _____ Other facility documents

2-132



Shipping papers should be available at transportation incidents.

Table 2.11
Shipping Paper Identification

Transportation Mode	Shipping Paper Name	Location of Papers	Party Responsible
Air	Air Bill	Cockpit	Pilot
Highway	Bill of Lading	Vehicle Cab	Driver
Rail	Trainlist/Consist	Engine (or Caboose)	Conductor
Water	Dangerous Cargo Manifest	Bridge or Pilot House	Captain or Master

2-133



Shipping papers follow the ISHP sequence.

- I = Identification Number
- S = Proper Shipping Name
- H = Hazard Class or Division
- P = Packing Group

2-134



The X denotes that a hazardous material is present.

STRAIGHT BILL OF LADING
ORIGINAL, NON-NEGOTIABLE

Shipper No. _____
Carrier No. _____
Date _____

Page _____ of _____ (Total of pages) (SAC)

Shipper: _____
Name: _____
Address: _____
City: _____ State: _____ Zip Code: _____
Phone: _____
Fax: _____
E-mail: _____

Consignee: _____
Name: _____
Address: _____
City: _____ State: _____ Zip Code: _____
Phone: _____
Fax: _____
E-mail: _____

1-800-555-2222

Quantity	Unit	Material Description	UN Number	Proper Shipping Name	Hazard Class	Packing Group	Remarks
1	Box	Carriage bolts					
4	Drums	X UN1805, Phosphoric acid solution, 8, PGII					
1	Drum	X UN1805, Flammable liquid, n.s.s., (contains methanol), 3, PGII, Cargo Aircraft Only					

Courtesy of PHMUSA

2-135



NOTE

Shipping paper information may be provided in a variety of formats such as FAX and email.

2-136



Safety Data Sheets provide detailed information about a product.



2-137



An SDS is organized according to OSHA regulations.

- Section 1: Identification
- Section 2: Hazard(s) identification
- Section 3: Composition/information on ingredients
- Section 4: First aid measures
- Section 5: Fire fighting measures
- Section 6: Accidental release measures
- Section 7: Handling and storage
- Section 8: Exposure controls/personal protection

(Cont.)

2-138



An SDS is organized according to OSHA regulations.

- Section 9: Physical and chemical properties
- Section 10: Stability and reactivity
- Section 11: Toxicological information
- Section 12: Ecological information
- Section 13: Disposal considerations
- Section 14: Transport information
- Section 15: Regulatory information
- Section 16: Other information

2-139



SAMPLE SAFETY DATA SHEET (SDS)



SAFETY DATA SHEET

1. Identification

Product identifier	CHLORINE
Other means of identification	Not available.
Recommended use	Chlorinating and oxidizing agent, Water treatment chemicals, pharmaceutical, Synthesis, Disinfectants and general biocidal products, Plastics
Recommended restrictions	None known.
Manufacturer / Importer / Supplier / Distributor Information	
Company name	Olin Chlor Alkali Products
Address	490 Stuart Road, NE Cleveland, TN 37312
Company name	Pioneer Americas, LLC (d/b/a Olin Chlor Alkali Products)
Address	490 Stuart Road, NE Cleveland, TN 37312
Company name	Olin Canada ULC (d/b/a Olin Chlor Alkali Products)
Address	2020 University, Suite 2190 Montreal, Quebec H3A 2A5
General Information	
Telephone	(888) 658-MSDS (6737)
Website	olinchloralkali.com
Contact person	ORC MSDS Control Group
Emergency phone number	CHEMTREC US: 1-800-424-9300 Canada: 1-800-567-7455

2. Hazard(s) identification

Physical hazards	Oxidizing gases	Category 1
	Gases under pressure	Liquefied gas
Health hazards	Acute toxicity, inhalation	Category 2
	Skin corrosion/irritation	Category 1
	Serious eye damage/eye irritation	Category 1
	Specific target organ toxicity, single exposure	Category 3 respiratory tract irritation
	Specific target organ toxicity, repeated exposure	Category 1 (Lung)
OSHA defined hazards	Not classified.	

Label elements



Signal word	Danger
Hazard statement	May cause or intensify fire; oxidizer. Contains gas under pressure; may explode if heated. Causes severe skin burns and eye damage. Fatal if inhaled. May cause respiratory irritation. Causes damage to organs (lung) through prolonged or repeated exposure.
Precautionary statement	
Prevention	Keep/Store away from clothing/combustible materials. Keep reduction valves/valves and fittings free from oil and grease. Do not breathe gas. Use only outdoors or in a well-ventilated area. Do not eat, drink or smoke when using this product. Wear protective gloves/protective clothing/eye protection/face protection. Wear respiratory protection. Wash thoroughly after handling.
Response	In case of fire: Stop leak if safe to do so. Get medical advice/attention if you feel unwell. If inhaled: Remove person to fresh air and keep comfortable for breathing. If swallowed: Rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor. Specific treatment is urgent. Wash contaminated clothing before re-use.
Storage	Store in a well-ventilated place. Keep container tightly closed. Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

Immediately evacuate personnel to safe areas. Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks). Keep people away from and upwind of spill/leak. Keep out of low areas. Keep unnecessary personnel away. Ventilate closed spaces before entering them. Wear appropriate protective equipment and clothing during clean-up. Local authorities should be advised if significant spillages cannot be contained.

For response to Chlorine gas it is recommended to use as a minimum level "B" protection that is compatible to Chlorine. For Liquid spills it is recommended to utilize as a minimum enhanced level "B" (Enhanced Level "B" is the addition of a splash hood). Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Responders can reference Chlorine Institute pamphlet #65 on PPE.

Methods and materials for containment and cleaning up

Extinguish all flames in the vicinity. Keep combustibles (wood, paper, oil, etc.) away from spilled material. Ventilate well, stop flow of gas or liquid if possible. If possible, turn leaking containers so that gas escapes rather than liquid. Dike far ahead of spill for later disposal. Isolate area until gas has dispersed. Neutralize spilled material with crushed limestone, soda ash or lime. Collect spillage.

Never return spills to original containers for re-use. Clean up in accordance with all applicable regulations. For waste disposal, see section 13 of the MSDS.

Environmental precautions

Avoid discharge into drains, water courses or onto the ground. Contact local authorities in case of spillage to drain/aquatic environment.

7. Handling and storage

Precautions for safe handling

Avoid heat, sparks, open flames and other ignition sources. Keep away from clothing and other combustible materials. Use only chlorine-compatible lubricants. Do not use greases and oils. Do not breathe gas. Do not get in eyes, on skin, on clothing. Use in a sealed system and/or a well-ventilated area. Wear appropriate personal protective equipment. Observe good industrial hygiene practices. Avoid release to the environment.

