

Firefighter Con Ed

Hazardous Materials Identification

Placards, Labels, Transportation and Storage

The purpose of this training bulletin is to familiarize the members of the Fire Service on the recognition and identification of Hazardous Materials to the Awareness and Operations levels. Many individuals confuse Hazardous Material and Weapons of Mass Destruction incidents as one in the same. While each classification may have similar aspects and responses, it is important to remember that the majority of Hazardous Material incidents are accidental in nature while Weapons of Mass Destruction incidents are intentional, adding additional concerns.

In this Continuing Education we will review some information, and we will also review techniques used in identifying the Hazardous Materials that are involved in an emergency. We will specifically concentrate on Placards, Labeling, Transportation Vehicles and Storage Facilities.

In the State of Ohio all Police, Fire and EMS personnel are required to meet the standards of WMD response dependent on their response role. We will review the levels of training, basic responsibilities of the Awareness Level response and understanding Hazardous Materials.

There are five levels of Hazardous Materials response training:

- Awareness
- Operations
- Technician
- Specialist
- On Scene Incident Commander

First Responder Awareness: Responders at the Awareness Level are individuals who are likely to witness or discover a hazardous substance release and who have been trained to initiate an emergency response sequence by notifying the proper authorities of the release. They would take no further action beyond notifying the authorities of the release.

- First Responders must be able to perform basic:
 1. Recognition
 2. Identification
 3. Isolation/protection
 4. Notification
 5. Initiation of the Incident Command System
- First Responders must be able to understand Hazardous Materials:

1. Potential Outcomes
 - Chemical Exposure
 - Thermal (Fire and/or Explosion)
 - Asphyxiation
 - Ionizing Radiation
 - Alpha Particles
 - Beta Particles
 - Gamma/X
 - Neutron
 - Etiological
 - Mechanical
2. Routes of Exposure
 - Inhalation
 - Ingestion
 - Absorption
 - Injection
3. Exposure to Hazards
 - Acute
 - Chronic
4. Terrorist Events
 - Intentional Release
 - Secondary Devices
 - Infliction of Mass Casualties
5. Terrorists Chemical Agents
 - Choking Agents
 - Blood Agents
 - Blister Agents
 - Nerve Agents
6. Emergency Medical Care
 - Safety First
 - If in Doubt – Do Not Expose Yourself

In this education packet we will concentrate on identifying Hazardous Materials considering the methods of transportation, storage containers and identifying markers.

A. Transportation Sources:

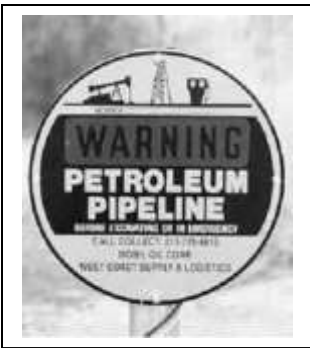
- a. Marine
- b. Pipeline
- c. Air
- d. Highway
- e. Rail

1. Marine:

- a. Is used as a source of delivery for Hazardous Materials;
- b. Shipping containers can be in the form of a trailer that is simply off loaded to a dock and hooked to a truck or placed on a rail car for transportation.
- c. Quantities of hazardous materials can be large.

2. Pipeline: Carry a wide variety of products including;

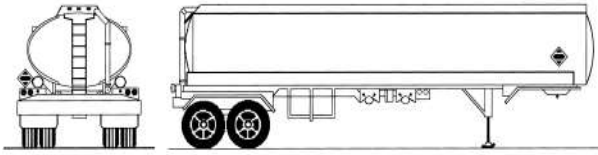
- a. Natural Gas
 - b. Crude Oil
 - c. Gasoline
 - d. Diesel
 - e. Heating Oil
- i. **Note: Whenever a pipeline crosses transportation routes they are required to have markers with information as to what the pipeline carries and who to contact in case of emergency.**



3. Air: Usually found in small packages.

4. Highway:

- a. Responders are more likely to have a hazardous incident related to highway transportation than with any other mode.
- b. Many different types of containers are used in highway transportation.
- c. First responders should familiarize themselves with these containers so that a rapid identification can be made for responder safety. We will give examples of various transportation containers with examples of typical cargo.

