CDC 47201
HAZARDOUS MATERIALS AWARENESS

SUPPLEMENT 1
Student Study Guide
PREFACE

Welcome to the Hazardous Materials - Awareness certification course. This course references National Fire Protection Association (NFPA) standards; specifically, NFPA Standard 472: Professional Competence of Responders to Hazardous Materials Incidents, 1997 edition, which is required to achieve the Hazardous Materials - Awareness certification level. The Learning Objectives outlined in the course Instructor Guide Sheets and Performance Test Supplement identify the relevant NFPA objective(s) that the student must meet.

You, the candidate, will become certified from this training; therefore, you must put forth the most effort. Once you’ve successfully completed the academic portion, and performance objectives for this certification level, you will then become certified through the Department of Defense, Fire Fighter Certification System, 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 AFI 32-4002. 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)
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This study guide was designed as a reference tool for the first level hazardous materials student (Awareness). This guide replaces the need to purchase outside reference material with the exception of the North American Emergency Response Guidebook.
Emergency responders at the awareness level shall be trained to meet all competencies of NFPA 472 Chapter 2. 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), and other appropriate state, local, or provincial occupational health and safety regulatory requirements.

First responders at the awareness level are persons who, in the normal course of their duties, could be the first on scene of an emergency involving hazardous materials. They are expected to recognize the presence of hazardous materials, protect themselves, call for trained personnel, and secure the area. Responders at the awareness level are not expected to take any action that would require a great deal of training and experience. Rather, their actions will be defensive, and limited.
GOAL (2-1.3)

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 materials, the first responder at the awareness level shall be able to:

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

1. *Detect* the presence of hazardous materials.

2. *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.


(b) **Implement** actions consistent with the local emergency response plan, the organization’s standard operating procedures, and the current edition of the NAERG by completing the following tasks:

1. *Initiate* protective actions.

2. *Initiate* the notification process.
2-2 COMPETENCIES - ANALYZING THE INCIDENT

DETECTING THE PRESENCE OF HAZARDOUS MATERIALS (2-2.1)

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 with at least 80% accuracy.

IDENTIFY THE DEFINITION OF HAZARDOUS MATERIALS OR DANGEROUS GOODS, IN CANADA (2-2.1.1)

(a) **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.

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

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

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

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

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

(g) **Dangerous Goods** - In Canadian Transportation, hazardous materials are called dangerous goods.
* The 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 and many materials will have other hazards as well. 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

1. **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.

   (a) **Division 1.1** - Explosives that have a mass explosion hazard. A mass explosion is one that affects almost the entire load instantaneously.

   - Common examples include black powder, dynamite, and T-N-T.

   (b) **Division 1.2** - Explosives that have a projection hazard but not a mass explosion hazard.

   - Common examples include aerial flares, detonation cord, and power device cartridges.
(c) **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 mass explosion hazard.

- Common examples include Liquid-fueled rocket motors, and propellant explosives

(d) **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 projection of fragments of appreciable size or range is expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.

- Common examples include practice ammunition, and signal cartridges

(e) **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.

- Common examples include prilled ammonium nitrate fertilizer - fuel oil mixtures, (blasting agents)

(f) **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.

- Common examples include explosive squib devices

2. **Placards** - Orange background, Bursting Ball (for divisions 1.1-1.3) with the word “Explosives” or “Blasting Agents” - (1.5)
Class 2 (Gases)

Major Hazards: BLEVE (Boiling Liquid Expanding Vapor Explosion)

* Sub-hazards: Flammable, Oxidizer, Poisonous

1. **Division 2.1** - **(Flammable gas)** means any material that is a gas (boiling point) at (20ºC) 68ºF or less and (101.3 kPa) 14.7 psi of pressure, a material that has a boiling point of (20ºC) 68ºF or less at (101.3 kPa) 14.7 psi and that:

   a) Is ignitable at 101.3 kPa (14.7 psi) when in a mixture of 13% or less by volume with air; **or**

   b) Has a flammable range at 101.3 kPa (14.7 psi) with air of at least 12% regardless of the lower limit

   ● Common examples include inhibited butadiene’s, methyl chloride, and propane.