Conditions for safe storage, including any incompatibilities

Contents under pressure. Keep away from heat, sparks and open flame. Secure cylinders in an upright position at all times, close all valves when not in use. Store in a well-ventilated place. Store away from incompatible materials.

Store at temperatures not exceeding 55°C/131°F. For the above specified temperature the system pressure is 225 psig (1551kPa).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Material	Type	Value
CHLORINE (CAS 7782-50-5)	Ceiling	3 mg/m ³
		1 ppm

US. ACGIH Threshold Limit Values

Material	Type	Value
CHLORINE (CAS 7782-50-5)	STEL	1 ppm
	TWA	0.5 ppm

Biological limit values

No biological exposure limits noted for the ingredient(s).

Exposure guidelines

Check State and local regulations for other applicable exposure limits.

Appropriate engineering controls

Should be handled in closed systems, if possible. Provide adequate ventilation. Observe Occupational Exposure Limits and minimize the risk of inhalation. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection

Wear goggles/face shield. Gas-proof goggles are recommended.

Skin protection

Hand protection

Wear cold insulating gloves. Suitable gloves can be recommended by the glove supplier.

Other

Wear appropriate chemical resistant clothing.

Respiratory protection

If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.

Thermal hazards

Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations

Do not eat, drink or smoke when using the product. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	Compressed liquefied gas.
Physical state	Gas Compressed, liquified.
Form	Liquefied gas.
Color	Yellow green.
Odor	Pungent.
Odor threshold	1.7 ppm
pH	Not available.
Melting point/freezing point	-149.8 °F (-101 °C) (1 atm)
Initial boiling point and boiling range	-29.27 °F (-34.04 °C) (1 atm)
Flash point	Not applicable.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not applicable.
Flammability limit - lower (%) temperature	Not applicable.
Flammability limit - upper (%)	Not applicable.
Flammability limit - upper (%) temperature	Not applicable.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	113 psia (25°C/77°F) 779 kPa (25 °C/77 °F) 4800 mm Hg (25°C/77°F)
Vapor density	2.5
Relative density	Not available.
Solubility(ies)	0.73 g/100g H2O (20°C/68°F) (760 mm Hg)
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Bulk density	88.76 lb/ft ³ 59.8 °F (15.6 °C)
Density	0.76 lb/ft ³ 32 °F (0 °C) 53.51 psia
Heat of vaporization	123.9 BTU/lb
Molecular formula	Cl2
Molecular weight	70.906 g/mol

10. Stability and reactivity

Reactivity	Contact with combustible material may cause fire.
Chemical stability	Stable under normal temperature conditions and recommended use.
Possibility of hazardous reactions	Hazardous polymerization does not occur.

Conditions to avoid	Avoid heat, sparks, open flames and other ignition sources. Titanium will react vigorously, resulting in spontaneous ignition, when contacted by Dry Chlorine. Combustion will be supported in carbon steel systems and equipment containing a Chlorine environment at temperatures greater than 480 °F (248.9 °C). Properly purge systems and equipment PRIOR to conducting Hot Work.
Incompatible materials	Reducing agents. Organic material. Alkalis.
Hazardous decomposition products	Hydrogen chloride. Hypochlorous acid.

11. Toxicological information

Information on likely routes of exposure

Ingestion	Causes digestive tract burns.
Inhalation	Fatal if inhaled. Irritating to respiratory system.
Skin contact	Contact with liquefied gas can cause damage (frostbite) due to rapid evaporative cooling.
Eye contact	Contact with liquefied gas can cause damage (frostbite) due to rapid evaporative cooling. Can cause blurred vision, redness, pain, severe tissue burns and eye damage.

Symptoms related to the physical, chemical and toxicological characteristics

Contact with this material will cause burns to the skin, eyes and mucous membranes. Cough, shortness of breath, headache, nausea, vomiting. May cause lung damage. Unconsciousness.

Information on toxicological effects

Acute toxicity	Fatal if inhaled. Irritation Threshold: approximately 0.5 ppm Immediately Dangerous to Life or Health: 10.0 ppm.
-----------------------	--

Product	Species	Test Results
CHLORINE (CAS 7782-50-5)		
Acute		
<i>Inhalation</i>		
LC50	Rat	293 ppm, 1 hr
Skin corrosion/irritation	Causes severe skin burns.	
Serious eye damage/eye irritation	Causes serious eye damage.	
Respiratory sensitization	No data available.	
Skin sensitization	No data available.	
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.	
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.	
Reproductive toxicity	No data available.	
Specific target organ toxicity - single exposure	Not available.	
Specific target organ toxicity - repeated exposure	Causes damage to organs (lungs) through prolonged or repeated exposure.	
Aspiration hazard	Due to the physical form of the product it is not an aspiration hazard.	
Chronic effects	Prolonged exposure may cause chronic effects.	
Further information	Be aware that symptoms of lung edema (shortness of breath) may develop up to 24 hours after exposure.	

12. Ecological information

Ecotoxicity Very toxic to aquatic life with long lasting effects.

Product	Species	Test Results
CHLORINE (CAS 7782-50-5)		
Aquatic		
Crustacea	LC50	Pacific oyster (<i>Crassostrea gigas</i>) 637.5 mg/l, 1 hours
		Water flea (<i>Daphnia magna</i>) 0.017 mg/l, 46 hours
Fish	LC50	Bluegill (<i>Lepomis macrochirus</i>) 0.44 mg/l, 96 hours
		Bullhead, catfish (<i>Ictalurus sp.</i>) 0.07 mg/l, 96 hours
		Yellow perch (<i>Perca flavescens</i>) 0.88 mg/l, 1 hours
Persistence and degradability	No data available.	
Bioaccumulative potential	Will not bio-accumulate.	

Mobility in soil The Gas will disperse in the air. This product is miscible in water.
Other adverse effects No data available.

13. Disposal considerations

Disposal instructions Return the empty cylinder to the supplier. Disposal recommendations are based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

Local disposal regulations Dispose in accordance with all applicable regulations.

Hazardous waste code D002: Waste Corrosive material [pH <=2 or >=12.5, or corrosive to steel]

Waste from residues / unused products Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions). Avoid discharge into water courses or onto the ground.

Contaminated packaging Since emptied cylinders may retain product residue, follow label warnings even after cylinder is emptied.

