MODULE 11

HAZMAT AWARENESS

Student Guide

Introduction

Welcome to the Hazardous Materials - Awareness certification module. This module references National fire Protection Association (NFPA) standards; specifically, NFPA Standard 472: Professional Competence of Responders to Hazardous Materials Incidents, 2002 edition, which is required to achieve the Hazardous Materials - Awareness certification level.

You, the new fire fighter, will become certified from this training; therefore, you must put forth the most effort. Once you've successfully passed the Certification test with a score of 70% or higher, and the performance objectives for this certification level, you will then become certified through the Indiana Department of Homeland Security Training Division, which has been accredited by the International Fire Service Accreditation Congress (IFSAC) operated by Oklahoma State University.

Annual refresher training is required for all graduates of this course in accordance with the code of federal regulations and the State of Indiana. 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).

Purpose of this module. The purpose of this module is to provide you, the recruit firefighter, a basic understanding and awareness of hazardous materials that can be a threat to you and your community. As firefighters, you must be trained and certified in hazmat awareness not only for your protection, but also as a requirement of law.

Objectives. By the end of this module, you will:

1. Be able to describe the protection provided by firefighter protective clothing

including helmet, bunker coat, bunker boots, nomex hood, gloves and duty uniforms.

2. Describe the limitations of the firefighter protective clothing listed in 1 above.
3. Know steps for protecting self from infectious disease and bloodborne pathogens.
4. List types of personal protective equipment, not listed in A above.

5. Don firefighter personal protective clothing within 1 minute.
6. Doff firefighter personal protective clothing and prepare for reuse.
7. Inspect personal protective clothing.

Conditions. The instruction you receive in this module is intended for firefighter recruits, meaning, it is our assumption that you know little or nothing about firefighting. Instruction will take place here in a classroom environment. We will use lecture, conference, and practical exercises to deliver your instruction.

Firefighting is filled with the potential for being seriously injured or killed. And one of these potentials is your exposure to hazardous materials.

General. Emergency responders at the **awareness level** shall be trained to meet all competencies of NFPA 472 Chapter 4. In addition, awareness level responders shall receive training to meet applicable United States Department of Transportation (DOT), Environmental Protection Agency (EPA), and Occupational Safety and Health Administration (OSHA) requirements.

Definition. **First responders at the awareness level** are persons who, in the normal course of their duties, could be the first on scene of emergency involving hazardous materials. They are expected to recognize the presence of hazardous materials, protect themselves, call for trained personnel, and secure the area.

Implement actions consistent with the local emergency response plan, the organization's standard operating procedures, and the current edition of the *Emergency Response Guidebook* by initiating and completing the following tasks:

- Protective actions.
- Notification process.

Goal. The goal of the competencies at the awareness level shall be to provide first responders with the knowledge and skills necessary to perform the following tasks safely. Therefore, when first on the scene of an emergency involving hazardous material, the first

responder at the awareness level shall be able to:

Analyze The Incident

Analyze the incident to determine both the hazardous materials present and the basic response information by completing the following tasks:

- *Detect* the presence of hazardous materials.
- *Survey* a hazardous materials incident, from a safe location, to identify the name, United Nations/North American (UN/NA) identification number, or type placard applied for any hazardous materials involved.
- *Collect* hazard information from the current edition of the *Emergency Response Guidebook*.

COMPETENCIES - ANALYZING THE INCIDENT Detecting the presence of hazardous materials. The first responder at the awareness level shall, given various facility and/or transportation situations or both, with and without hazardous materials present, identify those situations where hazardous materials are present.

Hazardous Materials as defined by the DOT is one that poses an unreasonable risk to the health and safety of operating or emergency personnel, the public, and/or the environment if it is not properly controlled during handling, storage, manufacture, processing, packaging, use, disposal, or transportation. It covers all of the hazard classes/divisions.

Hazardous Substances - EPA term for chemicals that, if released into the environment above a certain amount, must be reported and, depending of the threat to the environment, federal involvement in handling the incident can be authorized.

Extremely Hazardous Substances - EPA term for chemicals that must be reported to the appropriate authorities if released above the threshold reporting quantity.

Toxic Chemicals - EPA term for chemicals whose total emissions or release must be reported annually by owners and operators of certain facilities the manufacture, process, or otherwise use a listed toxic chemical.

Hazardous Wastes - EPA term for chemicals that are regulated under the Resource, Conservation, and Recovery Act.

Hazardous Chemicals - OSHA term that denotes any chemical that would be a risk to employees if exposed in the work place.

Dangerous Goods - In Canadian Transportation, hazardous materials are called dangerous goods.

IDENTIFY THE DOT HAZARD CLASSES AND DIVISIONS WITH EXAMPLES, PRIMARY HAZARDS AND ASSOCIATED PLACARDS AND LABELS.

The Department of Transportation (DOT) has classified hazardous materials according to their primary danger and assigned standardized symbols to identify the classes.

Materials are grouped by their major hazardous characteristic. Many materials will have other hazards as well.

Safety Note: All hazardous materials have more than one hazard. Example: A material may be poisonous, corrosive and flammable but will only be grouped with whichever is considered the worst.

Class 1 (Explosives)

- **Major Hazard**: Explosion.
- **Definition** - Explosive means any substance or article, including a device, that is designed to function by explosion (i.e. release of gas and heat) or that, by chemical reaction within itself, is able to function by explosion.

Division 1.1 - Explosives that have a mass explosion affects almost the entire load instantaneously. (Examples: Black Powder, dynamite, T-N-T, blasting caps, nitroglycerin)

Division 1.2 - Explosives that have a projection Hazard but not a mass explosion hazard. (Examples: Aerial flares, detonation cord, and power device cartridges)

Division 1.3 - Explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard, or both, but not a

Class 1.1

Mass explosion that affects almost the entire load

Class 1.2

Projection hazard but not a mass explosion hazard

Class 1.3

Fire hazard and either a minor blast or minor projection hazard

mass explosion hazard. (Examples: Liquid-fueled rocket motors, propellant explosives)

Division 1.4 - Explosive devices that present a minor explosion hazard. No device in the division may contain more than 25 grams (0.9 oz) of a detonating material. The explosive effects are largely confined to the package and no projections of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package. (Examples: Practice ammunition, signal cartridges)

Class 1.4

Presents a minor explosion hazard

Division 1.5 - Very insensitive explosives - substances that have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport. (Examples: Prilled ammonium nitrate fertilizer - fuel oil mixtures, (blasting agents))

Class 1.5

Very insensitive explosives with mass explosion hazard

Division 1.6 - Extremely insensitive articles that do not have a mass explosive hazard. This division is comprised of articles that contain only extremely insensitive detonating substances and that demonstrate a negligible probability of accidental initiation or propagation. (Examples: Explosive squib devices)

Class 1.6

Extremely insensitive explosives

- **Placards** - Orange, Bursting Ball with word "Explosives" or "Blasting Agents" - (1.5)

<u>Class 2</u> <u>(Compressed gas)</u>

Major Hazards: BLEVE (Boiling Liquid Expanding Vapor Explosion) (Sub-hazards:

Flammable, Oxidizer, Poisonous)

Division 2.1 - (Flammable gas) means any material that is a gas (boiling point) at 68ºF or less and 14.7 psi of pressure, a material that has a boiling point of 68ºF or less at 14.7 psi and that:

Class 2.1
Flammable Gases

- A material that is a gas at 68º F or less at 14.7 psi or has a boiling point of 68º degrees or less at 14 psi.
  - Ignitable at 14.7 psi in a mixtur of 13% or less by volume with air
  - Has a flammable range of at least 12% regardless of the

Is ignitable at 14.7 psi when in a mixture of 13% or less by volume with air; or
Has a flammable range at 14.7 psi with air of at least 12% regardless of the lower limit
Inhibited butadienes, methyl chloride, propane, methane and hydrogen

Class 2.1
Flammable Gases

- A material that is a gas at 68º F or less at 14.7 psi or has a boiling point of 68º degrees or less at 14.7 psi.
  - Ignitable at 14.7 psi in a mixture of 13% or less by volume with air
  - Has a flammable range of at least 12% regardless of the lower limit.

Division 2.2 - (Nonflammable, nonpoisonous Compressed Gas, Including Compressed Gas, Liquefied Gas, Pressurized Cryogenic Gas, and Compressed Gas in solution) A nonflammable, nonpoisonous compressed gas means any material (or mixture) that exerts in the packaging an absolute pressure of 280 kPa (41psia) at 20◦C (68◦F). A cryogenic liquid means a refrigerated, liquefied gas having a boiling point colder than -90◦ C (-130◦F) at 101.3 kPa (14.7 psi) absolute. Anhydrous ammonia, cryogenic argon, carbon dioxide,compressed nitrogen, neon, and helium.

Class 2.2 - Nonflammable, Nonpoisonous Gases

- Any material or mixture that exerts an absolute pressure of 41 psia at 68º F.

- Compressed gases, including liquefied gas, pressurized cryogenic gas, and compressed gas in solution.

Division 2.3 - (Poisonous Gas, toxic by inhalation) means gases that vaporize easily, that are very dangerous to life, even in small amounts. A material that is a gas at 20◦C (68◦F) or less and a pressure of 101.3 kPa (14.7 psi or 1 atm), a material that has a boiling point of 20◦C (68◦F) or less at 101.3 kPa (14.7 psi), and that:

Class 2.3 Poisonous Gas

- Vaporize easily and very dangerous to life, even in small amounts.
- Known to be so toxic to humans as to pose a hazard to health during transportation.
- Presumed to be toxic because of laboratory testing.

Is known to be so toxic to humans as to pose a hazard to health during transportation; or

In the absence of adequate data on human toxicity, it is presumed to be toxic to humans because, when tested on laboratory animals, it has an LC50 value of not more than 5,000 ppm.

Anhydrous hydrogen fluoride, arsine, chlorine diphosgene, methyl bromide.

Division 2.4 - Corrosive gases (Canada)

- Placards.
  - Flammable - Red background, White Flame
  - Non-Flammable - Green background, White Cylinder
  - Oxidizer - Yellow background, Flaming "O"
  - Poison Gas - White background, Skull & Crossbones

Class 3 - Flammable and Combustible liquids

- **Major Hazard**: Burns readily.
- **Definition** - (flammable liquid) any liquid having a flash point of not more than 60.5◦C (141◦F) (Examples: Acetone, amyl acetate, gasoline, methyl alcohol, and toluene)

Division 3.1 - Flash point <0◦F
Division 3.2 - Flash point 0◦F to 73◦F
Division 3.3 - Flash point 73◦F to 141◦F

Flammable Liquids

- Any liquid having a flash point (FP) of not more than 141 degrees F.
  - Three divisions
    - 3.1 - FP **< 0 degrees F**
    - 3.2 - FP **0 to < 73 degrees F**
    - 3.3 - FP **73 to < 141 degrees F**

- **Definition** - (combustible liquid) any liquid that does not meet the definition of any other hazard class and has a flash point above 60◦C (140◦F) and below 93◦C (200◦F) (Examples: Mineral oil, peanut oil, No. 6 fuel oil, pine oil, and plastic solvents)

- Flammable liquids with a flash point above 38◦C (100◦F) may be reclassified as a combustible liquid.