2. **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 20ºC (68ºF).

   A cryogenic liquid means a refrigerated, liquefied gas having a boiling point colder than -90ºC (-130ºF) at 101.3 kPa (14.7 psi) absolute.

   ● Common examples include anhydrous ammonia, cryogenic argon, carbon dioxide, and compressed nitrogen.
3. **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:

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

   b) 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.

   - Common examples include anhydrous hydrogen fluoride, arsine, chlorine and methyl bromide

4. **Division 2.4 - Corrosive Gases** (Canada)

5. **Placards** Flammable - Red background, White Flame
   Non-Flammable - Green background, White Cylinder
   Oxidizer - Yellow background, Flaming “O”
   Poison Gas - White background, Skull & Crossbones
   Corrosive Gas - White background, Black Cylinder
Class 3 - Flammable and Combustible liquids

Major Hazard: Burns readily

1. Flammable Liquid is any liquid having a flash point of not more than 60.5°C (141°F)
   a) Division 3.1 - Flash point <17.7°C (<0°F)
   b) Division 3.2 - Flash point 17.7°C to 22.7°C (0°F to 73°F)
   c) Division 3.3 - Flash point 22.7°C to 60.5°C (73°F to 141°F)
      ● Common examples include acetone, amyl acetate, gasoline, methyl alcohol, and toluene.

2. Combustible Liquid is 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)
   ● Common examples include mineral oil, peanut oil, and No. 6 fuel oil.

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

3. 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 a liberation of mass quantities of smoke

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

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

   b) 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

   c) Readily combustible solids - solids that may cause a fire through friction and any metal powders that can be ignited

   ● Common examples include magnesium (pellets, turnings, or ribbons), and nitrocellulose.

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

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

   2. Self-heating material - a material that, when in contact with air and without an energy supply, is liable to self-heat

   ● Common examples include aluminum alkyls, charcoal briquettes, magnesium alkyl's, and phosphorus
3. **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.

- Common examples include calcium carbide, magnesium powder, potassium metal alloys, and sodium hydride

4. **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”

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**Class 5 - Oxidizers**

**Major Hazards**

5.1: Supports Combustion intensifies fire

5.2: Unstable/Reactive Explosives

1. **Division 5.1 - (Oxidizer)**

means a material that may, generally by yielding oxygen, cause or enhance the combustion of other materials.

- Common examples include ammonium nitrate, bromine trifluoride, and calcium hypochlorite.

2. **Division 5.2 - (Organic Peroxide)**

means an organic compound containing oxygen (O) in the bivalent [O-O] structure that can 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.

a) Type A - can detonate or deflagrate rapidly as packaged for transport. Transportation of type A organic peroxides is forbidden.

b) Type B - neither detonates nor deflagrates rapidly, but that can undergo a thermal explosion.

c) Type C - neither detonates nor deflagrates rapidly and cannot undergo thermal explosion.

d) Type D - detonates only partially or deflagrates slowly, with
medium to no effect when heated under confinement.

e) Type E - neither detonates nor deflagrates and shows low, or no, effect when heated under confinement.

f) 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.

g) 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.

- Common examples include dibenzoyl peroxide, methyl ethyl ketone peroxide, and peroxyacetic acid.

3. **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

1. **Division 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.

   - Common examples include aniline, arsenic compounds, carbon tetrachloride, hydrocyanic acid, and tear gas.

2. **Division 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.

   - Common examples include anthrax, botulism, rabies, and tetanus.

3. **Placard**  White background, Skull and Crossbones

Class 7 - Radioactive

Major Hazard: Radioactive poisonous burns

1. Definition - material having a specific activity greater than 0.002 microcurie per gram (mCi/g).

   - Common examples include cobalt, uranium, hexafluoride, and “yellow cake”.

2. **Placard**  Yellow top, White bottom, Black “Propeller”
Class 8 - Corrosives

Major Hazards: burns/emulsification skin damage

1. Definition - (Corrosive material) 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

- Common examples include nitric acid, phosphorus trichloride, sodium hydroxide, and sulfuric acid.