14. Transport information

DOT

UN number UN1017
UN proper shipping name Chlorine
Transport hazard class(es) 2.3
Subsidiary class(es) 5.1, 8
Packing group Not available.
Environmental hazards
Marine pollutant Yes
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.
Special provisions 2, B9, B14, N86, T50, TP19
Packaging exceptions None
Packaging non bulk 304
Packaging bulk 314, 315

IATA

UN number UN1017
UN proper shipping name Chlorine
Transport hazard class(es) 2.3
Subsidiary class(es) 5.1, 8
Packaging group Not available.
Environmental hazards No
Labels required Not available.
ERG Code 2CP
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.

IMDG

UN number UN1017
UN proper shipping name CHLORINE
Transport hazard class(es) 2.3
Subsidiary class(es) 5.1, 8
Packaging group Not available.
Environmental hazards
Marine pollutant Yes
Labels required Not available.
EmS F-C, S-U
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

CERCLA Hazardous Substance List (40 CFR 302.4)

CHLORINE (CAS 7782-50-5)

LISTED

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - Yes
 Delayed Hazard - Yes
 Fire Hazard - No
 Pressure Hazard - Yes
 Reactivity Hazard - Yes

SARA 302 Extremely hazardous substance Yes

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
CHLORINE	7782-50-5	98-100

Other federal regulations**Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List**

CHLORINE (CAS 7782-50-5)

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

CHLORINE (CAS 7782-50-5)

Clean Water Act (CWA) Section 112(r) (40 CFR 68.130) Hazardous substance

Safe Drinking Water Act (SDWA) 4 mg/l
4.0 mg/l

Food and Drug Administration (FDA) Not regulated.

US state regulations**US. Massachusetts RTK - Substance List**

CHLORINE (CAS 7782-50-5)

US. New Jersey Worker and Community Right-to-Know Act

CHLORINE (CAS 7782-50-5) 100 lbs

US. Pennsylvania RTK - Hazardous Substances

CHLORINE (CAS 7782-50-5)

US. Rhode Island RTK

CHLORINE (CAS 7782-50-5)

US. California Proposition 65

This product is not listed, but it may contain elements known to the State of California to cause cancer or reproductive toxicity as listed under Proposition 65 Safe Drinking Water and Toxic Enforcement Act. For additional information, contact Olin Technical Services (800-299-6546).

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Not listed.

International Inventories

Country(s) or region	Inventory name	On Inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 23-August-2013

Revision date -
Version # 01
NFPA Ratings



List of abbreviations
LD50: Lethal Dose, 50%.
LC50: Lethal Concentration, 50%.
EC50: Effective concentration, 50%.
TWA: Time weighted average.

References
EPA: AQUIRE database
HSDB® - Hazardous Substances Data Bank
US. IARC Monographs on Occupational Exposures to Chemical Agents
IARC Monographs. Overall Evaluation of Carcinogenicity
ACGIH Documentation of the Threshold Limit Values and Biological Exposure Indices

Disclaimer
This information is provided without warranty. The information is believed to be correct. This information should be used to make an independent determination of the methods to safeguard workers and the environment.

SAMPLE SHIPPING PAPER FOR TRAINING USE ONLY



HAZMAT CHEMICAL COMPANY Inc.

AT DEER PARK TX	SHIPPER'S ID NO. 141 A04602	B/L SEQ. NO. 978	CARRIER NAME MATLACK 6189	SHIPPING DATE 11-05-98
FOR CHEMICAL EMERGENCY CALL CHEMTREC DAY OR NIGHT 1-800- 424-9300	ROUTE CODE	ROUTE		
CUSTOMER NUMBER 39300001	SEAL NO(S) 88288 -90			
CONSIGNEE TO JOHN OGORMAN 1123 DATELOG WAY HOUSTON, TX 77090	BILL TO JPO INDUSTRIES P.O. BOX 90674 HOUSTON, TX 77090	CUSTOMER ORDER NO. 90576 R-4		
ORDERED BY AND DATE MO DAY YR. 11 01 98	SUGGESTED SHIPPING DATE 11 04 98	REQUESTED DELIVERY DATE 11 06 98		
ORDERER'S INITIALS AMH 713-444- 2430				

HM NO. & KIND PRODUCT HAZARD CLASS UN NO.
GUIDE PAGE

	PACKAGES	NAME		
X	1 T/T RQ,	EPICHLOROHYDRIN, GUIDE 131	6.1, UN 2023,	
	LINE 01		4,500	GAL
	GROSS WT	TARE	NET	
	70,240	25,960	44,280	

SPECIAL INSTRUCTIONS	
<ul style="list-style-type: none"> • ANY UNLOADING DETENTION CHANGES BILL TO CONSIGNEE • EQUIP. T/T WITH 2" CAMLOCK FITTING for UNLOADING and 2" MALE CAMLOCK FITTING for VENTING • DELIVER 10 AM - 3 PM 11/06 	
IF SHIPPMENT IS PREPAID MAIL Chemical Products FREIGHT BILL IN DUPLICATE WITH NO. 4 COPY OF B/L TO: Accounting	HAZMAT Chemical Company Inc. Attention: P.O. Box 1876 Accounting Houston, Texas 77251 Freight
SHIPMENTS VIA MOTOR CARRIER <input type="checkbox"/> DOT HAZARDOUS MATERIALS PLACARDS FURNISHED BY:	
<input type="checkbox"/> SHIPPER <input type="checkbox"/> CARRIER	
Carrier certifies that the container supplied by Carrier for this shipment is a proper container for transportation of the Materials as described above. Carrier _____ Per Agent _____	DELIVERY RECEIPT - Received in good condition Customer/Customer's Carrier certifies that the container supplied by it for this shipment is a proper container for transportation For _____ By _____

SAMPLE WAYBILL/CONSIST FOR TRAINING USE ONLY

DENVER AND PUEBLO CONNECTION RAILWAY COMPANY

EMERGENCY CONTACT NUMBER
1-800-584-0584

Train R129 Time: 2100

CARS IN THIS CONSIST COUNT FROM FRONT TO REAR

DPC 9197 L D
DPC 3447 L D
DRGW 8292 L D
DPC 1586 L D

<u>POS</u>	<u>CAR NUMBER</u>	<u>TYPE</u>	<u>STCC</u>	<u>ALPHA</u>	<u>CONSIGN</u>	<u>CTY/ST</u>
001	SCL 11120	LB	2647110	PAPER	SANITARYS	PUEBLOCO
002	BN 45642	LC	0119510	POTATOES	MCDONALDS	PUEBLOCO
003	UP 011501	LC	2891112	CEMENT	HOLMANCEM	PORTLACO
004	TTAX 972345	LF		HAZMAT	INTERSTAT	PUEBLOCO