Combustible Liquids

- Any liquid that does not meet the definition of any other hazard class and has a flash point above 141 degrees F and below 200 degrees F.

  NOTE: A flammable liquid with a flash point at or above 100 degrees that does not meet the definition of any other hazard class except 9, may be reclassified as combustible.

- **Placards.**
  - Flammable - Red background, White Flame w/the word "Flammable"
  - Combustible - Red background, White Flame w/the word "Combustible"

Class 4 - Flammable Solids

- **Major Hazard**: Rapid combustion with liberation of mass quantities of smoke.

Division 4.1 - (Flammable Solid) means any of the following three types of materials.

4.1 Flammable Solids

- Three types
  - Wetted explosives
  - Self-reactive materials
  - Readily combustible solids

- Wetted explosives - explosives wetted with sufficient water, alcohol, or plasticizer to suppress explosive properties.

- Self-reactive materials - materials that are liable to undergo, at normal or elevated temperatures, a strongly exothermic decomposition caused by excessively high transport temperatures or by contamination.

- Readily combustible solids - solids that may cause a fire through friction and any metal powders that can be ignited. (Examples: Magnesium (pellets, turnings, or ribbons), nitrocellulose, safety matches, and sulfur.)

4.2 Spontaneously Combustible Materials

- Pyrophoric Materials
- A liquid or solid that, even in small quantities and without an external ignition source, can ignite within 5 minutes after coming in contact with air.

Division 4.2 - (Spontaneously Combustible Material) means any of the following materials.

- Pyrophoric Material - a liquid or solid that, even in small quantities and without an ignition source, can ignite within 5 minutes after coming in contact with air.

- Self-heating material - a material that, when in contact with air and without an energy supply, is liable to self-heat. (Examples: Aluminum alkyls, charcoal briquettes, magnesium alkyds, and phosphorus)

Division 4.3 - (Dangerous When Wet Materials) means a material that, by contact with water, is liable to become spontaneously flammable or to give off flammable or toxic gas at a rate greater than 1 L/kg of the material, per hour. (Examples: Calcium carbide, magnesium powder, potassium metal alloys, and sodium hydride.)

4.3 Dangerous When Wet Materials

- Material that, by contact with water is liable to become spontaneously flammable or to give off flammable or toxic gas at a rate greater than 1 l/kg of the material, per hour.

- **Placards.**
  - Division 4.1 - Red and White Vertical Stripes, Black Flame and the words *"Flammable Solid".*
  - Division 4.2 - White Top, Red Bottom, Black Flame with words *"Spontaneously combustible".*
  - Division 4.3 - Blue background, White Flame, words *"Dangerous when Wet".*

Class 5 - **Oxidizers**

Major Hazards 5.1: Supports Combustion (intensifies fire).
Major Hazards 5.2: Unstable/Reactive Explosives.

Division 5.1 - (Oxidizer) means a material that may, generally by yielding oxygen, cause or enhance the combustion of other materials. (Examples: Ammonium nitrate, bromine trifluioide, calcium hypochlorite, chlorate, and permanganate.)

5.1 Oxidizers

- Materials that may, generally by yielding oxygen, cause or enhance the combustion of other materials.

Division 5.2 - (Organic Peroxide means an organic compound containing oxygen (O) in the bivalent [O-O] structure that may be considered a derivative of hydrogen peroxide, where one or more of the hydrogen atoms have been replaced by organic radicals. Materials are assigned to one of seven types.

5.2 Organic Peroxides

- Any organic compound containing oxygen in the bivalent O-O structure that may be considered a derivative of hydrogen peroxide, where one or more of the hydrogen atoms have been replaced by organic radicals.
- Organic peroxides have been further broken down into types a-g (worst to least hazardous).

- Type A - can detonate or deflagrate rapidly as packaged for transport. Transportation of type A organic peroxides is forbidden.
- Type B - neither detonates nor deflagrates rapidly, but that can undergo a thermal explosion.
- Type C - neither detonates nor deflagrates rapidly and cannot undergo thermal explosion.
- Type D - detonates only partially or deflagrates slowly, with medium to no effect when heated under confinement.
- Type E - neither detonates nor deflagrates and shows low, or no, effect when heated under confinement.
- Type F - will not detonate, does not deflagrate, shows only a low, or no, effect if heated when confined, and has low or no explosive power.
- Type G - will not detonate, does not deflagrate, shows no effect if heated when confined, and has no explosive power, is thermally stable, and is desensitized. (Examples: Dibenzoyl peroxide, methyl ethyl ketone peroxide, and peroxyacetic acid.)

- **Placards.**

  - 5.1 - Yellow background, Black Flaming "O" with word "Oxidizer".
  - 5.2 - Yellow background, Black Flaming "O" with words "Organic Peroxide"

Class 6 - **(Poison)**

- **Major Hazards**: Toxicity, Infectious: White Background; Skull & Crossbones.

6.1 - Poisonous Materials means a material, other than a gas, that is either known to be so toxic to humans as to afford a hazard to health during transport, OR in the absence of adequate data on human toxicity, is presumed to be toxic to humans, including irritating materials that cause irritation. (Examples: Parathion, potassium arsenate, tearing agent candles, xylyl bromide, hydrocyanic acid.)

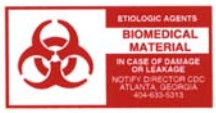
6.2 - Infectious Substance means a viable microorganism, or its toxin, that causes or may cause disease in humans or animals. Infectious substance and etiologic agent are synonymous. (Examples: Anthrax, botulism,

6.1 Poisonous Materials

- A material, other than a gas, that is either known to be so toxic to humans as to afford a hazard to health during transportation, or in the absence of adequate data on human toxicity, is presumed to be toxic to humans, including irritating materials that cause irritation.

6.2 Infectious Substances

- A viable microorganism, or its toxin, that causes disease in humans or animals.
- Infectious substance and etiologic agents are the same.
- No Placards (labels only)



rabies, tetanus, and poliovirus.)

Class 7 - **Radioactive**

- **Major Hazard:** radioactive poisonous burns.
- **Definition** - material having a specific activity greater than 0.002 microcurie per gram (Ci/g) (Examples: Cobalt, uranium, plutonium.)
- **Placard** - Yellow top, White bottom, Black "Propeller"

Class 7 Radioactive

- Major Hazard: Radioactive poisonous burns
- Definition: Materials having a specific activity greater than 0.002 microcurie per gram

Class 8 – **Corrosives.**

- **Major Hazards**: burns/emulsification skin damage.
- **Definition** - a liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact, or a liquid that has a severe corrosion rate on steel or aluminum. (Examples: Nitric Acid, Phosphorus Trichloride, Sodium Hydroxide, Sulfuric Acid, and ammonium hydroxide.)
- **Placard** - White Top, Black bottom, two test tubes, hand and steel bar

Class 8 Corrosives

- Major Hazard: Burns/
  - emulsification skin damage
- Definition: A liquid or solid that causes visible or irreversible alterations in human skin tissue at the site of contact, or a liquid that has a severe corrosion rate on steel or aluminum.

Class 9 - **Miscellaneous Hazardous Materials**

- **Definition** - a material that presents a hazard during transport, but that is not included in another hazard class. Also a material that has anesthetic, noxious, or other similar property, that could cause extreme annoyance or discomfort to a flight crew member so as to prevent the correct performance of assigned duties; or one that is not included in any other hazard class, but is subject to the DOT requirements (a hazardous substance or waste).

Class 9 Miscellaneous Hazardous Materials 44

- A material that presents a hazard during transport, but that is not included in another hazard class

- Division 9.1 - Miscellaneous Dangerous Goods (Canada)
- Division 9.2 - Environmentally hazardous substances (Canada)
- Division 9.3 - Dangerous wastes (Canada)
- Examples: Adipic acid, PCBs, molten sulfur, hazardous waste.

- **Placard** - Black and white vertical stripes on top, white bottom.

Other Regulated Materials (ORM-D)

- **Definition** - a material that presents a limited hazard during transportation due to its form, quantity, and packaging. (Examples: Consumer commodities, small arms ammunition, and furniture polish.)
- **No placard** (labels only)

Forbidden - means prohibited from being offered or accepted for transportation. Does not apply if the materials are diluted, stabilized, or incorporated into devices. There is no placard since they are not transported. (Example: 5.2 (a) materials.)

Marine Pollutant – means that a material that has an adverse effect on aquatic life.

Elevated Temperature Material – is a material that, when offered for transportation in a bulk packaging, meets one of the following conditions:

- Liquid at or above 100ºC (212ºF).
- Liquid with a flash point at or above 37.8ºC (100ºF) that is intentionally heated and is transported at or above its flash point.
- Solid at a temperature at or above 240ºC (464ºF).

Dangerous Material.

- A dangerous placard is used in transportation for mixed loads of certain chemicals. The placard is used when the combined weight of these chemicals is greater than 1,001 pounds.
- Separately, the hazards associated with these chemicals are minimum risk. However, these chemicals may react violently when mixed.

Dangerous

- Mixed loads of certain chemicals.
- Combined weight greater than 1,001.
- May react violently when mixed.

HAZARDOUS MATERIALS INCIDENTS VS. OTHER EMERGENCIES

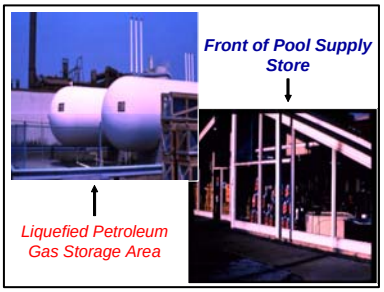
Hazardous materials incidents differ from other types of emergencies in some important ways. The adverse consequences of exposure to a hazardous material can be far-reaching and severe. Hazardous materials emergencies thus stand apart from other types of emergencies because they present such a large potential for doing great harm and because responders must be specifically trained and equipped to deal with them properly. All responders must take care to avoid making the situation worse than it is.

TYPICAL OCCUPANCIES AND LOCATIONS.

Typical occupancies and locations in the community where hazardous materials are manufactured, transported, stored, used, or disposed of are:

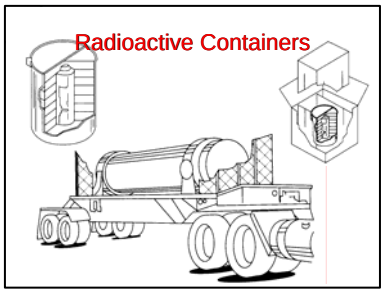
- Warehouses.
- Tank farms.
- Munitions storage area.
- Hospitals.
- Laboratories.
- Truck Terminals.
- Airport areas.
- Maintenance Facilities

Locations that involve some type of "**product transfer operation"** are most likely locations for hazardous materials uncontrolled release. Personnel developing the pre-incident plans should seek assistance from the **facility manager** in identifying hazardous materials locations and recording them on the plan in a way that will be useful to the first-arriving companies. Remember that hazardous materials manufactured, stored, processed, or used at a particular site are NOT subject to regulations affecting transported materials. Any occupancies and problem locations should be identified and evaluated during pre-incident planning.