2. Placard - White Top, Black bottom, two test tubes, hand and steel bar

Class 9  Miscellaneous Hazardous Materials

1. Definition - a material that presents a hazard during transport, but that is not included in another hazard class:

   a) Any 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.

   b) Any material that is not included in any other hazard class, but is subject to the DOT requirements (a hazardous substance or waste).

   i) Division 9.1 - Miscellaneous Dangerous Goods (Canada)
   ii) Division 9.2 - Environmentally hazardous substances (Canada)
   iii) Division 9.3 - Dangerous wastes (Canada)

- Common examples include adipic acid, PCBs, and molten sulfur.

2. Placard  Black and white vertical stripes on top, white bottom
Other Regulated Materials (ORM-D)

1. Definition - a material that presents a limited hazard during transportation due to its form, quantity, and packaging.
   - Common examples include consumer commodities and small arms ammunition.

2. 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 aren’t transported.
   - Common example of forbidden material is 5.2 (a) materials

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

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

1. Liquid at or above 100°C (212°F)

2. Liquid with a flash point at or above 37.8°C (100°F) that is intentionally heated and is transported at or above its flash point

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

HAZARDOUS MATERIALS INCIDENTS vs. OTHER EMERGENCIES
(2-2.1.4)

Hazardous materials incidents differ from other types of emergencies in some important ways. They have the potential for doing great harm since the effects can be far-reaching and severe, and often have long term effects on the environment, people, and property. Because of this, responders must be specifically trained and equipped to deal with them properly.
TYPICAL OCCUPANCIES AND LOCATIONS (2-2.1.5)

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

1. Warehouses
2. Tank farms
3. Weapons depots
4. Hospitals
5. Laboratories
6. Truck Terminals
7. Flight Line areas
8. Maintenance Facilities

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.
Radioactive containers may be in protective overpacks or casks. The protective overpacks will be used for smaller quantities and are cylindrical or boxlike in configuration. The casks are used for large transport shipments (trains and trucks) and are identified by reinforcing rings and cooling fins. Some may be up to 50 ft. in length. The containers may contain solid, liquids or gases.

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

1. 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. Containers of this type typically transport a liquefied gas.

2. MC-331 is used for highway shipment of pressurized products. The MC 331 cargo tank is a single compartment tank that has rounded ends and is usually constructed of seamless and/or welded steel. Tank design pressures range from 100 to 500 psi. The MC 331 will typically transport a liquefied gas.
3. **Pressure Rail Car** are cylindrical, non-compartmented tanks with rounded heads. Pressure tank cars are generally distinguished by the presence of a single protective housing on top that contains all valves and other fittings. Pressure tank cars may be insulated and/or thermally protected. Tank test pressures range from 100 to 600 psi. Pressure rail cars will typically transport a liquefied gas.

4. **High pressure tube trailer** consists of a group of stainless steel cylinders, 9 to 48 inches in diameter, permanently mounted on a semi-trailer. The tube trailer may have as few as two large cylinders or more than twenty smaller cylinders. All cylinders contain the same material, however each cylinder is independently piped and valved. The transported material will be a compressed gas but never a liquefied gas.

5. **Tube Module** (intermodal) horizontal cylinders are permanently mounted inside an open frame (8 foot X 8 foot) with a box-like compartment at one end enclosing the valving. All cylinders contain the same material, however each cylinder is independently piped and valved. The transported material will be a compressed gas but never a liquefied gas.
6. **High Pressure Tube Car** the most common configuration has up to 30 noninsulated seamless steel cylinders permanently mounted horizontally in a 40 foot frame with open sides on the car. All cylinders contain the same material, however each cylinder is independently piped and valved. The transported material will be a compressed gas but never a liquefied gas.

*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 too as large as rail cars. Cryogenic containers can usually be identified by the absence of top fittings, since the fittings are located in cabinets. Cryogenic containers carry refrigerated liquids (minus 90°C or 130°F and below).