* DANGEROUS *

PMTZ 204049 4931303
8DR ACETIC ACID, GLACIAL
8 UN2789 II
PLACARDED: CORROSIVE
3520 LBS

EMERGENCY CONTACT:
1-800-424-9300
TO: CONSIGNEE
INTERSTATE CHEM
PUEBLOWEST, CO

FROM: SHIPPER
WORLD CHEMICAL
SANFIELD, UT

4918715
3CTN CALCIUM HYPOCHLORITE, DRY
5.1 UN1748 II
RQ (CALCIUM HYPOCHLORITE)
PLACARDED: DANGEROUS
110 LBS

EMERGENCY CONTACT:
1-800-424-9300
TO: CONSIGNEE
INTERSTATE CHEM
PUEBLOWEST, CO

FROM: SHIPPER
WORLD CHEMICAL
SANFIELD, UT

FAK
39380 LBS

* DANGEROUS *

TTTU 070285 4909103 HAZMAT

IM ALCOHOLS, NOS
3 UN1987 PGI
PLACARDED: FLAMMABLE

EMERGENCY CONTACT
1-800-424-9300

TO: CONSIGNEE
INTERSTATE CHEMICAL
PUEBLO, CO

FROM: SHIPPER
WORLD CHEMICAL
SANFIELD, UT

005 UP 11684 EC 2821163 EMPTY/
CLEAN INTERSTATE PUEBLOCO

006 CELX 1115 ET 4931303 HAZMAT INTERSTATE PUEBLOCO

* DANGEROUS *

1 T/C //193800LBS//
ACETIC ACID, GLACIAL
8 UN2789 II
RQ (ACETIC ACID)
PLACARDED: CORROSIVE

EMERGENCY CONTACT:
1-800-424-9300

TO: CONSIGNEE
INTERSTATE CHEMICAL
PUEBLOWEST, CO

FROM: SHIPPER
WORLD CHEMICAL
SANFIELD, UT

007 ACL 25496 LB 3729992 AIRCRAFTPA USARMY ELPASOTX

008 UP 498856 LB 3531243 SPIKEPULLE ATSFYD PUEBLOCO

009 UTLX 082332 ET 4904102 HAZMAT BIG3GA SANTAFNM

* DANGEROUS *

1 T/C RESIDUE: LAST CONTAINED
CHLORINE
2.3 UN1017
RQ (CHLORINE)
POISON - INHALATION HAZARD
ZONE B MARINE POLLUTANT
PLACARDED: POISON GAS

EMERGENCY CONTACT:
1-800-424-9300

TO: CONSIGNEE
BIG 3 GAS INC
SANTAFE NM

FROM: SHIPPER
DENVER WATER WORKS
DENVER CO

010 DUPX 10027 ET 4935645 HAZMAT FARMLANDI DENVERCO

* DANGEROUS *

1 T/C RESIDUE: LAST CONTAINED
HEXAMETHYLENEDIAMINE SOLUTION
8 UN1783 II
PLACARDED: CORROSIVE

EMERGENCY CONTACT:
1-800-424-9300

TO: CONSIGNEE
FARMLAND INDUSTRIES
BATON ROUGE LA

FROM: SHIPPER
FARMLAND INDUSTRIES
DENVER CO

011 UTPX 932079 LT 4904210 HAZMAT BIG3GA SANTAFNM

* DANGEROUS *

1 T/C //145750LBS//
AMMONIA ANHYDROUS LIQUEFIED
2.2 UN1005
RQ (AMMONIA)
INHALATION HAZARD
PLACARDED: NONFLAMMABLE GAS

EMERGENCY CONTACT:

1-800-424-9300

TO: CONSIGNEE
BIG 3 GAS CO
SANTAFE NM

FROM: SHIPPER
ZAR COOLING COMPANY
FTCOLLINS CO

012 OBX 11401 LT 4910259 HAZMAT CHEVRON PASCAGMI

* DANGEROUS *

1 T/C //142000LBS//
PETROLEUM DISTILLATES, NOS (NAPHTHA)
3 UN1268 II
PLACARDED: FLAMMABLE

EMERGENCY CONTACT:

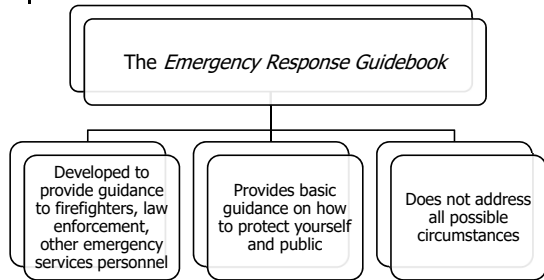
1-800-424-9300

TO: CONSIGNEE
CHEVRON CHEMICAL
PASCAGOULA, MI

FROM: SHIPPER
CHEVRON REFINERY
SALT LAKE CITY, UT

013	DTTX	72601	EF	2441189	EMPTY	UPRRCO	BOONECO
014	DTTX	72853	EF	2441189	EMPTY	UPRRCO	BOONECO
015	BN	63944	EF	2441189	EMPTY	UPRRCO	BOONECO
016	BN	63945	EF	2441189	EMPTY	UPRRCO	BOONECO
017	TTAX	89741	EF	2441189	EMPTY	UPRRCO	BOONECO

The ERG is primarily designed for use at transportation incidents.



2-140



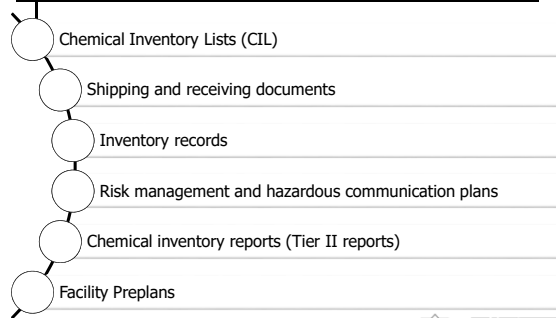
NOTE

Operations level responders at the scene of a hazmat incident should seek additional, specific information about any material in question as soon as possible. The information received by contacting the appropriate emergency response agency, calling the emergency response number on the shipping document, or consulting the information on or accompanying the shipping document may be more specific and accurate than the guidebook in providing direction for managing the materials involved.

2-141



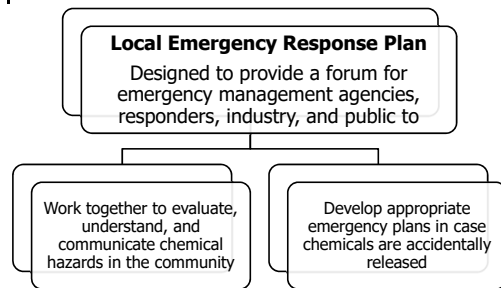
Facilities have various documents regarding hazardous materials.



2-142



The EPA requires preparation of a LERP.



2-143



Many written resources are now available in an electronic format.