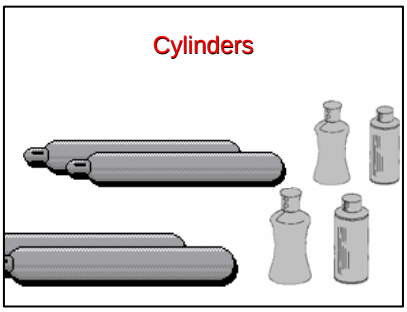
CONTAINER SHAPES

Radioactive containers generally come in two types of containers. They may be protective overpacks or casks. The protective overpacks are for smaller containers and are cylindrical or boxlike in configuration. The casks are used on large transport vessels (trains and trucks) and are identified by reinforcing rings and cooling fins. Some may be up to 50 ft. in length.

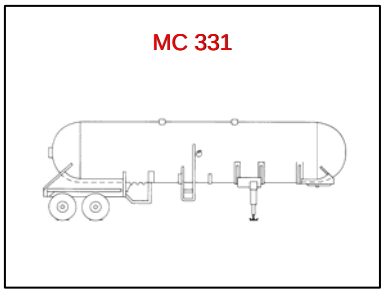


Pressurized products come in different types of containers, although all have certain characteristics that make them easy to identify.

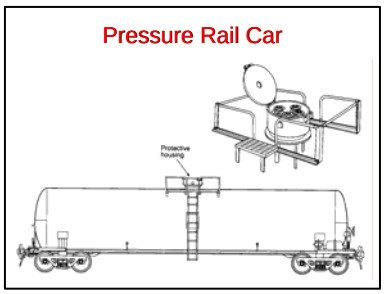
Cylinders have rounded ends and smoothly (or absence of) welded seams. A common example of this is oxygen cylinders you see used in welding operations, or a small aerosol container.



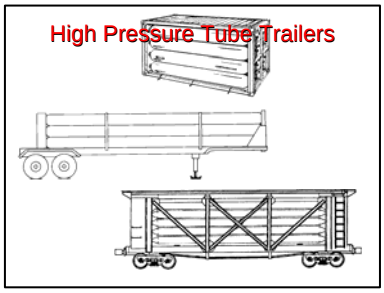
- **MC-331** used for highway shipment of pressurized products.



- **Pressure Rail Car.**



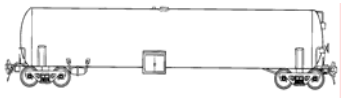
- High pressure tube trailers (highway), tube modules (intermodal), and tube cars (rail) are also used to transport pressurized products.
- Tube Module (intermodal).



- **Cryogenic containers** are constructed as a tank-within-a-tank or "thermos bottle" design. The double-shell and heavy insulation gives the ends a more "dished" appearance than the rounded ones of cylinders. They range in size from small non-bulk containers to rail cars.

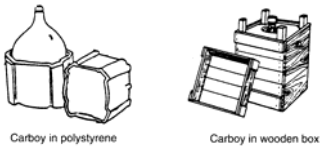
Cryogenic Containers

Cryogenic Rail Car

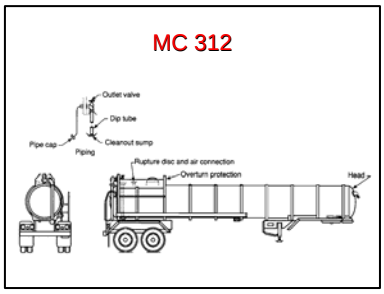


- **Corrosive materials** are carried in small quantities in carboys. Carboys are glass or plastic bottles that may be encased by a protective box. The protective boxes are usually made of wood or polystyrene (styrofoam).

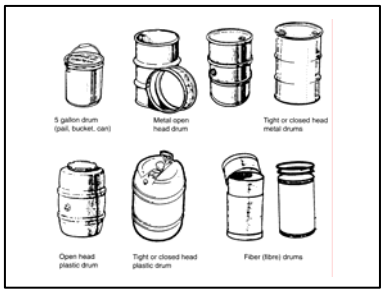
Carboys

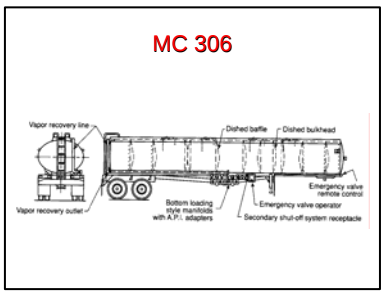


- Larger quantities are carried in the **MC-312** on the highway.

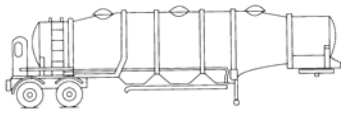


- **Flammable liquids** are most commonly carried in drums and jerricans for small amounts, and the MC-306 for bulk shipments. In addition, non-pressure rail cars transport flammable liquids.





Hopper



FACILITY AND TRANSPORTATION MARKINGS AND COLORS

Some markings used on facilities and in transportation can help you identify the presence (or more specifically the actual name) of a hazardous material. Transportation markings, including UN/NA identification number marks, marine pollutant mark, elevated temperature (HOT) mark, commodity marking, and inhalation hazard mark. Further discussion includes:

UN/NA Numbers.

UN/NA ID Numbers

- UN Class numbers (bottom of placard)
- Hazard class or ID number on placard or orange panel
- Symbols and colors
- Name of material

1026

- Four digit UN/NA numbers can be found on placards or on orange panels. Placards also give information by their colors and symbols. For example, a corrosive material could be identified from considerable distance using only the black and white background, or the test tube with the steel bar and hand at the top. A non-flammable gas would have a green background and the white cylinder on top. Refer to the previous section on classes and divisions for more examples.
- In addition, on placards, the hazard class number (sometimes class and division) is on the bottom. A combustible placard would have a "3" at the bottom, while an organic peroxide would have a "5.2" at the bottom.
- One of the most beneficial things that are sometimes included on a placard is the actual name of the material. Chlorine is a common example of this.
- Whether you can determine the name or only the general hazards associated with the material, any one of these markings can provide you with valuable information.

The NFPA 704 System is used on fixed facilities and will be discussed in detail in the next section.

Markings & Colors

- NFPA 704
- Suggested method for identifying hazardous materials

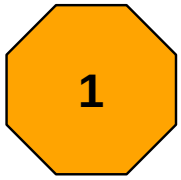
- Scale of 0-4 (4 being the worst hazard)
- Used only for facilities when mandated by local ordinances

Military hazardous materials markings provide information on explosives (fire symbols) and special (chemical) hazards.

- Class 1, Division 1 - Materials that present a mass detonation hazard.

Class 1, Division 1

- Materials that present a mass denotation hazard



- Class 1, Division 2 - Present an explosion fragmentation hazard.

Class 1, Division 2

- Presents an explosion with fragmentation hazard

- Class 1, Division 3 - Materials that present a mass fire hazard.

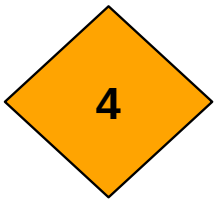
Class 1, Division 3

- Materials with a mass fire hazard

- Class 1, Division 4 - Materials that present a moderate fire hazard.

Class 1, Division 4

- Materials that present a moderate fire hazard



Special warnings include information on chemical hazards. Red is highly toxic, yellow denotes harassing agents, and white indicates white phosphorus munitions.

Special Warnings

- Chemical hazards

HIGHLY TOXIC

HARASSING AGENTS

WHITE PHOSPHORUS MUNITIONS

Lastly, the military marking system also includes the "apply no water" and the "wear protective breathing apparatus" symbols

Special Warnings

APPLY NO WATER

WEAR PROTECTIVE BREATHING APPARATUS

Special hazard communication markings could be most anything specific to your location that could indicate the presence of hazardous materials. A few common examples are Hazardous Materials Information System (HMIS) and Polychlorinated Biphenyl (PCB) labels. This system can be referenced in the Indiana Occupational Health and Safety Administration standard 29 CFR 1910.1200 *Hazard Communication*.

Markings & Colors

- **Special hazard communication markings**
- **Pipeline markers**
  - Metal sign placed adjacent to a hazardous materials pipeline right of way.
  - Contains information about
    - product and signal word
    - ownership of the line
    - emergency telephone number

Pipeline markers are metal signs placed next to hazardous materials pipeline right of way. They provide information on the location, ownership, and the transported commodity. They will also include a signal word such as "Danger" or "Warning".

Container markings (facility or transport) in some cases may have the actual name of the material stenciled onto the container.

NFPA 704 SYSTEM

The NFPA 704 marking system is intended to indicate the properties and potential dangers of hazardous materials in facilities. While you can get a general idea (**no specifics**) of the hazards from this symbol, it **<u>does not</u>** provide you with the name of the material.

The sign is diamond shaped and divided into four sections. The numbers in the three colored sections denote the severity of the hazard and range from 0-4. <u>The least hazardous is 0 with 4 being the worst</u>. The colors themselves represent:

a. Red – Flammability.
b. Blue – Health.
c. Yellow – Reactivity.
d. White - Special Information.

Special Information

- Avoid Use of Water
- Oxidizer (OX) (OXY)
- Used by some to indicate Alkaline materials
- Used by some to indicate Acidic materials

NFPA 704 Colors and Their Meanings

- 1 (Blue) = Health
- 2 (Red) = Flammability
- 3 (Yellow) = Reactivity
- 4 (White) = Special

The white section contains **special information**. In the example above, this represents materials that are reactive with water. An "OX" in this section would indicate a material is an oxidizer. It is also possible to see the "propeller" symbol here to represent radioactive materials (same as on a class 7 placard).