1. **MC 338 Cryogenic container** is vacuum-insulated and must connect with a vacuum gauge which indicates the absolute pressure within the insulation space. The tank will also have a suitable pressure gauge, indicating the lading pressure, located on the front of the jacket so the driver can read it in the rearview mirror. The inner tank pressure can range from 23.5 to 500 psi depending on the product being shipped.
2. **Cryogenic Liquid Tank Car** the space between the inner and outer tank is filled with insulation and kept under a vacuum to maintain product temperature. The combination of insulation and the vacuum protects the contents from ambient temperatures for only 30 days, making these shipments time-sensitive. Cryogenic liquid tank cars carry low pressure, usually 25 psig or lower, refrigerated liquids.

![Cryogenic Liquid Tank Car](image)

Corrosive materials in small quantities are carried 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).

![Carboy in polystyrene](image)  ![Carboy in wooden box](image)

1. **MC-312** will carry larger quantities of corrosive materials in highway transportation. The MC 312 is most commonly a single-compartment tank, but may contain up to four separate compartments. The tanks may be insulated or non-insulated and may be lined or unlined. Rollover protection will surround the manway(s) and if required the front and rear of the tank.

![MC-312](image)
Flammable liquids are most commonly carried in drums and jerricans for small amounts, and the MC-306 for bulk shipments. Also, non-pressure rail cars may transport flammable liquids.

1. **MC 306** transports flammable liquids in highway transportation. The MC 306 may contain up to eight compartments, but most will contain four to five. The manways and dome lids are located along the tank top with the full-length roll over protection.

2. **Non-Pressure Tank Cars** transports flammable liquids in rail transportation. Either an expansion dome with visible fittings (on older cars) or the visible fittings without an expansion dome (on newer cars) distinguish non-pressure tank cars. Tank test pressures for non-pressure tank cars are 60 to 100 psi.
**Dry Bulk Carrier**  The Dry Bulk carrier is not manufactured to a specification mandated by 49 CFR. However, the vehicle must still be placarded and marked properly if it is carrying a regulated material.

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**MARKINGS AND COLORS (2-2.1.7)**

Some markings used on facilities and in transportation can help you identify the presence (or more specifically the actual name) of a hazardous material. These may include the following:

1. **UN/NA Numbers**

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 even more examples.

![UN/NA Numbers Example](image)

Also 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.

![Class Numbers Example](image)

One of the most beneficial things that is 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.

2. **The NFPA 704 System** is used on fixed facilities and will be discussed in detail in the next section.
3. **Military hazardous materials markings** provide information on explosives and special warnings.

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

   b) Class 1, Division 2 - Materials that present an explosion with fragmentation hazard

   ![Class 1, Division 1 and Division 2 symbols]

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

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

   ![Class 1, Division 3 and Division 4 symbols]

4. **Special Warnings** include information on **Chemical Hazards**. Red is **highly toxic**, yellow denotes **harassing agents**, and white indicates **white phosphorus munitions**.

   ![Special warnings symbols]
Lastly, the military marking system also includes the "apply no water" and the "wear protective breathing apparatus" symbols.

Pipeline markers are metal signs placed next to a pipeline right of way. They provide information on the location and ownership of the line. They will also include a signal word such as "Warning". Pipelines will often provide some information about the transported commodity.

Pipeline Information
- Location and ownership of the line
- Signal word (Warning)
- Transported commodity
- Emergency telephone number

Container marking (facility or transport) Often markings on a container will provide some information as to the type of product that it holds. In some cases they may have the actual name of the material stenciled on the container.
**NFPA 704 SYSTEM (2-2.1.8)**

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 of the hazards from this symbol, it *does not* provide you with the name of the material.

![NFPA 704 Symbol](image-url)

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. The least hazardous is 0 with 4 being the worst. The colors themselves represent:

- **Red** - Flammability
- **Blue** - Health
- **Yellow** - Reactivity
- **White** - Special Information

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).

**LOCATION OF MATERIAL SAFETY DATA SHEETS (2-2.1.10.1)**

The facility manager/employer (or designated representative) is required to maintain the Material Safety Data Sheets 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 Title 29, Code of Federal Regulations, Part 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  
(2-2.1.10, 2-2.1.10.2, 2-2.1.10.3)

Basic information and entries on a MSDS may indicate the presence of hazardous materials.