- ERG
- CAMEO
- WISER
- 911 Toolkit
- Hazmat IQ eCharts

2-144



REVIEW QUESTION



What written resources are first responders most likely to utilize, and why?

2-145



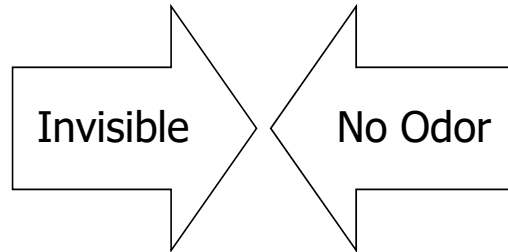
Learning Objective 9

Explain the limited role of the five senses for identifying the presence of hazardous materials.

2-146



Many hazardous materials cannot be readily detected by the senses.



2-147



Be aware of visual indicators of chemical actions.

- Spreading vapor cloud or smoke
- Unusual colored smoke
- Flames
- PPE fails
- Dying or discolored vegetation
- Container deterioration
- Containers bulging
- Sick humans
- Dead or dying birds, animals, insects, or fish
- Discoloration of valves or piping

2-148



Spreading vapor cloud or smoke is a visual indicator that a chemical reaction is taking place.



2-149



Be aware of visual indicators of physical actions.

- Rainbow sheen on water surfaces
- Wavy vapors over a volatile liquid
- Frost or ice buildup near a leak
- Containers deformed by the force of an accident
- Activated pressure-relief devices
- Pinging or popping of heat- or cold-exposed vessels

2-150



A rainbow sheen on water is a good indication that a hazardous material is present.



2-151



Be aware of sensory indicators of chemical reactions.

Heat

Unusual or unexpected temperature drop (cold)

Extraordinary fire conditions

Peeling or discoloration of a container's finish

Spattering or boiling of unheated materials

Distinctively colored vapor clouds

Smoking or self-igniting materials

Unexpected deterioration of equipment

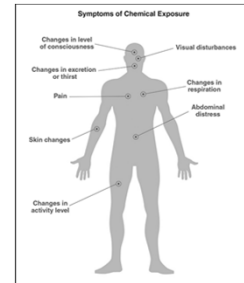
Peculiar smells

Unexplained changes in ordinary materials

2-152



Know the symptoms of chemical exposure.



2-153



REVIEW QUESTION



How can using the senses for hazardous materials detection be dangerous?

2-154



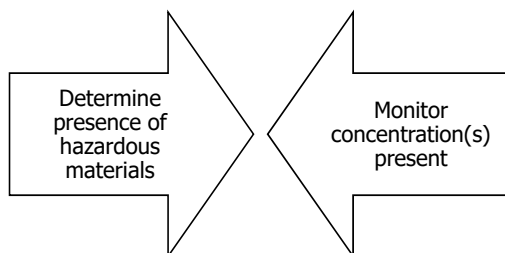
Learning Objective 10

Explain the role of monitoring and detection devices for Awareness Level personnel.

2-155



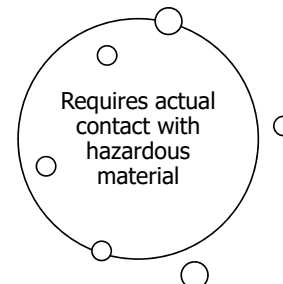
Monitoring and detection devices can be useful at hazmat incidents.



2-156



Use of monitoring and detection devices is outside the scope of action for Awareness Level personnel.



2-157



REVIEW QUESTION



Why will Awareness level personnel not use monitoring and detection devices?

2-158




Chapter 2: Analyzing the Incident: Recognizing and Identifying the Presence of Hazardous Materials

Key Terms

1. **Preincident Survey (48)** - Assessment of a facility or location made before an emergency occurs, in order to prepare for an appropriate emergency response. *Also known as* Preplan.
2. **Occupancy (48)**- (1) General fire and emergency services term for a building, structure, or residency. (2) Building code classification based on the use to which owners or tenants put buildings or portions of buildings. Regulated by the various building and fire codes. *Also known as* Occupancy Classification.
3. **Transportation Mode (50)**-Technologies used to move people and/or goods in different environments; for example, rail, motor vehicles, aviation, vessels, and pipelines.
4. **Container (52)**-(1) Article of transport equipment that is: (a) of a permanent character and strong enough for repeated use; (b) specifically designed to facilitate the carriage of goods by one or more modes of transport without intermediate reloading; and (c) fitted with devices permitting its ready handling, particularly its transfer from one mode to another. The term "container" does not include vehicles. *Also known as* Cargo Container or Freight Container. (2) Box of standardized size used to transport cargo by truck or railcar when transported over land or by cargo vessels at sea; sizes are usually 8 by 8 by 20 feet or 8 by 8 by 40 feet (2.5 m by 2.5 m by 6 m or 2.5 m by 2.5 m by 12 m).
5. **Packaging (52)**- Shipping containers and their markings, labels, and/or placards.
6. **Manway (56)**-(1) Opening (hole) through which a person may go to gain access to an underground or enclosed structure. (2) Opening that is large enough to admit a person into a tank trailer or dry bulk trailer. This opening is usually equipped with a removable, lockable cover. *Also known as* Manhole.
7. **Cryogen (56)** - Gas that is converted into liquid by being cooled below -130°F (-90°C). *Also known as* Refrigerated Liquid and Cryogenic Liquid.
8. **Oxidizer (56)** - Any material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials. (Reproduced with permission from NFPA® 400-2010, *Hazardous Materials Code*, Copyright©2010, National Fire Protection Association®).
9. **Intermediate Bulk Container (IBC) (63)**-Rigid (RIBC) or flexible (FIBC) portable packaging, other than a cylinder or portable tank, that is designed for mechanical handling with a maximum capacity of not more than three 3 cubic meters (3,000 L, 793 gal, or 106 ft:3) and a minimum capacity of not less than 0.45 cubic meters (450 L, 119 gal, or 15.9 ft³) or a maximum net mass of not less than 400 kilograms (882 lbs.).
10. **Dust Explosion (65)** - Rapid burning (deflagration), with explosive force, of any combustible dust. Dust explosions generally consist of two explosions: a small explosion or shock wave creates additional dust in an atmosphere, causing the second and larger explosion.
11. **Label (72)** - Four-inch-square diamond-shaped marker required by federal regulations on individual shipping containers that contain hazardous materials, and are smaller than 640 cubic feet (18 m³) .
12. **Placard (72)** - Diamond-shaped sign that is affixed to each side of a structure or a vehicle transporting hazardous materials to inform responders of fire hazards, life hazards, special hazards, and reactivity potential. The placard indicates the primary class of the material and, in some cases, the exact material being transported; required on containers that are 640 cubic feet (18 m³) or larger.
13. **Emergency Response Guidebook (ERG) (74)**- Manual that aids emergency response and inspection personnel in identifying hazardous materials placards and labels; also gives guidelines for initial actions to be taken at hazardous materials incidents. Developed jointly by Transport Canada (TC), U.S. Department of Transportation (DOT), the Secretariat of Transport and Communications of Mexico (SCT), and with the collaboration of CIQUIME (Centro de Información Química para Emergencias).
14. **Elevated Temperature Material (79)** - Material that when offered for transportation or transported in bulk packaging is (a) in a liquid phase and at temperatures at or above 212°F (100°C), (b) intentionally heated at or above its liquid phase flash points of 100°F (38°C), or (c) in a solid phase and at a temperature at or above 464°F (240°C).