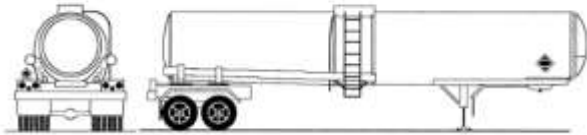


i. DOT/MC 306 Non-Pressure Tank:

1. OPS pressure less than 3 PSI
2. New tanks aluminum
3. 9,000 gallon capacity
4. Oval/Multiple compartments
5. Examples include; Gasoline, Fuel Oil, Alcohol, Other Flammable/Combustible Liquids

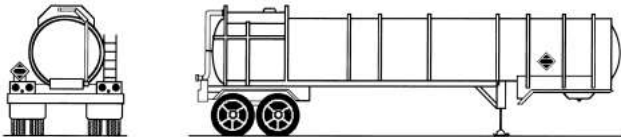
ii. DOT/MC 307 Low Pressure Tank:

1. OPS 25-40 PSI
2. Steel tank/may be rubber lined
3. 6,000 typical capacity
4. Single outlet bottom discharge for each compartment
5. Rollover protection
6. May have multiple compartments
7. Examples of cargo: Flammable/Combustible Liquids, Acids, Caustics, Poisons.



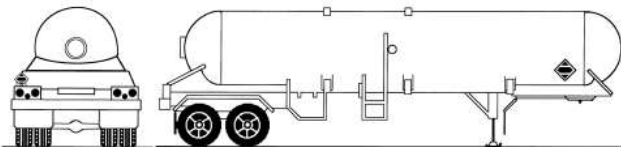
iii. MC-312 Corrosive Liquid Tank:

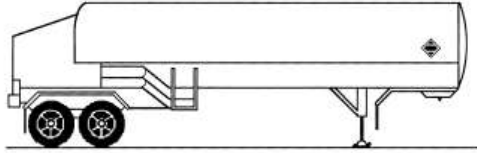
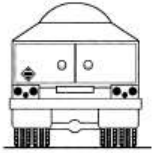
1. OPS pressure less than 75
2. Typical capacity 6,000 lbs
3. Steel Tank may be rubber lined
4. Top Loading at center or rear
5. Small diameter for length
6. Examples of cargo: Corrosive Liquids, Typically Acids



iv. MC-331 High Pressure Tank:

1. OPS pressure up to 300 PSI
2. 11,500 gallon capacity
3. Single steel/non-insulated compartment.
4. Bolted manhole at front or rear
5. Round/dome ends
6. Typically painted white or other reflective color
7. May be marked Flammable Gas and Compressed Gas
8. Cargo examples: Pressurized Gases & Liquids, Anhydrous Ammonia, Propane, Butane, Other Gases Liquefied under pressure.

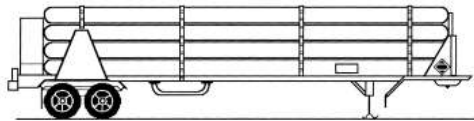
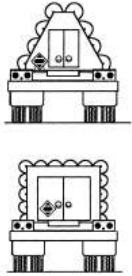




v. MC-338 Cryogenic Liquid Tank:

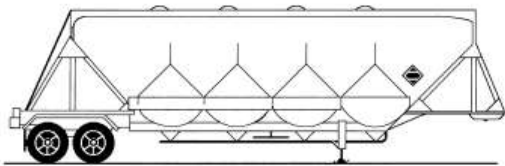
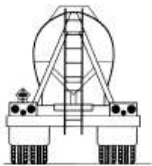
1. OPS pressure less than 22 PSI
2. Well insulated thermos bottle like steel tank
3. May have vapor discharging from relief valves
4. Round tank with some type of cabinet at rear
5. Cargo examples: Liquid Oxygen, Liquid Nitrogen, Liquid Carbon Dioxide, Liquid Hydrogen, Other Gases liquefied by lower their temperature.

vi. Compressed Gas/Tube Trailer:



1. OPS pressure at 3,000-5,000lbs
2. Gases only
3. Individual steel cylinders stacked and banded together
4. Typically will have over pressure device for each cylinder
5. Bolted manhole at front or rear
6. Protected valves at rear
7. Flat truck with multiple cylinders stacked in modular shape
8. Cargo Examples: Helium, Hydrogen, Methane, Oxygen, Other Gases.