(Note) A sample MSDS is provided in the back of this student study guide)

Basic Information

1. Manufacturers name and location
2. Name and family of chemical
3. Hazardous ingredients
4. Physical data
5. Fire and explosion data
6. Health hazard data
7. Spill or leak procedures
8. Special protection information
9. Special precautions to be taken

Basic Entries

1. General Information - includes manufacturer’s name, address and emergency phone number, chemical name and family, and all synonyms

2. Hazardous Ingredient Statement - breaks out the active ingredients by percentage. Trade secrets restrictions may sometimes minimize the amount of information available on an MSDS, although responders should have access to this data during an emergency.

3. Physical Data - includes physical properties.

4. Fire and Explosion Data - includes control and extinguishment measures, proper extinguishing agents, UEL/LEL, auto-ignition temperature, etc.

5. Spill and Leak Control Procedures – include procedures and precautions for handling chemical releases as well as waste disposal methods.

6. Special Protection Information - includes protective clothing and respiratory protection requirements.

7. Other Special Precautions (as necessary).

8. Health and Reactivity Hazard Data (as necessary) - includes toxicology information, signs and symptoms of exposure, emergency care, chemical incompatibilities, decomposition products, etc.
Basic Information and Entries on shipping papers

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

If you are looking at an MSDS, you are 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”.

**SHIPPING PAPERS/PERSON RESPONSIBLE (2-2.1.10.4, 2-2.1.10.5, 2-2.1.10.6, 2-2.1.10.7)**

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.

<table>
<thead>
<tr>
<th>Transport Route</th>
<th>Title of Shipping Paper</th>
<th>Responsible Person</th>
<th>Location of Shipping Papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highway</td>
<td>Bill of Lading or freight bill</td>
<td>Driver</td>
<td>Cab of vehicle</td>
</tr>
<tr>
<td>Rail</td>
<td>Way bill and/or consist</td>
<td>Conductor or Engineer</td>
<td>With member of train crew</td>
</tr>
<tr>
<td>Water</td>
<td>Dangerous cargo manifest</td>
<td>Captain or Master</td>
<td>Wheelhouse or pipelike container on a barge</td>
</tr>
<tr>
<td>Air</td>
<td>Air bill</td>
<td>Pilot</td>
<td>Cockpit or attached to a package</td>
</tr>
</tbody>
</table>

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 through CHEMTREC.
Sometimes it’s fairly 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.

**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!
Events in recent years have included criminal or terrorist activity involving hazardous materials. The Oklahoma City bombing is a vivid example. Some potential criminal or terrorist targets may include:

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

Some indicators (clues) of possible criminal or terrorist activity are:

- HazMat or irrelevant lab equipment.
- Intentional releases.
- Unexplained sudden onset illnesses or death.
- Unusual odors or tastes.
- Unexplained irritations to the skin, eyes, or airway.
- Unexplained vapor clouds.
- Patient signs and symptoms.

Not all HazMat incidents are caused by criminal or terrorists activity. 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.
DIFFICULTIES AND SOURCES FOR DETERMINING NAMES OF HAZARDOUS MATERIALS (2-2.2.1, 2-2.2.2, 2-2.2.3)

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 “Dangerous” placard may be used if the gross weight of two or more categories of hazardous materials listed in Table 2 exceeds 454 kg or 1001 lbs. A freight container, unit load device, motor vehicle, or rail car which contain non-bulk packages with two or more categories of hazardous materials that require placards specified in Table 2 may use the Dangerous placard instead of separate placarding specified for each material.

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.

Although difficult, you should always try to determine the name of the material. In transportation, use the North American Emergency Response Guidebook (NAERG) 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.

In facilities, Material Safety Data Sheets (MSDS) are an excellent source. Also, markings on containers should be used in conjunction with emergency planning documents. The best time to identify hazardous materials in facilities is before an incident occurs.

PROTECTION OF SELF AND OTHERS (2-4.1.3)

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? Or 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.
MEDICAL CARE PRECAUTIONS (2-4.3.1)

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 (2-4.1.3.2)

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
- Cutting and welding operations
- Frictional heat
- Static
- Lightning
- Smoking materials
- Heated surfaces
- Radiant heat
- Electrical and mechanical sparks
- Spontaneous ignition (i.e. chemical reactions, pyrophoric material etc.)