15. **Globally Harmonized System of Classification and Labeling of Chemicals (GHS) (88)**- International classification and labeling system for chemicals and other hazard communication information, such as safety data sheets.
16. **Safety Data Sheet (SDS) (88)-Form** provided by chemical manufacturers, distributors, and importers; provides information about chemical composition, physical and chemical properties, health and safety hazards, emergency response procedures, and waste disposal procedures.
17. **CAS® Number (92)** - Number assigned by the American Chemical Society's Chemical Abstract Service that uniquely identifies a specific compound.
18. **Bill of Lading (99)**- Shipping paper used by the trucking industry (and others) indicating origin, destination, route, and product; placed in the cab of every truck tractor. This document establishes the terms of a contract between a shipper and a carrier. It serves as a document of title, contract of carriage, and receipt for goods. *Similar to Air Bill and Waybill.*
19. **Local Emergency Planning Committee (LEPC) (103)**-Community organization responsible for local emergency response planning. Required by SARA Title III, LEPCs are composed of local officials, citizens, and industry representatives with the task of designing, reviewing, and updating a comprehensive emergency plan for an emergency planning district; plans may address hazardous materials inventories, hazardous material response training, and assessment of local response capabilities.
20. **Local Emergency Response Plan (LERP) (103)** - Plan detailing how local emergency response agencies will respond to community emergencies; required by U.S. Environmental Protection Agency (EPA) and prepared by the Local Emergency Planning Committee (LEPC).
21. **Computer-Aided Management of Emergency Operations (CAMEO) (104)** -A system of software applications that assists emergency responders in the development of safe response plans. It can be used to access, store, and evaluate information critical in emergency response.
22. **Wireless Information System for Emergency Responders (WISER) (104)** - This electronic resource brings a wide range of information to the hazmat responder such as chemical identification support, characteristics of chemicals and compounds, health hazard information, and containment advice.
23. **Olfactory Fatigue (105)** - Gradual inability of a person to detect odors after initial exposure; can be extremely rapid with some toxins, such as hydrogen sulfide.

Hazardous Materials for First Responders
Fifth Edition



Chapter 3 – Implementing the Response: Awareness Level Actions at Hazmat Incidents


HAZARDOUS MATERIALS FOR FIRST RESPONDERS FIFTH EDITION



Learning Objective 1

Recognize notification procedures.


3-1




The notification process should be defined in predetermined procedures.

For Awareness level personnel Notification may be as simple as dialing 9-1-1 to report an incident and request emergency assistance

3-2



Quickly calling for help and securing the area can save lives.



Courtesy of Rich Maloney


3-3



Communication methods are usually covered in departmental SOPs.

Responders must be trained to use the communication equipment assigned to them in accordance with policies and procedures


3-4



NOTE

All of the actions discussed in this chapter are also applicable to Operations level responders.

3-5



REVIEW QUESTION



Where should the notification procedures for Awareness level personnel be defined?

3-6



Learning Objective 2

Describe ways first responders use the *Emergency Response Guidebook* at hazardous materials incidents.

3-7



The *ERG* helps to quickly identify hazards at a transportation incident.

Emergency Response Guidebook Allows you to protect yourself and others by avoiding/minimizing hazards

Isolation and protection distances based on conditions commonly associated with transportation incidents in open areas

3-8



NOTE

The *ERG* does **NOT** address all possible circumstances that may be associated with a dangerous good/hazardous materials incident.

3-9



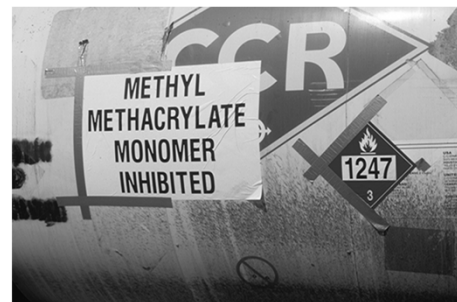
Information in the *ERG* can be located in several different ways.

Identify four-digit U.N. numbers	Yellow bordered pages
Reference the name of materials involved	Blue bordered pages
Identify material's transportation placard and then reference three-digit guide code	<i>Table of Placards and Initial Response Guide</i> (front of <i>ERG</i>)
Reference container profiles	White pages, then orange-bordered page

3-10



The exact spelling of a chemical name is important when using the *ERG*.



Courtesy of Rich Mahoney

3-11



Use container profiles if placards or four-digit ID numbers are not visible.



3-12



The ERG front white pages provide instructions for use.

- Shipping documents
- How to use the guidebook
- Local emergency telephone numbers
- Safety precautions
- Notification and request for technical information
- Hazard classification system
- Introduction to the Table of Markings, Labels, and Placards
- Table of Markings, Labels, and Placards and Initial Response Guide
- Rail Car Identification Chart
- Road Trailer Identification Chart
- GHS System of Classification and Labeling of Chemicals
- Hazard information numbers
- Pipeline transportation

3-13



The ERG back white pages provide instructions for use.

- ERG User's Guide
- Protective clothing
- Fire and spill control
- BLEVE safety precautions
- Criminal/terrorist use of chemical/biological/radiological agents
- Improvised Explosive Device (IED) safe standoff distances
- Glossary
- Canada and United States National Response Centers
- Emergency Response Assistance Plans (ERAP)
- Emergency response telephone numbers

3-14



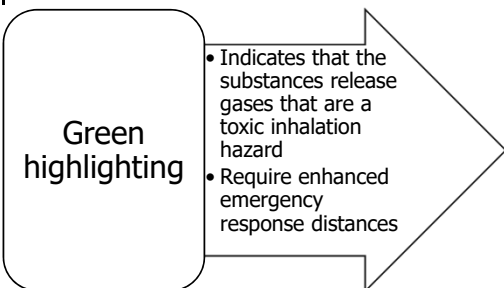
The ERG yellow-bordered pages provide an ID number index.