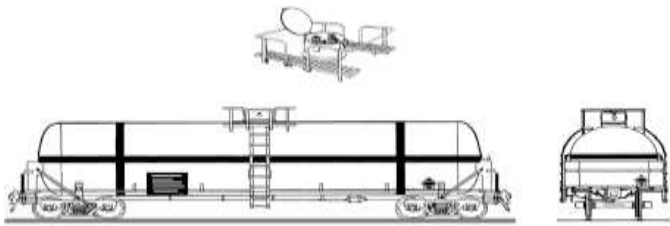
vii. Bulk Cargo Tanker:



1. OPS pressure less than 22 PSI
2. Typically not under pressure
3. Top side manholes
4. Bottom valves/air assisted loading and unloading
5. Shapes vary but it will have hoppers
6. Cargo Examples: Calcium Carbide, Oxidizers, Corrosive Solids, Cement, Plastic Pellets, Fertilizers.

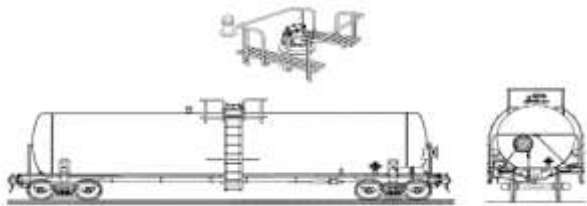
5. Railroad:

- a. Responders should be aware of locations of railroad lines.
- b. There should be a list of telephone numbers for immediate contact with the railroad company should an incident occur. This may be kept at the Dispatch Center.
- c. Responders should be familiar with railcar types to assist in rapid identification of a hazardous incident. We will give some examples of various types and some characteristics.



i. Pressure Tank Cars:

1. Will have all fittings inside a dome on top of the car.

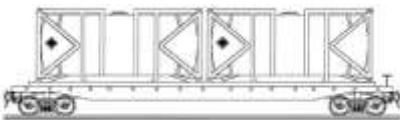
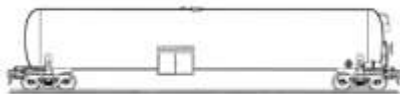


ii. Non-Pressure Tank Cars:

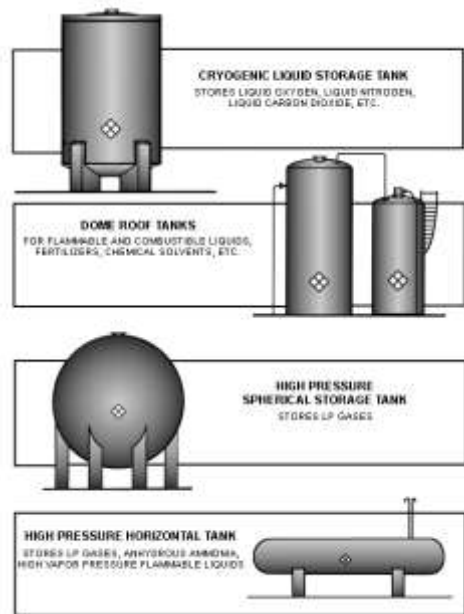
1. Can be identified by the presence of multiple fittings on the top and/or bottom of the car
2. When in doubt, always consider a tank car under pressure until proven otherwise.

iii. Other Types of Cars Include:

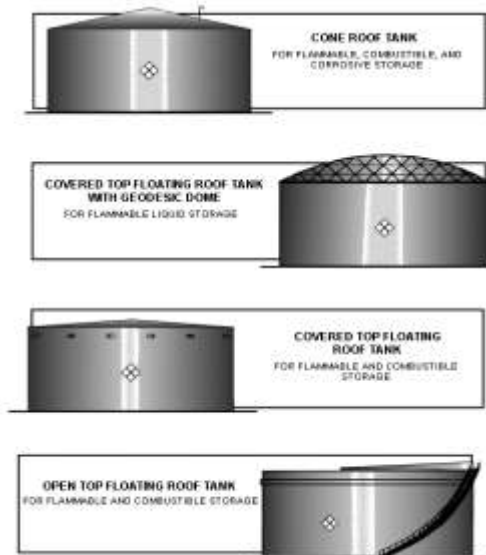
1. Covered Hopper – bulk dry goods
2. Pneumatic Hopper – flow-able dry goods
3. Gondola
4. Box Car
5. Open Top Hopper
6. Cryogenic Car
7. Flat Bed with Inter-modal
 - a. COFC (container on flat car)
 - b. TOFC (tank on flat car)



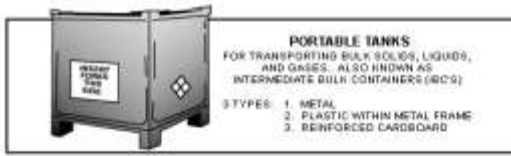
2. Storage Containers:



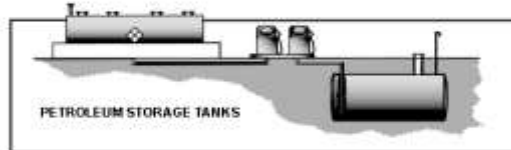
- a. **Cryogenic Liquid Storage Tank:**
 - i. Stores Liquid Oxygen, Liquid Nitrogen, Liquid Carbon Dioxide, Etc.
 - ii. Pressure is less than 100 PSI
- b. **Dome Roof Tanks:**
 - i. For Flammable/Combustible Liquids, Fertilizers, Chemical Solvents, Etc.
 - ii. Pressure is less than 100 PSI
- c. **High Pressure Spherical Storage Tank:**
 - i. Stores Liquid Petroleum Gas
 - ii. Designed to handle internal pressure higher than 100 PSI
- d. **High Pressure Horizontal Tank:**
 - i. Stores Liquid Petroleum Gases such as Anhydrous Ammonia and additional High Pressure Flammable Liquids
 - ii. Designed to handle internal pressures higher than 100 PSI.



- e. **Cone Roof Tank:**
 - i. Found in Petroleum Tank Farms;
 - ii. For Flammable, Combustible and Corrosive Storage.
- f. **Covered Top Floating Roof Tank With Geodesic Dome:**
 - i. Found in Petroleum Tank Farms
 - ii. Flammable Liquid storage.
- g. **Covered Top Floating Roof Tank:**
 - i. Found in Petroleum Tank Farms
 - ii. Flammable and Combustible storage.
- h. **Open Top Floating Roof Tank:**
 - i. Found in Petroleum Tank Farms
 - ii. Flammable and Combustible storage.



- i. **Portable Tanks:**
 - i. For transporting bulk solids, liquids and gases.
 - ii. Can carry more than 400 gallons of product.
 - iii. Also known as an Intermediate Bulk Containers (IBC's).
 - iv. 3 Types:
 - 1. Metal
 - 2. Plastic within metal frame
 - 3. Reinforced cardboard



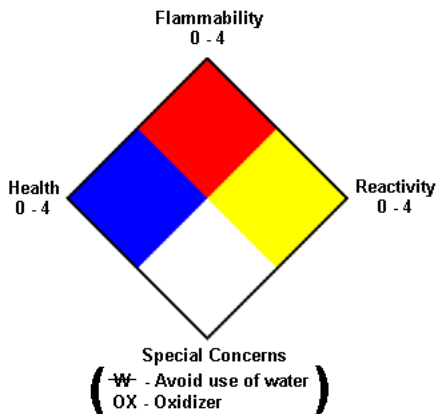
- j. **Petroleum Storage Tanks:**
 - i. Above ground tank in a vault
 - ii. Underground Storage Tanks (UST's)



- k. **Horizontal Tanks:**
 - i. For Flammable and Combustible Liquids, Corrosives, Poisons, Etc.

- l. **Miscellaneous Containers: Various Sizes:**
 - i. Drums
 - ii. Cylinders
 - iii. Boxes
 - iv. Bottles
 - v. Pails
 - vi. Etc.

3. Markings and Colorings:

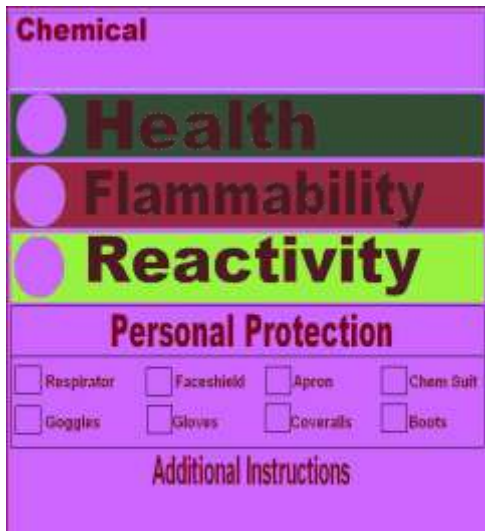


1. National Fire Protection Association (NFPA) 704 System:

- a. Special markings and colors are used for rapid recognition and identification of hazardous materials.
- b. Each area is rated on a 0-4 scale.
 - i. 0 is the **Least** Hazardous.
 - ii. 4 is the **Most** Hazardous.
 - iii. Four areas it addresses:
 - 1. Health – Blue
 - 2. Flammability – Red
 - 3. Reactivity – Yellow
 - 4. Special Concerns – White