HARMFUL EFFECTS OF HAZARDOUS MATERIALS (2-4.1.3.3, A-2-4.1.3.3)

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

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

An awareness of these items can help you limit the amount of harm by removing the hazard, or removing the people.
Being exposed to a hazardous material provides a chance for it to enter the body. It will do so in one of four ways.

1. Contact - skin surface hazard/damage (burns)
2. Absorption - includes entry through the eyes, skin and through punctures.
3. Inhalation - respiratory function
4. Ingestion - mouth

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. The responder must fully understand the potential hazards.
The 1996 *North American Emergency Response Guidebook* (NAERG) 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 name and generic hazards of the material(s) involved in the incident, and protecting themselves and the general public during the initial response phase of the incident.

The next several areas deal with the NAERG 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** will provide a guide page number when only a general placard or hazard is known.

**Yellow Pages** a listing of materials arranged by 4-digit UN/NA numbers (numerical index)

**Blue Pages** a listing of materials by name in alphabetical order (alphabetical index)

**Oranges Pages** the “guide pages” themselves

**Green Pages** Table of initial isolation and protective action distances

**White Pages** provide explanations and additional information
The goal of using the NAERG is to get guidance for the incident. Guidance is found in the orange or “guide” pages, so the first item is to determine which guide page to use. There are three methods to get to the appropriate guide page.

1. Four digit UN/NA ID number in the yellow pages (numerical index)
2. Name of the material in the blue pages (alphabetical index)
3. 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. Also the name of the material is listed in the next column.

In this example, the four digit ID number(1026) 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 5 different entries that lead to 3 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 14-15. If you are using this, you are working with limited information and should consult more specific guidance 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 phone.

HAZARDS ON EACH PAGE (2-2.3.2)

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

1. Fire and explosion hazard

2. Health hazards
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, this materials’ health hazards are more dangerous than the fire or explosion hazards.

**RESPONSE INFORMATION (2-4.1.4, 2-4.1.4.1)**

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

1. Emergency Actions (fire, spill or leak, and first aid)
2. Protective Clothing necessary
3. Initial isolation and protective action distances

**Emergency actions** take 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.

1. Street Clothing and Work Uniforms
2. Structural Fire Fighters’ Protective Clothing
3. Positive Pressure Self-Contained Breathing Apparatus (SCBA)
4. Chemical Protective Clothing and Equipment
To gain a better understanding of the protective clothing, look at page 343 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 almost always 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 **initial isolation 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 a small initial isolation 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 **Protective Action 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.

<table>
<thead>
<tr>
<th>DEFINITIONS OF PROTECTIVE ACTIONS (2-4.1.4.2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The protective actions listed in the NAERG include Isolate the hazard area and deny entry, evacuate, and In-place protection.</td>
</tr>
</tbody>
</table>

**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 area of 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 NAERG. Even after people move to the distances recommended, they may not be completely safe from harm. They should not be permitted to congregate at the incident scene. 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 a 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.

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**SHAPES OF ISOLATION AND PROTECTIVE ACTION ZONES**

(2-4.1.4.3)

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 298 and 299 in the NAERG, or use the picture on the next page.
DIFFERENCE BETWEEN SMALL AND LARGE SPILLS (2-4.1.4.4)

Take a look at the Table of Initial Isolation and Protective Action Distances. Starting on Page 300 (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), a one ton cylinder or multiple spills from many small packages. The day and night columns are based on sunrise and sunset.
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 that 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.

Many times when looking up distances and guidance in the NAERG 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 North American 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 NAERG also provides guidance for response initiation, though not specific for different areas.
ISOLATION TECHNIQUES/AREA DENIAL (2-4.1.5)

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

1. Use a vehicle to block a road.
2. Divert traffic.
3. Close doors and gates.
4. Public address systems
5. Place a rope or some other type of barricade across the entrance.

ACTIONS NECESSARY INVOLVING CRIMINAL OR TERRORIST ACTIVITY (2-4.1.6)

When responding to an incident that you suspect involved criminal or terrorist activities, you should do certain things to handle the situation. Always communicate your suspicion during the notification of the incident. Pass this information up the chain of command as soon as possible. Isolate potentially exposed people to protect them and others in the area. Document your initial observations, in case you are asked about them later.