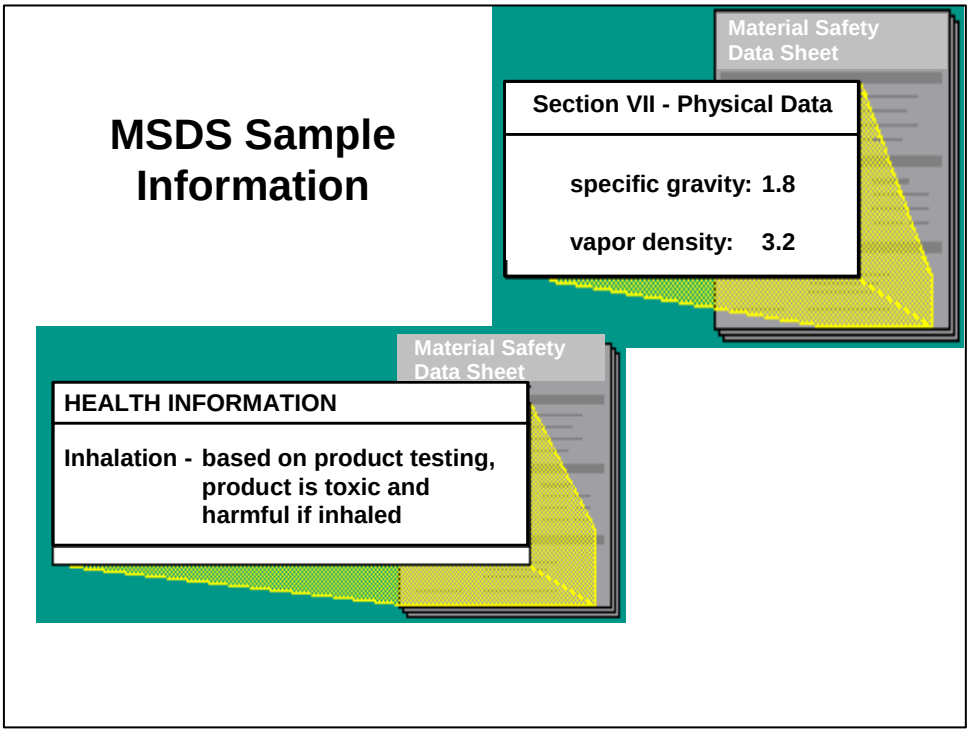
IDENTIFY U.S. AND CANADIAN PLACARDS AND LABELS

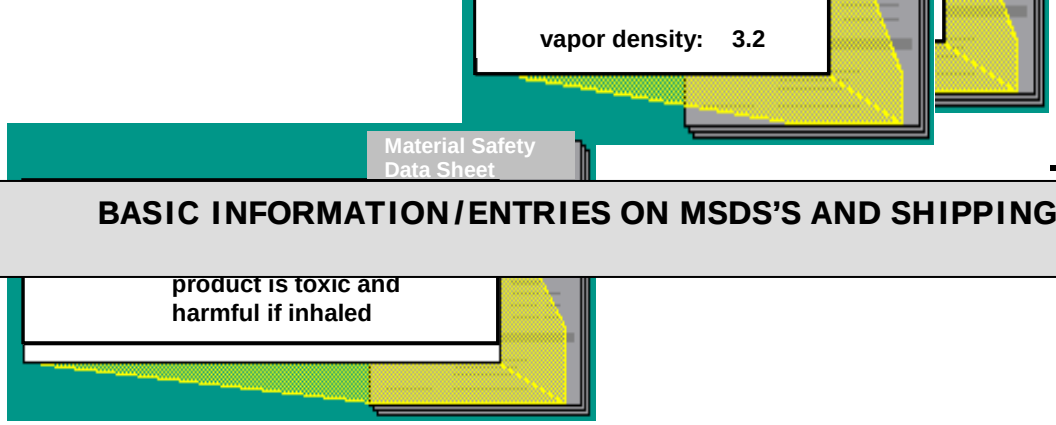
The following hazard classes have additional warning information that is used in Canada:

- Class 2 Gases: Division 2.4 Corrosive gases.
- Class 9 Miscellaneous dangerous goods:
  - Division 9.1: Miscellaneous dangerous goods.
  - Division 9.2: Environmentally hazardous substances.
  - Division 9.3: Dangerous wastes

LOCATION OF MATERIAL SAFETY DATA SHEETS

Material Safety Data sheets are required to be maintained in each facility where hazardous materials are used or stored. They should be kept in a central location where employees have easy access to them. This is dictated by the law on hazard communication standards (29 CFR 1910.1200). All employees have a "right-to-know" that these materials are in their workplace.





BASIC INFORMATION/ENTRIES ON MSDS'S AND SHIPPING PAPERS

- Manufacturers name and location.
- Name and family of chemical.
- Hazardous ingredients.
- Physical data.
- Fire and explosion data.
- Health hazard data.
- Spill or leak procedures.
- Special protection information.
- Special precautions.

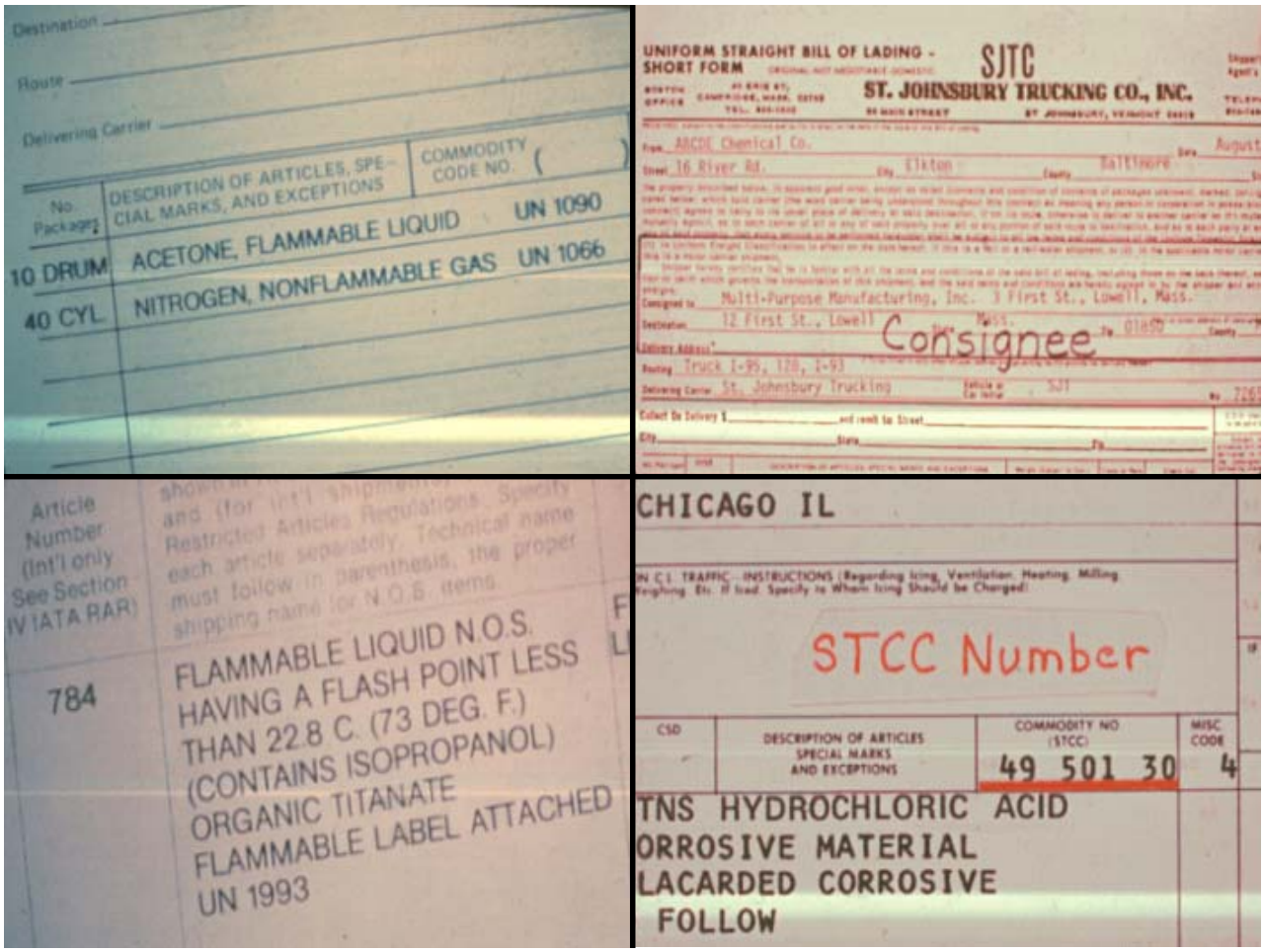
Basic Information and Entries on shipping papers

- Proper Shipping Name.
- Hazard Class and Division.
- UN/NA identification Number.
- STCC (Standard Transportation Commodity Code) Number.
- CAS (Chemical Abstract Service) Number.

If you are looking at an MSDS, you <u>are</u> reading information about a hazardous material. Keying in on the specific areas will provide you with valuable information on the specific hazards of the material. Shipping papers are a different story. You could be looking at a large list of materials, some of them hazardous and some of them not. The material name along with UN/NA numbers or class and division easily identify which ones are hazardous. STCC numbers are found on rail transport items and the CAS number is sometimes referred to as the chemicals "social security number". See what information you can pick out of these two.

SHIPPING PAPERS/PERSON RESPONSIBLE

Each mode of transportation has a specific place to carry shipping papers, and a specific person who is responsible for them. The following chart breaks out all four.



- Identify entries on shipping papers that indicate the presence of hazardous materials.
  - Proper shipping name
  - Hazard class and division
  - Product identification number
  - STCC number
  - CAS number (chemical's social security #)

- Match the name of the shipping papers found in transportation (air, highway, rail, and water) with the mode of transportation.

- Identify the person responsible for having the shipping papers in each mode of transportation.

- Identify where the shipping papers are found in each mode of transportation.

- Identify where the papers can be found in an emergency in each mode of transportation.
  - Normal location
    - Highway
    - Rail
    - Water
    - Air

- **Highway (Bill of Lading)**
  - Cab of vehicle - Driver
- **Rail (Waybill / Consist)**
  - Engine or caboose - Conductor/Engineer
- **Water**
  - Wheelhouse (or pipe-like container on barge) - Captain/Master
- **Air**
  - Cockpit/Flight-deck (or attached to package) - Pilot

Mode of Transport	**Person Responsible**	**Location**
Highway (**Bill of Lading**)	Driver	Cab of vehicle
Rail (**Waybill/Consist**)	Conductor or Engineer	With member of train crew
Water	Captain or Master	Wheelhouse or pipelike container on a barge
Air	Pilot	cockpit/flightdeck or attached to a package

During an emergency, it may be difficult to obtain the shipping papers. Physical wreckage may prevent you from getting to them, or the hazards of the material may prevent your approach. If you can safely reach them, attempt to locate the papers in their normal (or by searching around) place. If you are still unable to find or reach them, call the shipper/manufacturer or CHEMTREC.

CLUES AND LIMITATIONS OF IDENTIFYING HAZARDOUS MATERIALS USING THE SENSES

Identify examples of clues (other than occupancy/location, container shape, markings/colors, placards/labels, MSDS, and shipping papers) that use the senses of sight, sound, and odor to indicate hazardous materials.

Sometimes it's obvious when there are hazardous materials present. If you saw the paint bubbling and melting off a container or a gas vapor cloud, this would be an instant "stop" signal to find out more information before proceeding. Here are some examples clues that use your normal senses.

Identify examples of clues (other than occupancy/location, container shape, markings/colors, placards/labels, MSDS, and shipping papers) that use the senses of sight, sound, and odor to indicate hazardous materials.

Sight.

- Visible corrosive actions.
- Chemical reactions.
- Pooling liquids.
- Condensation lines on pressure tanks.
- Injured victims or casualties.
- Fire or Vapor cloud

Sound - Hissing of pressure releases.

Odor.

- Fire or Vapor cloud.
- Gas leaks.

There are some ***serious*** limitations involved with identifying hazardous materials in this manner. If you are close enough to see or smell a material, you may have endangered yourself and be at risk of injury. Touching a material also could cause injury, and tasting is **not** a recommended method of identification. The picture below is a **BAD** example of identifying a material using the senses.

The methods described earlier in this book (UN/NA Numbers, 704, MSDS's) are better ways to identify hazardous materials than using the senses. Just realize that if you notice one of the items above, use that as information gained along with all the other sources. Don't ignore anything!

TARGETS OF CRIMINAL OR TERRORIST ACTIVITY

Events in recent years have included criminal or terrorist activity involving hazardous materials. The Oklahoma City bombing and the attack on the World Trade Center in New York are vivid examples. Some common targets include:

- Places of public assembly.
- Public buildings.
- Mass transit systems.
- Places with high economic impact.
- Telecommunications facilities.
- Places with historical or symbolic significance.
- Military installations.
- Airports.
- Industrial facilities.

DIFFERENCE BETWEEN A CHEMICAL AND A BIOLOGICAL INCIDENT

A chemical incident is characterized by a rapid onset of medical symptoms (minutes to hours) and can have observed signatures such as colored residue, dead foliage, pungent odor, and dead insect and animal life.