3-15



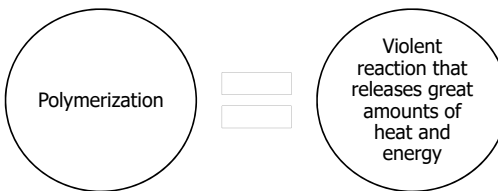
Toxic inhalation hazards are highlighted in green.



3-16



Materials that polymerize are marked with a "P."



3-17



The blue-bordered pages provide an index by material name.

Blue-bordered pages

- Index of dangerous goods in alphabetical order by material name
- First responder can quickly identify which Guide to consult for the name of the material involved
- Displays material's name followed by assigned three-digit emergency response Guide and four-digit UN/NA ID number

3-18



A mistake in spelling can lead to a substantial misunderstanding of a product's behavior.



3-19



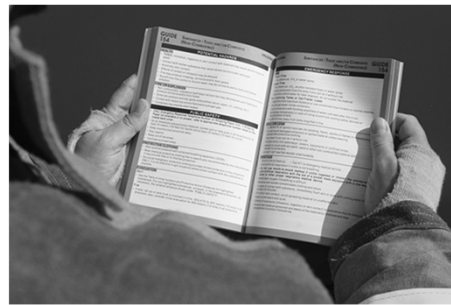
NOTE

Many agencies use a phonetic alphabet to spell chemical names.

3-20



The orange-bordered pages are Initial Action Guides in three sections.



3-21



The Initial Action Guides provide safety recommendations and general hazards information.

Left hand page

- Potential hazards
- Public safety information

Right hand page

- Emergency response information

3-22



The Potential Hazards Section addresses two types of hazards.



Potential hazards

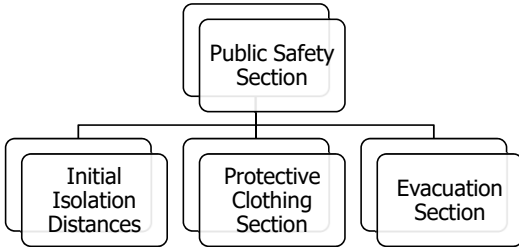
Health Hazards

Fire or Explosion Hazards

3-23



The Public Safety Section provides several types of information.



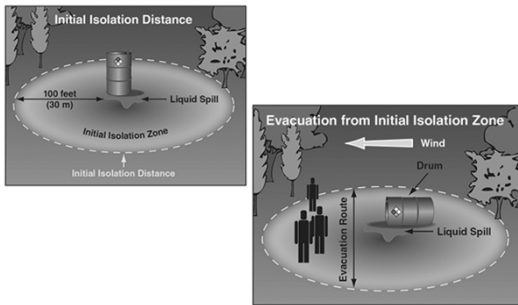
Isolation distances are provided in the bullet points immediately below the Public Safety section heading.



The initial isolation distance is a distance within which all persons should be considered for evacuation in all directions from the hazmat spill or leak source



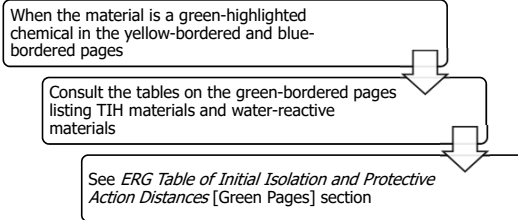
Evacuate people from the initial isolation zone to outside the safe distance.



The Protective Clothing Section describes PPE that should be worn.



The Evacuation Section provides recommendations for spills and fires.



Awareness level personnel will probably not be involved in evacuations beyond the initial isolation phase



The Emergency Response Section describes emergency response topics.

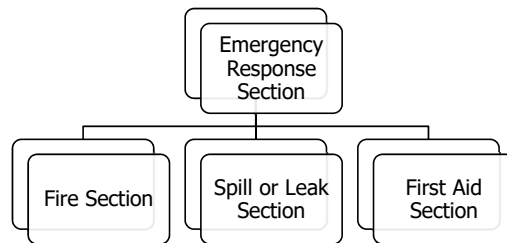
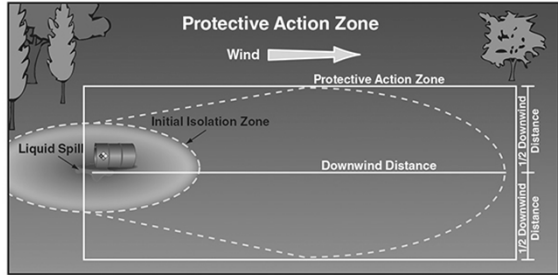


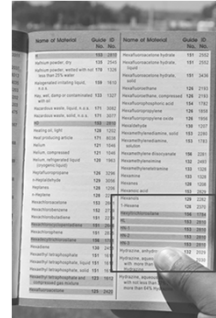
Table 1 provides the protective action distance for TIHs.



3-36



Protective action distances for TIHs are also provided in the blue-bordered pages.



3-37



Table 1 distances will always be at least 100 feet (30 m).

ID No.	NAME OF MATERIAL	SMALL SPILLS				LARGE SPILLS			
		ISOLATE # of Downwind Feet	ISOLATE # of Downwind Meters	PROTECT DAY # of Downwind Feet	PROTECT DAY # of Downwind Meters	ISOLATE # of Downwind Feet	ISOLATE # of Downwind Meters	PROTECT DAY # of Downwind Feet	PROTECT DAY # of Downwind Meters
100	Ammonia, anhydrous	30	9.1	51	15.5	30	9.1	51	15.5
101	Ammonia, refrigerated	30	9.1	51	15.5	30	9.1	51	15.5
102	Ammonia, liquefied	30	9.1	51	15.5	30	9.1	51	15.5
103	Ammonia, compressed	30	9.1	51	15.5	30	9.1	51	15.5
104	Ammonia, dissolved	30	9.1	51	15.5	30	9.1	51	15.5
105	Ammonia, aqueous solution	30	9.1	51	15.5	30	9.1	51	15.5
106	Ammonia, gas	30	9.1	51	15.5	30	9.1	51	15.5
107	Ammonia, solid	30	9.1	51	15.5	30	9.1	51	15.5
108	Ammonia, dry ice	30	9.1	51	15.5	30	9.1	51	15.5
109	Ammonia, solid, stabilized	30	9.1	51	15.5	30	9.1	51	15.5
110	Ammonia, solid, unstabilized	30	9.1	51	15.5	30	9.1	51	15.5
111	Ammonia, solid, stabilized, hydrogen peroxide, oxidant	30	9.1	51	15.5	30	9.1	51	15.5
112	Ammonia, solid, unstabilized, hydrogen peroxide, oxidant	30	9.1	51	15.5	30	9.1	51	15.5

3-38



Table 2 lists water reactive materials which produce large amounts of TIH.