INITIAL NOTIFICATION PROCEDURES (2-4.2)

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.

Sample Material Safety Data Sheet (MSDS)
I. PRODUCT IDENTIFICATION

HMIS HAZARD RATINGS Based on the National Paint & Coatings Associations HMIS rating system.

HEALTH HAZARD 3
FIRE HAZARD 0
REACTIVITY 1

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

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.

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 WT 100
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
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

II.  PHYSICAL DATA

BOILING POINT @ 760 mm Hg. -34ºC (-28.3ºF)
FREZING POINT: -101ºC (-150ºF)
VAPOR PRESSURE: 2748mm Hg @ 0ºC
SPECIFIC GRAVITY (H2O=1): 1.4 @ 15.4ºC
SOLUBILITY IN H2O % BY WT: 0.7 % @ 20ºC
VAPOR DENSITY (Air=1): 2.5

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

III.  FIRE AND EXPLOSION DATA

FLASH POINT: N/A
AUTOIGNITION TEMPERATURE: N/A
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.

IV. 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 pneumonia and pulmonary edema. Repeated exposure to chlorine may result in reduced pulmonary capacity and dental erosion.

SKIN: Contact with liquid chlorine may cause 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 pneumonia 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.

V. 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.
VI. 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.

SPECIFIC 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.

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 sulfonyl chloride. 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. 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 Clean 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).

X. 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 hypochlorite 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
**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

**CUSTOMER NUMBER**
**3930001**

**SEAL NO(S)**
**88288-90**

**CONSIGNMENT TO**
**JOHN OGORMAN**

**BILL TO**
**JPO INDUSTRIES**

**CUSTOMER ORDER NO.**
**90576 R-4**

**ORDERED BY AND DATE**
**AMH 713-444-2430**

**SUGGESTED SHIPPING DATE**
**11 04 98**

**REQUESTED DELIVERY DATE**
**11 06 98**

**ORDERER’S INITIATS**
**AMH 713-444-2430**

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**SPECIAL INSTRUCTIONS**
- 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 SHIPMENT IS PREPAID MAIL**
HAZMAT Chemical Company Inc.
Attention: Chemical Products Accounting
P.O. Box 1876
Houston, Texas 77251

**SHIPPED VIA MOTOR CARRIER**
DOT HAZARDOUS MATERIALS PLACARDS FURNISHED BY:
- SHIPPER
- CARRIER

Carrier certifies that the container supplied by Carrier for this shipment is a proper container for transportation of the Materials as described above.

Customer/Carrier’s Carrier certifies that the container supplied by it for this shipment is a proper container for transportation.

**DELIVERY RECEIPT - Received in good condition**

**Sample Shipping Paper for Training Use Only**
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

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* DANGEROUS *

| PMTZ 204049 | 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

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**EMERGENCY CONTACT:**
- **TO:** CONSIGNEE
- **FROM:** SHIPPER
- **INTERSTATE CHEMICAL**
- **WORLD CHEMICAL**
- **PUEBLO, CO**
- **SANFIELD, UT**

**Phone Number:** 1-800-424-9300

**Note:** All shipments are HAZMAT and require special handling.

**Dangerous Goods:**
- Alcohol, NOS
- Flammable
- Acetic Acid, Glacial
- Corrosive
- Poison Gas
- Chlorine
- Hexamethylenediamine Solution

**Special Instructions:**
- Residue: Last contained
- Poison - Inhalation Hazard
- Marine Pollutant

**Consignee:**
- BIG 3 GAS INC
- DENVER WATER WORKS

**Shipper:**
- FARMLAND INDUSTRIES
011 UTPX 932079
**************************
* DANGEROUS *
**************************

EMERGENCY CONTACT:
1-800-424-9300
TO:  CONSIGNEE
     BIG 3 GAS CO
     SANTA FE NM
FROM:  SHIPPER
       ZAR COOLING COMPANY
       FTCOLLINS CO

012 OBX 11401
**************************
* DANGEROUS *
**************************

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