With biological incidents, the onset of symptoms usually requires days to weeks and there are typically no characteristic signatures because biological agents are usually odorless and colorless. The area affected can be greater due to the migration of infected individuals because of the delayed onset of symptoms. An infected person could transmit the disease to another person. Some indicators (clues) of possible criminal or terrorist activity are:

- Involving chemical agents.
  - Hazmat or irrelevant lab equipment.
  - Intentional releases.
  - Unexplained patterns of sudden onset illnesses or death.
  - Unusual odors or tastes that are out of character with surroundings.
  - Multiple individuals exhibiting unexplained signs of skin, eye, or airway irritation.
  - Unexplained bomb/munitions-like material, especially if it contains a liquid.
  - Unexplained vapor clouds, mists, and plumes.
  - Multiple individuals exhibiting unexplained health problems such as nausea, vomiting, twitching, tightness in chest, sweating, pinpoint pupils (miosis), runny nose (rhinorrhea), disorientation, difficulty breathing, convulsions, or death.
  - Trees, shrubs, bushes, food crops, and/or lawns that are dead, discolored, abnormal in appearance, or withered (no current drought or not just a patch of dead weeds.)
  - Surfaces exhibiting oily droplets/films and unexplained oily film on water surfaces.
  - An abnormal number of sick or dead birds, animals, and/or fish.
  - Unusual security, locks, bars on windows, covered windows, barbed wire.
  - Not all hazmat incidents are caused by criminals or terrorists. If you respond to a leak in a laboratory—it's probably just that. Someone was working and had an accident causing a spill or leak. On the other hand, if there's a report of barrel leaking and causing a vapor cloud inside a shopping mall, that's far from normal. Common sense and judgment are required to determine what's normal and what's out of place. If you have suspicions, communicate them during the notification process.

- Involving biological agents.
  - Unusual number of sick or dying people or animals. (Any number of symptoms could occur. The time required before symptoms are observed is dependent on the agent used, but usually required days to weeks).
  - Health care facilities reporting multiple casualties with similar signs or symptoms.
  - Unscheduled or unusual spray being disseminated, especially if outdoors during period of darkness.
  - Abandoned spray devices. (Devices will have no distinct odors.)

DIFFICULTIES AND SOURCES FOR DETERMING NAMES OF HAZARDOUS MATERIALS

Sometimes it can be a formidable task to determine the actual name of a material involved in an incident. Placards or labels may be missing, or show only the class or division (not a product identifier such as a 4-digit number). A placard that provides you with "*Organic Peroxide, 5.2*" is good info, but you still don't know the name of the material. A mixed load may carry the "*Dangerous*" placard, or the placard displayed may even be wrong (human error). The shipping papers would clear things up, but they may be inaccessible due to the wreckage or the hazards in the area. Facility storage containers may display the 704 symbol or a site-specific numbering system (i.e....Tank 1, Tank 2) which requires you to look elsewhere for the name.

- Identify difficulties encountered in determining the specific names of hazardous materials in both facilities and transportation.
  - Facilities
  - Transportation

Although difficult, you should always try to determine the name of the material. In transportation, use the *Emergency Response Guidebook* (ERG) and the shipping papers. With the NAERG, you can match up a 4-digit identification number with a material name. The shipping papers will have the name, as well as a 4-digit number.

- Identify sources for obtaining the names of, UN\NA identification numbers for, or types of placard associated with hazardous materials in transportation

Emergency response information services such as CHEMTREC and CHEM-TEL, INC. have agreed to provide emergency response information to all callers. This information is located on page 10 of the *Emergency Response Guidebook* (ERG).

In facilities, Material Safety Data Sheets (MSDS) are an excellent source. In addition, markings on containers should be used in conjunction with emergency planning documents. At fixed facilities, the names of hazardous materials are found on the MSDS and in the emergency planning documents, and there may be signs or other markings on storage containers. The best time to identify hazardous materials in facilities is **before** an incident occurs.

- Identify sources for obtaining names of hazardous materials in a facility.

COLLECTING HAZARD INFORMATION

The three methods for determining the appropriate guide page in the ERG include the following:

- Using the numerical index for UN/NA identification numbers.
- Using the alphabetical index for chemical names.
- Using the "Table of Placards and Initial Response Guides."

Determine the Appropriate Guidebook Pages

- Four digit ID# (yellow pages)
- Spelling of the product (blue pages)
- Placards (table of placards)
- Dealing with an unknown

The two **general** types of hazards found on each guide page include **information of the fire and** explosion hazard and on the **health hazard of the specific hazardous material or hazard class**. "P" represents a polymerization hazard.

More information and training on the ERG will be provided in the last section of this training book.

Terminal Objective: Collecting Information & Initiating Response Actions etc.

Given the name, UN/NA identification number or type placard, a current copy of the 2004 Emergency Response Guidebook (2000 ERG) a local emergency response plan and standard operating procedures, and a facility or transportation scenario including hazardous materials, collect hazard information, initiate protective actions, and initiate the notification process within 60 minutes.

Note: The committee felt that the responder at this level would not be involved in

COMPETENCIES – PLANNING THE RESPONSE

planning for an emergency response but would apply <u>standard operating procedures</u> established by the organization or found in the local emergency response plan. At the awareness level, the responder's sole responsibilities are to identify a hazardous material, notify the authorities, and isolate the material if "safely" possible.

PROTECTION OF SELF AND OTHERS

When an incident occurs, it is essential to protect the people in the area. There are two general ways to accomplish this. The first, and best way, is to evacuate everyone from the area. Remove them from the danger area, and isolate the area to prevent anyone from returning. The second way is to use In-place protection. Although not as good as evacuation, it is sometimes a realistic option. To accomplish in-place protection, have everyone remain inside and stay away from doors and windows. Shutting down air handling systems in the building may also be appropriate. Vapor clouds are probably the best examples for this method. By having people evacuate, do you have to send them *through* the vapors? Alternatively, should you leave them inside where they have at least some protection? A judgment call that differs with each situation. If you have, trouble deciding here's a helpful guideline. If evacuation places them in more danger than just sitting still, in-place protection is probably a good option. "In-place protection," "sheltering in-place "and" protection in-place" all mean the same thing.

MEDICAL CARE PRECAUTIONS (4.4.1.3a)

Encountering people that require medical attention at hazardous materials incidents is common. As a first responder, your first instinct may be to rush up and provide that help. That instinct could get you into trouble. Consider first that the victim may be contaminated and measures must be taken to decontaminate them before it's possible to provide medical care. Awareness level responders typically do not wear respiratory or any other protective clothing and equipment, making it impossible to enter a hazardous atmosphere. Understand your own limitations so that you don't become a victim yourself.

IGNITION SOURCES (4.4.1.3b)

Sources of ignition often cause, or are present at hazardous materials incidents. You should take measures to eliminate these, especially if there are flammable vapors in the area. As an additional safety measure, eliminate the vapors by using a water fog to suppress or disperse them. Some typical ignition sources are:

- Open flames.
- Smoking materials.
- Cutting and welding operations.
- Heated surfaces.
- Frictional heat.
- Radiant heat.
- Static.
- Electrical and mechanical sparks.
- Lightning

HARMFUL EFFECTS OF HAZARDOUS MATERIALS (4.4.1.3c)

Hazardous materials can harm people, property, or the environment in several ways.

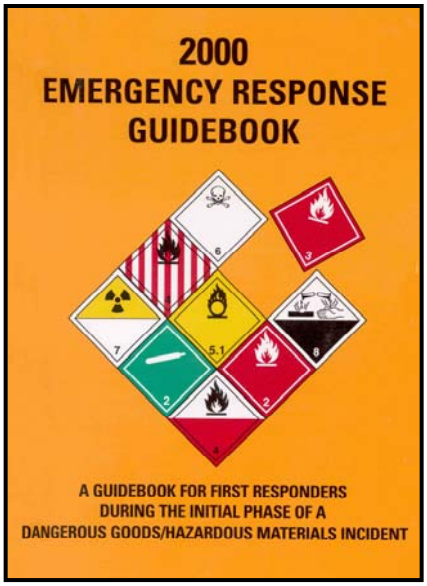
- Thermal.
- Mechanical.
- Poisonous.
- Corrosive.
- Asphyxiation.
- Radiation.
- Etiologic.
- Psychological.

An awareness of these items can help you limit the amount of harm by removing the hazard, or removing the people.

HAZARDOUS MATERIALS ENTERING THE BODY (4.4.1.3d)

Being exposed to a hazardous material provides a chance for it to enter the body. It will do so in one of four ways.

- Contact.
- Absorption.
- Inhalation.
- Ingestion.



Knowing the hazards of a material will give clues to the method that it may enter your body. Most anything gives off at least *some* vapors that may be inhaled, though gases much more than liquids or solids. Liquids and solids may contact your skin and further absorb into your body. Avoid any material, and realize that victims in the area may not have.

The 2004 *Emergency Response Guidebook* (ERG2000) was developed jointly by Transport Canada, the U.S. Department of Transportation and the Secretariat of Communications and Transportation of Mexico for use by fire fighters, police, and other emergency services personnel who may be the first to arrive at the scene of a transportation incident involving dangerous goods. It is primarily a guide to aid first responders in quickly identifying the specific of generic hazards of the material(s) involved in the incident, and protecting themselves and the public during the initial response phase of the incident.

- Given the identity of various hazardous materials (name, UN/NA identification number, or type placard), identify the following response information:
  - Emergency actions from guide pages
  - Protective Clothing
  - Initial isolation & protective action distances

The next several areas deal with the ERG 2004 and it's use. Have the book out and follow along with the examples for better understanding. The key areas of the book are:

- **Table of Placards** - provide a guide page number when only a general placard or hazard is known (i.e...."corrosive").

- **Yellow Pages** - a listing of materials arranged by 4-digit UN/NA numbers.

- **Blue Pages** - a listing of materials by name in alphabetical order.

- **Oranges Pages** - the "guide pages" themselves.

- **Green Pages** - Table of initial isolation and protective action distances.
- **White Pages** - provide explanations and additional information

DETERMINING THE APPROPRIATE GUIDE PAGE (4.2.3.1)

The goal of using the ERG 2004 is to get guidance for the incident. Guidance is found in the orange or "guide" pages, so the first item is determine which guide page to use. There are three ways to get to the correct page.

- Four digit ID number in the yellow pages.
- Name of the material in the blue pages.
- Associated Placard from the Table of Placards

A four-digit ID number can be obtained from the shipping papers, a placard, or an orange panel. Look up the number in the yellow pages, and find the three-digit guide number in bold print to the right. In addition, the name of the material is listed in the next column.
In this example, the four digit ID number from an orange panel leads you to guide page **119**, and is the material "Cyanogen", either liquefied or gas.

If you have the name of the material, use the blue pages and look it, up in the alphabetical listing. "Cyanogen" looked up in this manner should lead you to the same guide page. "Magnesium" takes you to guide **138** and as a freebie you learn that it's, 4-digit ID number is 1869. Always make sure of correct spelling and the similar materials in a group. When you looked up the number 1026, you got the guide number. When looking up the word "Cyanogen", you see that there are five different entries that lead to three different guide pages. Is the material just Cyanogen, or is it "Cyanogen Bromide"? Make sure of the complete name and spelling.
The last way to determine the appropriate guide page is by using the Table of Placards on pages 15-17. If you are using this, you are working with limited information and should consult guidance that is more specific when information is available (i.e.. you obtain the shipping papers). Here's another example.