2. Hazardous Materials Information System (HMIS):

- a. Similar to the NFPA 704 labeling system
- b. Uses the same colors and numbers, as NFPA 704, on a label or sign to define basic hazards
- c. This system uses a vertically stacked color bar chart to indicate:
 - i. Health – Blue
 - ii. Fire/Flammability – Red
 - iii. Reactivity – Yellow
 - iv. Personal Protective Equipment (PPE) to be worn – White
- d. Each of the four colors rate the degree of the hazard
 - i. 0 is the **least** hazard
 - ii. 4 is the **greatest** hazard
- e. White section does NOT have a numerical scale, it advises the level of PPE necessary
 - i. May be stated verbally in the box
 - ii. By a letter system to identify the PPE requirements
 - iii. May have icons in the box indicating the PPE necessary



4. Placards and Labels:

1. Placards:

- a. Diamond shaped, 10-3/4 inches square
- b. Are required to be displayed on all four sides of a transport vehicle carrying hazardous materials
- c. The placard provides information as to the possible presence of hazardous materials
- d. Information is presented in the form of:
 - i. A colored background
 - ii. A symbol at the top
 - iii. A United Nations hazard class number at the bottom
 - iv. Hazard class wording or an identification number in the center

2. Labels:

- a. Similar to placards in appearance
- b. Must be securely affixed to packages containing hazardous materials
- c. Should be located near the proper shipping name
- d. Must not be obscured by other markings

5. United Nation Hazard Classes:

- f. The System was devised to provide an international standard of identification for hazardous materials.
- g. UN hazard classification system is integrated into the Department of Transportation's (DOT) warning system for recognition of hazardous materials.
- h. Components of the UN hazard class system are combined on DOT placards or labels.
- i. Indicate specific properties and warnings of hazardous materials.
- j. These markings include:
 1. UN Hazard Class Number
 - a. Located in the bottom corner of the placard/label
 2. UN ID Number
 - a. Required on bulk loads and must be present on the placard
 - b. Or on an orange sign immediately adjacent to the placard
 - c. Must be written on the shipping papers or manifest.
- k. The primary hazard of each chemical can be determined by the hazard class and division that it is shipped under.



1. Class 1: Explosives:

1. Primary Hazard is the separation of body parts. Below are additional classifications and examples:
 - a. 1.1 Mass Explosives – Dynamite
 - b. 1.2 Projection Hazards – Flares

- c. 1.3 Mass Fire Hazards – Display Fireworks
- d. 1.4 Minor Hazards – Ammunition
- e. 1.5 Very Insensitive – Explosive Devices

2. Class 2: Compressed Gasses:



- 1. Primary Hazard is a pressure explosion.
- 2. Secondary Hazard is fire, toxics, etc.
- 3. Every chemical will have more then one secondary hazard but will be shipped under only one primary hazard class.
 - i. Example: Gasoline is flammable and poisonous but is shipped only under the flammable hazard class
- A. 2.1 Flammable Gases – Propane
- B. 2.2 Non-Flammable Gases – Helium
- C. 2.3 Poisonous/Toxic Gases – Fluorine, Compressed

3. Class 3: Flammable Liquids:



- 1. Primary Hazard is they can ignite and burn
- 2. Placard is red with white lettering

4. Class 4: Flammable Solids:



- 1. Can be very difficult to extinguish
- 2. May require specific materials for extinguishment
- 3. May be red with white stripes, half red half white or blue
- 4. A road flare would be classified as a flammable solid
- 5. Sub-classes:
 - a. 4.1: Flammable Solids – Magnesium
 - b. 4.2 Spontaneously Combustible – White Phosphorus
 - c. 4.3 Spontaneously Combustible When Wet - Sodium



5. Class 5: Oxidizers/Organic Peroxides:



1. An Oxidizer will allow products that do not normally burn to burn
2. Yellow background with black lettering
3. It can allow a product that normally burns to burn explosively
4. Organic Peroxides have both fuel and oxygen in their chemical make-up.
5. All they need to ignite is heat.
6. Sub-classes:
 - a. 5.1: Oxidizers – Ammonium Nitrate
 - b. 5.2: Organic Peroxides – Methyl Ethyl Ketone Peroxide.