Water Reactive Materials which Produce Toxic Gases

Lists materials that produce large amounts of TIH gases when the material is spilled in water

Identifies the TIH gases produced as result of spill

Materials listed in ID number order

3-39



Table 3 lists the TIH materials that may be commonly encountered.

Table 3, Initial Isolation and Protective Action Distances for Different Quantities of Six Common TIH (PIH) in the US Gases

- Ammonia (UN1005)
- Chlorine (UN1017)
- Ethylene oxide (UN1040)
- Hydrogen chloride (UN1050) and Hydrogen chloride, refrigerated liquid (UN2186)
- Hydrogen fluoride (UN1052)
- Sulfur dioxide (UN1079)

3-40



REVIEW QUESTION



What are the sections of the *ERG* and what information do the different sections contain?

3-41



Learning Objective 3

Explain the role of first responders in initiating protective actions.

3-42



Protective actions can ensure your own safety and safety of others.

Protective Actions Isolation

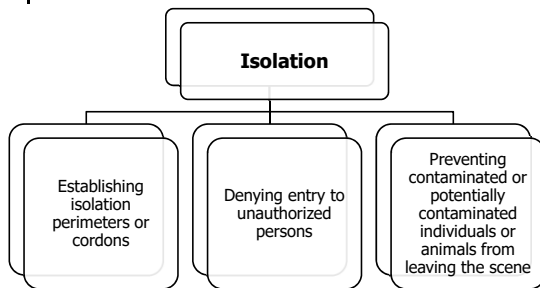
Scene control

Defending/sheltering in place

3-43



Isolation involves physically securing the maintaining the emergency scene.



3-44



Barrier tape can help establish isolation perimeters.



3-45



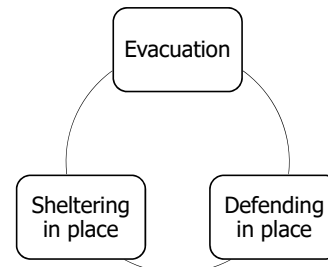
Vehicles and barricades can help provide scene control.



3-46



The isolation process may continue.



3-47



REVIEW QUESTION



Explain the difference between isolation and scene control.

3-48



Learning Objective 4

Identify actions that Awareness level personnel should take when responding to terrorist incidents.

3-49



Terrorist incidents may differ from ordinary hazmat incidents.

Terrorist Incidents

Protect yourself and others by isolating the incident and denying entry

Prevent contaminated persons and animals from leaving the scene; direct them to safe waiting area

Avoid contacting contaminants or contaminated surfaces

Remember WMD agents may be deadly in very small amounts
Biological agents may not cause symptoms for several days

3-50



Immediately notify law enforcement if a terrorist incident is suspected.

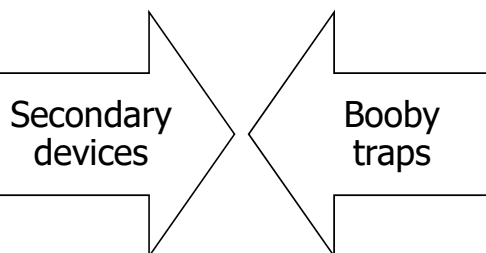


Courtesy of August Wynn

3-51



First responders must remain alert at suspected terrorist incidents!



3-52



Awareness level personnel are likely to be on or near the scene.

You may be a witness

Law enforcement will want to know what you saw and when

If it can be done safely, you should

- Document your observations
- Take pictures if possible
- Make note of other witnesses and observers at the scene
- Protect evidence at crime scene as best as you can

3-53



REVIEW QUESTION



What are the responsibilities of Awareness level personnel at terrorist incidents?

3-54



Chapter 3: Implementing the Response: Awareness Level Actions at Hazmat Incidents

Key Terms

- 1. Toxic Inhalation Hazard (TIH)** - Volatile liquid or gas known to be a severe hazard to human health during transportation.
- 2. Polymerization** - Chemical reactions in which two or more molecules chemically combine to form larger molecules; this reaction can often be violent.
- 3. Initial Isolation Distance** - Distance within which all persons are considered for evacuation in all directions from a hazardous materials incident.
- 4. Initial Isolation Zone** - Circular zone, with a radius equivalent to the initial isolation distance, within which persons may be exposed to dangerous concentrations upwind of the source and may be exposed to life-threatening concentrations downwind of the source.
- 5. Street Clothes** - Clothing that is anything other than chemical protective clothing or structural firefighters' protective clothing, including work uniforms and ordinary civilian clothing.
- 6. Structural Firefighters' Protective Clothing** - General term for the equipment worn by fire and emergency services responders; includes helmets, coats, pants, boots, eye protection, gloves, protective hoods, self-contained breathing apparatus (SCBA), and personal alert safety system (PASS) devices.
- 7. Self-Contained Breathing Apparatus (SCBA)** - Respirator worn by the user that supplies a breathable atmosphere that is either carried in or generated by the apparatus and is independent of the ambient atmosphere. Respiratory protection is worn in all atmospheres that are considered to be Immediately Dangerous to Life and Health (IDLH). *Also known as Air Mask or Air Pack.*
- 8. Chemical Protective Clothing (CPC)** - Clothing designed to shield or isolate individuals from the chemical, physical, and biological hazards that may be encountered during operations involving hazardous materials.
- 9. Evacuation** - Controlled process of leaving or being removed from a potentially hazardous location, typically involving relocating people from an area of danger or potential risk to a safer place.
- 10. Decontamination-Process** of removing a hazardous foreign substance from a person, clothing, or area. *Also known as Decon.*
- 11. Cross Contamination** - Contamination of people, equipment, or the environment outside the hot zone without contacting the primary source of contamination. *Also known as Secondary Contamination.*
- 12. Protective Action Distance** - Downwind distance from a hazardous materials incident within which protective actions should be implemented.
- 13. Isolation Perimeter** - Outer boundary of an incident that is controlled to prevent entrance by the public or unauthorized persons.
- 14. Defending in Place** - Taking offensive action to protect persons in immediate danger at hazmat incidents.
- 15. Sheltering in Place** - Having occupants remain in a structure or vehicle in order to provide protection from a rapidly approaching hazard, such as a fire or hazardous gas cloud. *Opposite of evacuation. Also known as Protection-in-Place, Sheltering, and Taking Refuge.*
- 16. Incidental Release** - Spill or release of a hazardous material where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area, or by maintenance personnel who are not considered to be emergency responders.