If you see this placard, use the table to determine the correct guide page. The book sends you to guide **127**, so go there and utilize that guidance. To emphasize the need to obtain more specific information, look up the word "Combustible" in the blue pages. You will find an entry "Combustible liquid, n.o.s." The "n.o.s." stands for "not otherwise specified". You will also see that it sends you to guide **128**, not guide **127**. Reading through the guidance provides little differences in this example, but you get the idea. You should strive to obtain the ID number or the name of the material, through the shipping papers or by telephone.

In the orange guide pages, there are two general types of hazards to be found on each page.

- Fire or explosion.
- Health.

Turn to guide 126 and you will see under Fire or explosion:

- Some may burn, but none ignite readily.
- Containers may explode when heated.
- Ruptured cylinders may rocket.

Health hazards listed are:

- Vapors may cause dizziness or asphyxiation without warning.
- Vapors from liquefied gas are initially heavier than air and spread along ground.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Fire may produce irritating, corrosive and/or toxic gases.

The properties of the material that are considered more hazardous are listed first; in this case fire or explosion. If you look at 125 on the previous page, the health hazards of these materials are more dangerous than the fire or explosion hazards.

RESPONSE INFORMATION (4.4.1.4a,b,c,)(4.4.1.5a, 5b, 5c, & 5d)

The response information in the guide pages that's vital to a successful response is:

- Emergency Actions.
- Protective Clothing.
- Initial isolation and protective action distances

Emergency response takes up the right hand page of the numbered guides. Look at guide 140. If you had a large fire, take the appropriate action from the list. Depending on the incident, one or more of these actions should help to stabilize the situation. There's also information for spills or leaks and first aid measures.

Protective clothing is found on the left hand guide page, and makes reference to four types.

- Street Clothing and Work Uniforms.
- Structural Fire Fighters' Protective Clothing.
- Positive Pressure Self-Contained Breathing Apparatus (SCBA).
- Chemical Protective Clothing and Equipment

To gain a better understanding of the protective clothing, look at page 350 of the book. Each type is explained in detail. As an Awareness level responder, remember that you may only have the first type (street clothing) available.

Initial isolation and protective action distances are found on the left page in the "Public Safety" section. The first two entries on these are usually the same.

- **CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- Isolate spill or leak area immediately for at least XX to XX meters (XX to XX feet) in all directions.

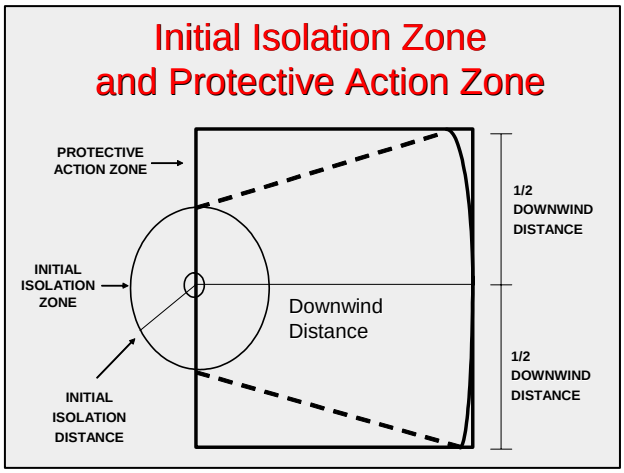
The second entry is the evacuation distance. It is a circle shaped area drawn from the point of the incident. Where the X's are, it will have the distance in feet and meters for the material you were looking up. Look at guide 121. Whatever material led to this guide page (compressed helium would be one example) requires only an Immediate Precautionary Distance; 30 to 80 feet. Flipping to guide 120 reveals a material that requires an initial isolation distance of 80 to 160 feet. Twice as far as helium, though nothing extremely hazardous (dry ice would send you to this page).

The Evacuation Distance is also found on the left page, in the Evacuation area. Here you will find a distance to evacuate downwind personnel. It may be the same, or vary greatly from the initial isolation distance.

DEFINITIONS OF PROTECTIVE ACTIONS (4.4.1.6a,b,c)

The protective actions listed in the ERG 2004 include Isolate the hazard area and deny entry, evacuate, and In-place protection.

Isolate the hazard area and deny entry means keep everybody away from the area if they are not directly involved in emergency response operations. Unprotected emergency responders should not be allowed to enter the isolation zone. The "isolation" task is done first to establish control over the operations. This is the first step for any protective actions that may follow.



Evacuate means move all people from a threatened area to a safer place. To perform evacuation, there must be enough time for people to be warned, to get ready, and to leave an area. If there is enough time, evacuation is the best protective action. Begin evacuating people nearby and those outdoors in direct view of the scene. When additional help arrives, expand the area to be evacuated downwind and crosswind to at least the extent recommended in the ERG 2004. Even after people move to the distances recommended, they may not be completely safe from harm. They should not be permitted to congregate at such distances. Send evacuees to a definite place, by a specific route, far enough away so they will not have to be moved again if the wind shifts.

In-Place Protection means people inside a building should remain inside until the danger passes. In the case of short-term spills and toxic vapor clouds, the material may be deflected by a multistory building and pass by without affecting the occupants of the building. In-place protection is used when evacuating the public would cause greater risk than staying where they are, or when an evacuation cannot be performed. Direct the people inside to close all doors and windows and to shut off all ventilating, heating and cooling systems. In-place protection may not be the best option if (a) the vapors are flammable; (b) if it will take a long time for the gas to clear the area; or (c) if buildings cannot be closed tightly. Vehicles can offer some protection for a short period if the windows are closed and the ventilating systems are shut off. Vehicles are not as effective buildings for in-place protection. Stay in contact with a competent person inside buildings and keep them informed. In-place protection is sometimes called "Sheltering In-Place Protection".

Every incident is different having special problems and concerns. Select the action to protect the public carefully and continue to gather information throughout the incident.

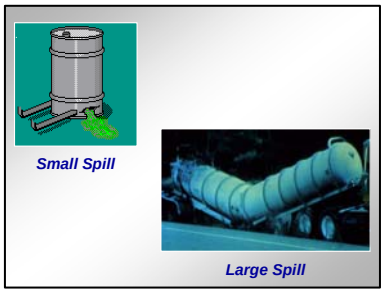
SHAPES OF ISOLATION AND PROTECTIVE ACTION ZONES

The initial isolation and protective action zones are laid out in specific manners. When you get the initial isolation distance, the initial isolation zone is drawn in a **circle** from the incident outward. If the distance is 100 ft., the circle would be 200 ft. wide. The protective action zone is drawn straight downwind from the center of the incident, then expanded crosswind 1/2 that distance in each direction. A complex way to say that it's a **square-shaped** zone. This is explained on pages 300 and 301 in the ERG 2004, or uses the picture on the next page.

DIFFERENCE BETWEEN SMALL AND LARGE SPILLS (4.4.1.8)

Look at the Table of Initial Isolation and Protective Action Distances. Starting on Page 302 (and forcing you to turn the book sideways), it continues for 36 pages with a list of materials arranged by 4-digit ID number.

When looking up a material in these pages, you must determine if it is a large or a small spill. A small spill would be one that involves a single, small package (i.e. up to a 55 gallon drum), a small cylinder, or a small leak from a large package. A LARGE spill is one which involves a spill from a large package (i.e. more than a 55 gallon drum), or multiple spills from many small packages. The day and night columns are based on sunrise and sunset.

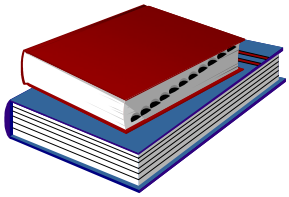


CIRCUMSTANCES UNDER WHICH DISTANCES ARE USED (4.4.1.9a & 9b, 4.4.1.10)

The orange-bordered pages provide information to protect from the immediate (such as fragmentation in a fire or explosion) hazards of the material. This guidance should be used at **ALL INCIDENTS**. **If you are looking up a material and it is highlighted, use the orange guidance first**. After the guidance from the orange page has been carried out, look up the material in the **green** pages and set the "extra" distances into effect. The green pages are used to protect people from **vapors** resulting from spills involving materials, which are considered poisonous/toxic by inhalation. Only materials that are highlighted will be found here. If there are no distances listed in the isolation/protective action columns and the material is spilled in water, turn to the last 2 green pages. These identify substances that are dangerous water-reactive materials. When a water reactive material is involved, it will produce a toxic vapor. These two pages list what toxic vapor will be produced at the bottom of the pages.

If a material is involved in a fire, use the orange pages even if it is highlighted. If it's not on fire and it's highlighted, use the green pages.

Information Available



Many times when looking up distances and guidance in the ERG you will find more information than maybe you wanted to deal with. A common question is; "If the material is on fire and it's highlighted, can I use the distances in the green pages anyway?" The answer is yes. You can never go wrong when using the greater of two distances. Other things you will encounter are "isolate 50 to 100 feet in all directions". Is it 50? or is it 100? Small distances may be easy, but can you stand in one place and accurately guess how far 1.7 miles is? In all cases, make your mistake on the side of safety...GO LONG!

The Emergency Response Guidebook is an excellent source of information for the Awareness responder. Taking the time to read and understand all of the explanation in the white pages will make you more effective at using the book at a response.

The Emergency Response Plan and Standard Operating Procedures are applicable to each jurisdiction. They are commonly maintained by responsible agencies (i.e. Fire Dept., Law Enforcement). The Awareness level responder must be familiar with the location and contents of these, so they can know their role at an incident. For a response to be successful, the responder must assess the situation and initiate the appropriate measures as outlined in the response plan. The ERG also provides guidance for response initiation, though not specific for different areas.

ISOLATION TECHNIQUES/AREA DENIAL (4.4.1.11)

Everyone not directly involved in the incident should be kept away from the danger area. Some techniques to isolate the hazard and deny entry is:

- Use a vehicle to block a road.
- Divert traffic.
- Close doors and gates.
- Public address systems.

ACTIONS NECESSARY INVOLVING CRIMINAL OR TERRORIST ACTIVITY (4.4.1.12)

When responding to an incident that you suspect involved criminal or terrorist activities, you should do certain things to handle the situation:

- Take the appropriate actions to protect yourself and other responders.
- Communicate the suspicion during the notification process.
- Isolate potentially exposed people and animals.
- Document the initial observation.
- Attempt to preserve evidence while performing operational duties.
- Be alert for booby traps and/ or explosive devices (secondary devices).
- Establish control zones and access control points.
- Prevent secondary contamination, including from handling patients.

INITIAL NOTIFICATION PROCEDURES (4.4.2).

The notification procedures for everyone are different, depending on where you work. A firefighter or policeman may simply radio a control center with something observed during the day, but it's not that easy for a medic who has spotted something while driving around. Be familiar with the notification procedures that apply to you.