6. Class 6: Toxic Materials and Infectious Substances:



1. Poisonous, toxic or infectious substances that are not compressed gases (Class 2).
2. White background with black lettering.
3. Sub-classes:
 - a. 6.1: Poison (Toxic Material) – Potassium Cyanide
 - b. 6.2: Infectious Substances – Anthrax Virus

7. Class 7: Radioactive Materials:



1. Radioactive – Uranium
2. White background or White/Half Yellow
3. Remember the three types of radioactive materials
 - a. Alpha
 - b. Beta
 - c. Gamma

8. Class 8: Corrosives:



1. Primary Hazard is destruction of tissue and metals
2. Half White/Half Black background
3. Corrosives – Battery Fluid

9. Class 9: Miscellaneous:



1. Most hazardous wastes are shipped in this class
2. White background with black stripes on top half
3. Miscellaneous Hazardous Materials – Polychlorinated Biphenyls (PCB)
4. Other Regulated Material – Domestic (ORM-D) – Food Flavorings, Medicines

10. Associated Placard Colors:

1. Orange – Indicates Explosive
2. Red – Indicates Flammable
3. Green – Indicates Non-Flammable Gas
4. Yellow – Indicates Oxidizing Material
5. White – Indicates Toxic/Poisonous Material
6. White With Vertical Red Stripes – Indicates Flammable Solid
7. Yellow Over White – Indicates Radioactive Material
8. White Over Black – Indicates Corrosive Material
9. Blue – Indicates Water Reactive Substances

11. Dangerous Placard:

1. First Responders will have no idea what hazardous materials are being transported when the Dangerous placard is being used.
2. A freight container, unit load device, transport vehicle or rail car which contains bulk packaging with two or more categories of certain hazardous materials that require different placards may be placarded with **Dangerous** placards instead of the separate placards for each of the materials.
3. In these instances responders will have to identify, and utilize, information using additional resources.

12. Shipping Papers and Material Safety Data Sheets (MSDS):

1. Shipping papers and MSDS's are important sources of information.
2. They must be available in all modes of transportation or any business or industry.
3. Although they may not be accessible to the responder at an emergency scene.
4. Be sure to ask on-scene personnel if there are additional copies via other means.
5. The Shipping Paper will usually have the hazard listed in the following ways:
 - a. Listed first on the shipping document;
 - b. May be highlighted by a different color;
 - c. May be marked in a special hazardous materials column
6. Shipping papers describe the hazardous materials being transported, if transporting non-hazardous materials also the hazards will be defined separately;
7. Shipping orders, bill of lading, and manifests are all shipping papers.

13. Material Safety Data Sheet:

1. An MSDS is required, by law, to be available to anyone who requests them;
2. An MSDS will give information on the hazard that each product presents;
3. An MSDS sheet is a written, or printed, document about the material being transported;
4. The contents of the MSDS will address issues concerning the hazardous chemical which includes:
 - a. Name of the chemical;
 - b. Emergency response phone numbers;
 - c. NFPA and/or HMIS information
 - d. Hazards and First Aid procedures.

14. Human Senses:

1. NEVER deliberately use your own sense of taste or smell to identify a hazardous material, however, do not forget that a victim or witness may have already used these senses and may be of great benefit if asked what the product smelled like and how they are feeling.
 - a. Odors can indicate the presence of hazardous materials
 - b. If you can smell a hazardous material it is time to GET OUT!
 - c. Some odors, such as rotten fruit or eggs, or freshly cut grass, are characteristic of certain hazardous materials
 - d. Clandestine labs produce distinct odors dependent on the materials and methods involved in the drug manufacturing process
 - e. Some chemicals may rapidly desensitize your sense of smell;
 - f. The unique color of smoke, or flame, can help identify the presence of hazardous materials
 - g. Irritation to the eyes, or skin, can also be an indication of something hazardous
 - h. The most important sense that responders have to give an indication of a hazardous material release is the sense of hearing. Sounds of hissing, fizzing or whistling are all indications of an escaping gas or reaction. A high pitched sound could indicate the potential for a BLEVE.

In summary, with the ever changing modern world, the members of the Fire Service will have an increasing chance of responding to a Hazardous Material incident. Whether we encounter these incidents on the highway, airport, shipping port or an industrial setting, our members must recognize, very early in the incident, of the possibility of the incident involving hazardous materials. Once the potential is recognized, our members need the knowledge to initiate the proper response. Many lives may depend on the early initiation of the proper response.