REVIEW AND CLOSING

Review. For the last two hours, we have discussed some things relating to hazardous materials and the fire service. These included:

1. Knowing the mission of the fire service with regards to prevention, preparation. response and emergency medical services.
2. Being able to describe the chain of command within their fire department and describe the role of a firefighter.
3. Knowing what other agencies respond with their department and the role each plays in the response.
4. Understanding the fire department's role in homeland security preparation, planning, response and recovery.
5. Knowing the Indiana standards for responding to Sudden Infant Death Syndrome (SIDS)
6. Having a working knowledge of the Incident Command System (ICS)

Closing. Firefighters are exposed to hazardous materials often throughout their careers. The more you know about the threat of hazardous materials, the better you can combat them and the safer you'll be.

Sample Material Safety Data Sheet (MSDS)

MSDS NUMBER: M4734
MSDS DATE: 12-13-91
PRODUCT NAME: LIQUID CHLORINE
24 HOUR EMERGENCY PHONE: 1-800-733-3665

I. PRODUCT IDENTIFICATION

HMIS HAZARD RATINGS
HEALTH HAZARD 3 FIRE HAZARD 0 REACTIVITY 1
Based on the National Paint & Coatings Associations HMIS rating system.

SARA/TITLE III HAZARD CATEGORIES (See Section X)
Immediate (ACUTE) Health: YES Reactive Hazard: NO
Delayed (Chronic) Health: NO Sudden Release of Pressure: YES
Fire Hazard: YES

MANUFACTURER'S: Occidental Chemical Corporation
NAME AND: Customer Service Occidental Tower Telephone:
ADDRESS: P.O. Box 809050, Dallas, Texas 75380 (1-800-752-5151)

CHEMICAL NAME: Chlorine CASE NUMBER: 7782-50-5
SYNONYMS/COMMON NAMES: Chlorine Gas CHEMICAL FORMULA: C12
DOT PROPER SHIPPING NAME: Chlorine DOT HAZARD CLASS: 2.3
DOT I.D. NUMBER: UN1017 DOT HAZARDOUS SUBSTANCE: RQ = 10 lbs.
ADDITIONAL DESCRIPTION REQUIREMENT: Poison Inhalation Hazard, Hazard Zone 8

II. HEALTH HAZARD INFORMATION

EMERGENCY AND FIRST AID PROCEDURES
EYES: IMMEDIATELY flush eyes with plenty of water for at least 15 minutes holding lids apart to ensure flushing of entire eye surface. Washing eyes within several seconds is essential to achieve maximum effectiveness. SEEK MEDICAL ATTENTION IMMEDIATELY.

SKIN: Treat for inhalation first. Remove contaminated clothing under safety shower. Flush exposed skin with water. Wash with soap and water. If irritation is present after washing, GET MEDICAL ATTENTION.

INHALATION: Remove to fresh air. Administer oxygen until victim breathes easily. Keep warm and at rest. In mild cases, give milk to relieve irritation. DO NOT INDUCE VOMITING. GET MEDICAL ATTENTION AS SOON AS POSSIBLE.

INGESTION: NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. (If available, give several glasses of milk.) If vomiting occurs spontaneously, keep airway clear and give more water. SEEK MEDICAL ATTENTION IMMEDIATELY.
ROUTES OF EXPOSURE

INHALATION: May cause severe irritation to respiratory tract followed by coughing, burning, chest pain, vomiting, headache, anxiety and feeling of suffocation. Severe exposure may cause pneumonitis and pulmonary edema. Repeated exposure to chlorine may result in reduced pulmonary capacity and dental erosion.

SKIN: Contact with liquid chlorine may case burns, blistering and tissue destruction.
EYE CONTACT: Liquid and/or high concentration of chlorine gas in contact with the eyes will cause extreme irritation and/or burns.
INGESTION: Unlikely to occur.

EFFECTS OF OVEREXPOSURE
ACUTE: Liquid contact with skin or eyes may cause burns. Vapors may cause severe irritation to skin, eyes, and respiratory tract. Inhalation of large concentrations may cause pneumonitis and pulmonary edema.
CHRONIC: There are no known chronic effects from exposure to chlorine vapors at or below the accepted occupational limits for exposure. Repeated exposure to chlorine above the TLV may result in reduced pulmonary capacity and dental erosion.
TOXICOLOGY DATA: Chlorine gas is a primary irritant of the respiratory tract.
Severe exposure to vapor can be fatal. Exposure to liquid can cause burns on contact.
Prompt treatment is important to minimize effects.

The hazard at different concentrations is reported to be as follows:

0.2-0.5 ppm = No toxic, long term effect
1-3 ppm = Definite odor; irritation of eyes and nose
5-8 ppm = Throat, eye, and mucous membrane irritation
30 ppm = Intense coughing fits
34-51 ppm = Lethal in 1 to 1.5 hours exposure
40-60 ppm = Exposure for 30-60 minutes without effective respiration may cause bronchitis,
pulmonary edema or bronchopneumonia
100 ppm = May be lethal after 50 minutes of exposure (estimated)
430 ppm = Lowest concentration known to cause lethality after 30 minutes of exposure
1000 ppm = May be fatal with a few deep breaths

NOTES TO PHYSICIAN: Treatment is symptomatic. Because there is no known antidote for chlorine gas inhalation, effective and immediate relief of symptoms is the primary goal. Steroid therapy, if given early, has been reported effective in preventing pulmonary edema.

III. IMPORTANT COMPONENTS

CASE NUMBER / NAME
7782505 Chlorine

EXPOSURE LIMITS PERCENTAGE
PEL = 0.5 ppm: 1.5 mg/m3 TWA VOL ND
STEL = 1 ppm:3 mg/m3 WT100
TLV = 0.5 ppm: 1.5 mg/m3 TWA
STEL = 1 ppm:3 mg/m3

COMMON NAMES:
Listed On (List Legend Below):
01 02 13 16 18
See Section II
All components of this product that are required to be on the TSCA. Inventory are listed on the inventory.
Not listed as carcinogen - IARX, NTP OSHA

LIST LEGEND

1	SARA EXTR HAZ SUB. SECTION 302	2	SARA TOXIC CHEM. SECTION 313
13	PA ENVIRONMENTAL HAZ SUBSTANCE	16	NJ WORKPLACE HAZ SUBSTANCE LST
18	NY HAZARDOUS SUBSTANCES		

IV. FIRE AND EXPLOSION DATA

FLASH POINT: N/A AUTOIGNITION TEMPERATURE: NA
FLAMMABLE LIMITS IN AIR. % BY VOLUME - UPPER: Nonflammable
LOWER: Nonflammable
EXTINGUISHING MEDIA:
Use water to keep fire-exposed containers cool. If it is necessary to stop the flow of gas, use water spray to direct escaping gas away from persons effecting the shut-off. Wear full protective clothing. Use extinguishing media as appropriate for surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES:
In case of fire, chlorine containers should be removed from fire zone immediately. Tank cars or barges should be disconnected and pulled out of the danger area. If no chlorine is escaping, water should be applied to cool containers that cannot be moved. All unauthorized persons should be kept at a safe distance. Fire fighters must use self-contained breathing apparatus, eye protection and full protective clothing.

UNUSUAL FIRE AND EXPLOSION HAZARD:
Chlorine gas or liquid, it nonexplosive and nonflammable. However, like oxygen, it is capable of supporting combustion of certain substances. Reacts explosively, or forms explosive compounds, with many chemicals, such as acetylene, turpentine, ether, ammonia gas, hydrogen, and finely divided metals.

V. SPECIAL PROTECTION

VENTILATION REQUIREMENTS:
Provide general and local exhaust ventilation to meet OSHA Ceiling exposure limit of 1 ppm. Provide venting for low-lying areas. Use closed systems when possible.
SP`ECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY:
Use a NIOSH/MSHA approved respirator following manufacturer's recommendations where gas leaks may occur. Use supplied air respirator in positive pressure mode following ANSI Z117.1-1977 for tank and confined space entry.

EYE:
Face shield and chemical goggles should be worn.

GLOVES:
Impervious gloves should be worn. Natural rubber or latex have been used. Contaminated gloves should be discarded.

OTHER CLOTHING AND EQUIPMENT:
Standard work clothing. Wash contaminated clothing with soap and water and dry before reuse. Emergency shower and eyewash facility should be in close proximity.

VI. PHYSICAL DATA

BOILING POINT @ 760 mm Hg. -34ºC (-28.3ºF)
FREEZING POINT: -101ºC (-150ºF)
VAPOR PRESSURE: 2748mm Hg @ 0ºC
SPECIFIC GRAVITY (H2O=1): 1.4 @ 15.4ºC
SOLUBILITY IN H20 % BY WT: 0.7 % @ 20ºC
VAPOR DENSITY (Air=1): 2.5
APPEARANCE AND ODOR: Amber color liquid. Greenish-yellow gas. Pungent irritating odor.

pH: 0.7% solution has pH 5.5
% VOLATILES BY VOL: 100%

VII. REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY:
Chlorine is stable. Avoid the release of chlorine to the atmosphere. Do not place chlorine containers near heat or fire. Never use water on the source of a chlorine leak. Water spray may be used to direct the flow of escaping chlorine gas.

INCOMPATIBILITY:
Reducing agents, combustible materials. Keep away from materials such as acetylene, turpentine and other hydrocarbons, ammonia, hydrogen, ether, powdered metal, sulfur and aluminum. Reacts with hydrogen sulfide and water forming hydrochloric acid. Combines with carbon monoxide and sulfur dioxide forming phosgene and sulfuryl chlorine. Moist chlorine is highly corrosive to most metals. Chlorine reaction to some organic compounds can be explosive. Strong oxidizer.

HAZARDOUS DECOMPOSITION PRODUCTS:
None.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION:
None.

VIII. HANDLING AND STORAGE

HANDLING AND STORAGE PRECAUTIONS:
Store chlorine containers in a well ventilated area of low fire potential and away from incompatible materials (acetylene, turpentine, other hydrocarbons, ammonia, hydrogen, ether, powdered metals, sulfur, aluminum, reducing agents and combustible materials). Keep away from heat and source of ignition. Protect container from weather and physical damage. Follow safety procedures for containers of compressed gases. Provide special training to workers handling chlorine. Regularly test and inspect piping and containment used for chlorine service. Liquid levels should be less than 85% of tank or cylinder capacity.

IX. ENVIRONMENTAL PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:
If a material is spilled or released to the atmosphere, keep up-wind, provide ventilation, wear full protective equipment and shut off supply at source. Exclude non-essential personnel. Contain liquids and prevent discharges to streams or sewer systems; and control or stop the loss of volatile materials to the atmosphere. Large leaks may require environmental consideration and possible evacuation. Do not apply water to leak.

Spills or releases should be reported, if required, to the appropriate local, state and federal agencies.

NEUTRALIZING CHEMICALS:
Chlorine can be absorbed into an alkaline solution, i.e., caustic soda (NaOH), caustic potash (KOH), lime, etc.

WASTE DISPOSAL METHOD:
Move leaking container to isolated area. Position to release gas, not liquid. Absorb in alkaline solution of caustic soda, soda ash or hydrated lime.

Dispose in accordance with all federal, state, and local health and pollution regulations. Depending upon the particular situation involved, special equipment may be required. Consult your chlorine supplier.

X. ADDITIONAL INFORMATION

Spills of chlorine of 10 or more pounds must be reported to the National Response center, 1-800-424-8802.

Chlorine is contained on a list as required under Sec 101(14) of CERCLA, which includes substances designated pursuant to SEC 311 of the Clean Water Act, Hazardous Wastes under SEC 3001 of RCRA, Toxic Pollutants under SEC 307 of the Clean Water Act, Hazardous Air

Pollutants under Sec 112 of the Clear Air Act, Imminently hazardous Chemicals under Sec 7 of TSCA. Chlorine is designated a hazardous substance by 29 CFR Sec 1910, Subpart Z. The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) is applicable if chlorine is used as a pesticide or in water or sewer treatment applications.

OSHA Standard 29CFR 1910.1200 requires that information be provided to employees regarding the hazards of chemicals by means of a hazard communication program including labeling, materials safety data sheets, training and access to written records. We request that you, and it is your legal duty to, make all information in this Material Safety Data Sheet available to your employees.

To aid our customers in complying with regulatory requirements, SARA Title III hazard categories for this product are indicated in Section I. If the word "YES" appears next to any category, this product may be reportable by you under the requirements of 40 CFR part 370. Please consult those regulations for details.

This product contains a toxic chemical or chemicals subject to the reporting requirements of SECTION 313 of TITLE III of the SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 and 40 CFR PART 372. (See Section III, List Legend 02).

XI. PREPARATION INFORMATION

For additional Non-Emergency health, safety, or environmental information, telephone (716) 286-3081, or write to:

Occidental Chemical Corporation
Product Stewardship Department
Suite 400
360 Rainbow Boulevard South
Niagara Falls, NY 14302

For Emergencies: 24 HOUR EMERGENCY PHONE: 1-800-733-3665
This MSDS replaces MSDS Number: M4734 dated 09/05/91.
WARNING LABEL INFORMATION
EPA approved label 9/87
CHLORINE
LIQUEFIED GAS
UNDER PRESSURE
NON-FLAMMABLE

ACTIVE INGREDIENT
Chlorine 99.5%
INERT INGREDIENTS 0.5%

DANGER POISON

HAZARDOUS LIQUID AND GAS UNDER PRESSURE MAY CAUSE CHEMICAL PNEUMONIA AND EVEN DEATH
IN HIGH CONCENTRATIONS MAY CAUSE SEVERE IRRITATION TO SKIN,EYES AND RESPIRATORY TRACT
LIQUID MAY BURN EYES AND SKIN CAN REACT EXPLOSIVELY WITH ORGANIC PRODUCTS

PRECAUTIONARY STATEMENTS

HAZARD TO HUMAN AND DOMESTIC ANIMALS May be fatal if inhaled. Do not breath air containing this gas. Do not get in eyes, on skin, on clothing. Corrosive to handle or use until manufacturer's Material Safety Data Sheet has been read and understood. Wear face shield, goggles and rubber gloves when handling. Use NIOSH/MSHA approved respirator and local exhaust ventilation where vapor may be generated.

ENVIRONMENTAL HAZARDS
The product is toxic to fish. Do not discharge into lakes, streams, ponds or public waters unless in accordance with an NPDES permit. For guidance, contact regional Environmental Protection Agency office.

CHEMICAL-PHYSICAL HAZARDS
Chlorine is a non-flammable gas, liquefied, under pressure. Do not heat container. Avoid contact with organic products to prevent explosive reaction. Corrosive to most metals in presence of moisture.

STATEMENT OF PRACTICAL TREATMENT
(FIRST AID)

FOR EYES: Immediately flush eyes with plenty of water for at least 15 minutes holding eyelids apart to ensure flushing of entire eye surface. Washing eyes within several seconds after exposure is essential to achieve maximum effectiveness. SEEK MEDICAL ATTENTION IMMEDIATELY.

SKIN: Treat for inhalation first. Remove contaminated clothing under safety shower. Flush exposed skin with water. Wash with soap and water. If irritation is present after washing, GET MEDICAL ATTENTION.

INHALATION: Remove to fresh air. Administer oxygen until victim breathes easily. Keep warm and at rest. In mild cases, give milk to relieve irritation. DO NOT INDUCE VOMITING. GET MEDICAL ATTENTION AS SOON AS POSSIBLE.

INGESTION: NEVER give anything by mouth to an unconscious person. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. (If available, give several glasses of milk.) If vomiting occurs spontaneously, keep airway clear and give more water. SEEK MEDICAL ATTENTION IMMEDIATELY.

DIRECTION FOR USE - GENERAL CLASSIFICATION

It is a violation of Federal law to use this product in a manner inconsistent with the labeling.

USE AS A DISINFECTANT, by experienced personnel only, in municipal water supplies, sewage and waste management plants, in accordance with applicable local, state and federal regulations.

USE IN MANUFACTURING PROCESSES, by trained personnel only, in production of bleach, plastics, chlorinated solvents, refrigerants, etc. and intermediates for products containing no chlorine. Proper training in safety and use of protective equipment are essential. Well designed and maintained handling and processing facilities are required.

STORAGE AND DISPOSAL
HANDLING AND STORAGE: Provide special training to workers handling chlorine. Do not place chlorine containers near heat or fire. Handling and storage of chlorine containers should be in accordance with all local, state, and federal regulations. Regularly test and inspect piping and containment used for chlorine service. Liquid levels should be 85% of tank or cylinder capacity.

IN THE EVENT OF FIRE: Remove chlorine containers from fire zone immediately. use water to keep containers cool which cannot be moved, but do not use water on the source of a chlorine leak. Use water spray to direct chlorine away from persons effecting shut-off. Wear full protective clothing and self-contained breathing apparatus.

DISPOSAL: Vent waste chlorine gas into scrubber using dilute alkali solution. Dispose of resultant hypochlorate in accordance with local, state and federal regulations. Return empty chlorine tank cars and cargo tanks containing residual gas and/or liquid to supplier in compliance with applicable DOT regulations.

FOR ASSISTANCE IN CHEMICAL EMERGENCY, CALL CHEMTREC 800-424-9300
Spills of 10 pounds or more must be reported to the NATIONAL RESPONSE CENTER 1-800-424-8802.

UN 1017 CAS No. 7782-50-5

HMIS HAZARD RATING		NFPA FIRE HAZARD RATING	
HEALTH	3	HEALTH	3
FLAMMABILITY	0	FLAMMABILITY	0
REACTIVITY	1	REACTIVITY	0

APPROXIMATE NET CONTENTS: 55 or 90 TONS
EPA REG. NO. 935-8

EPA EST. NO.	AL-001	EPA EST. NO.	NY-001
EPA EST. NO.	AL-002	EPA EST. NO.	TX-001
EPA EST. NO.	DE-001	EPA EST. NO.	TX-002
EPA EST. NO.	LA-001	EPA EST. NO.	TX-003
EPA EST. NO.	LA-002	EPA EST. NO.	WA-001

OCCIDENTAL CHEMICAL CORPORATION, OxyChem
Electrochemicals & Specialty Products
Dallas, Texas 75380
LABEL 090987M4734

Practical Training Exercise

Instructions: Answer the following questions using the most current edition of the Emergency Response Guide. You may use the student manual to answer any question. You have 30 minutes to complete the exercise.

What is the isolation distance for a material placarded 1.4 under fire conditions?
_____.

What is the initial evacuation distance for a tank truck placarded "dangerous" when under fire conditions?

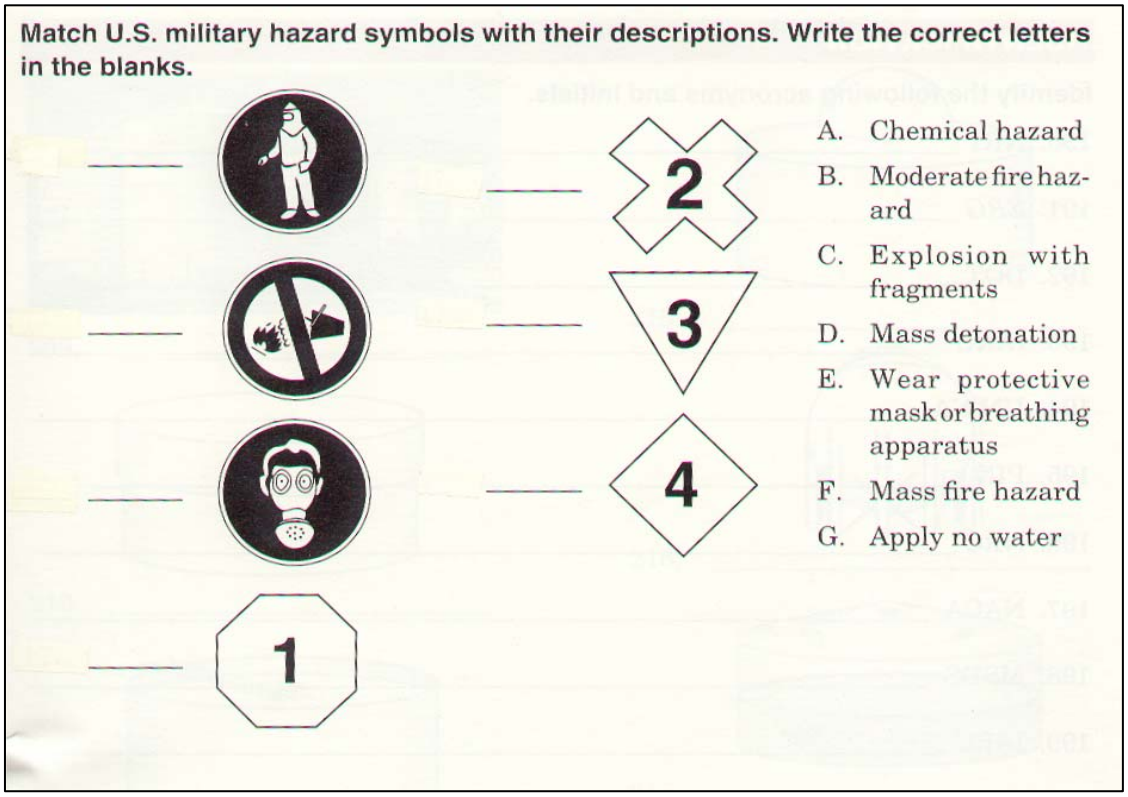
_____

What is the minimum acceptable respiratory protection for material placarded "dangerous when wet?"

_____

From the training lecture, do you remember what placard, the above placard replaced in 2001?

_____



1) You are on patrol and come upon a white trailer located in a farm field that is releasing its contents to the atmosphere. A white vapor cloud is visible from your location. Upon closer examination of the trailer, you see a green placard with the numbers "1005." Briefly, describe your actions for this situation.

2) You are dispatched to a reported auto accident. No further, dispatch information. Upon arrival, you see a passenger car underneath a semi-trailer. There is a large amount of liquid product on the roadway and currently entering a sewer manway and storm runoff drain. Upon closer examination of the semi-trailer, you see a placard with the numbers "2078." The truck driver is not injured, but the driver of the automobile is trapped and unconscious. The truck driver says the product is like "paint thinner." Briefly, describe your actions for this situation.

Using the DOT Emergency Response Guidebook, identify the correct guide number and identification number or hazardous material.

Hazardous Material	ID Number	Guide No.
_____	1618	_____
_____	3021	_____
Ethylene	____	_____
_____	1203	_____
Sodium nitrate	____	_____
Aviation Fuel	____	_____
_____	1693	_____
_____	1299	_____
Ammonium nitrate fertilizer	____	_____
_____	2918	_____