Hazard Communication

for Flammable, Toxic & Caustic Substances

Course Information

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Data Sources:

- Hazard Communication Standard, 29 CFR 1910.1200, OSHA
- Draft Model Training Program for Hazard Communication, U.S. Dept. of Labor, Occupational Safety and Health Administration
- ACA Standards for Institutions, 2004 Supplement, Appendix D: Guidelines for the Control and Use of Flammable, Toxic and Caustic Substances
- OP-150310, Hazard Communications Program

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ELM Code: DOC 450

Photography Credits

Our warmest thanks to the Jackie Brannon Correctional Center employees who agreed to appear in photos illustrating this course:

Sid Young, Maintenance Supervisor

David Nelms, Safety Consultant

Course Objectives

At the end of this course, students will be able to:

1. Understand the agency's hazard communication plan.
2. Identify the OSHA categories of hazardous chemicals.
3. Learn to understand the information on chemical labels and placards.
4. Understand the physical and health hazards of chemicals in the work area.
5. Learn methods of detecting the presence or release of a hazardous chemical in the workplace.
6. Identify protective measures an employee can take to avoid being harmed by hazardous chemicals.

Introduction

Welcome! This course was written to provide employees with information to recognize chemical hazards and take appropriate protective measures. This course will give employees a basic understanding of this serious subject.

Additional training will also be given at the work site when there is a change in chemical inventory and operation. This on-site training will be specific and provided to address any changes at that location.

Index

This index contains links to each chapter in the course. Employees who are taking the course for the first time should go through all the material by clicking on link #1 below. The course can also be used as a reference guide by clicking on the link of the section you want to review (see links below). You may return to this index from any slide by clicking the "Index" icon on the lower right side of the slide.

1. Click here to start course.

2. Hazard Communication Standard

3. Your Right to Know

4. Material Data Safety Sheets

5. Labels

6. DOT Placards

7. Categories, Health Hazards, Methods of Detection, First Aid, Emergency Procedures, and Use of Personal Protective Equipment (grouped by chemical category)

8. Knowledge Assessment

9. Conclusion

Hazard Communication Standard

(HCS)

Understanding the Hazard Communication Standard (HCS)

Our hazard communication program is based on the HCS. Just what is the HCS? It's an OSHA regulation that requires chemical manufacturers, suppliers, and importers to assess the hazards of the chemicals that they make, supply, or import, and to inform employers, customers, and workers of these hazards through MSDS information.

Understanding the Hazard Communication Standard (HCS)

How does a chemical earn the designation of hazardous?

- Manufacturers/importers evaluate their products
- If hazardous, an MSDS (material safety data sheet) is prepared and sent to customers/purchasers
- If non-hazardous, chemicals are not covered by the HCS.

Hazardous Chemicals: Your Right to Know

Understanding the Hazard Communication Standard (HCS)

How do employees learn about these hazards? Hazard information is communicated through:

- Container labeling
- Material safety data sheets (MSDS)
- Employee training (see examples on next slide)

Understanding the Hazard Communication Standard (HCS)

The Maintenance Supervisor shows employees a new chemical and explains its label and MSDS.

The Safety Consultant shows employees air monitoring equipment used to detect hazards in the workplace.

Your Right to Know

Our agency recognizes that its employees have a right to know the properties and potential safety and health problems of chemicals to which they may be exposed.

Unit/department supervisors must maintain an up-to-date "Chemical Inventory List" (CIL) of hazardous chemicals in their work areas. They must also maintain a Material Safety Data Sheet (MSDS) for each chemical listed on the Chemical Inventory List.

Your Right to Know

Unit/department supervisors will ensure that both the Chemical Inventory List and the Material Safety Data Sheets are accessible for review by employees and offenders.

What this means is you have the right to examine the list and data sheets.

Your Right to Know

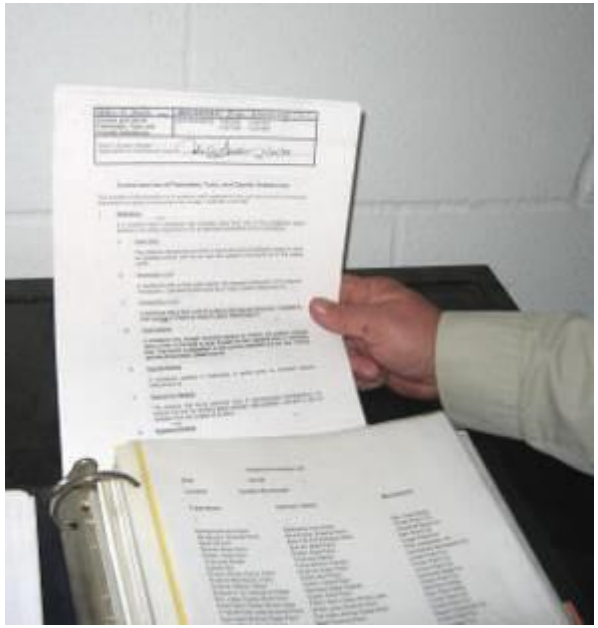
Example: The Jackie Brannon CC Safety Consultant keeps the MSDS and Chemical Inventory List documentation in his office, where any employee has the right to examine the material. Documentation is also kept in the hazardous material storage building.

Material Safety Data Sheets

(MSDS)

Material Safety Data Sheets

Material Safety Data Sheets (MSDS) are the primary source of information about a hazardous chemical. They are designed for workers and emergency personnel by the manufacturers of the chemicals.



When we order a hazardous chemical, it is shipped with a MSDS. These sheets are kept on file at each facility, typically in a loose-leaf binder with accompanying documentation.

Material Safety Data Sheets

Material Safety Data Sheets can vary in format, but the following information is usually present:

- Product name
- Incompatibilities
- Hazardous ingredients and exposure limits
- Required Personal Protective Equipment (PPE)
- Health hazards
- Exposure symptoms
- Fire, explosion and reactivity hazards
- Manufacturer
- Precautions for safe handling, storage and use
- Chemical characteristics
- Disposal methods
- Spill or leak procedures
- Transportation data
- Regulatory reporting requirements
- First-aid procedures

Material Safety Data Sheets

Material Safety Data Sheets (MSDS) contain many sections full of detailed information about a particular hazardous chemical. Let's examine some sections of a sample MSDS on the following slides.

MSDS, Example 1

The MSDS will contain the manufacturer's name. It will also contain the name/identity of the chemical. This may be a trade name, or the common chemical name. If the chemical is a mixture and/or particular strength, that will be shown as well.

MSDS *Material Safety Data Sheet*

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-995-5666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

HYDROCHLORIC ACID (10%-33%)

1. Product Identification

Synonyms: This MSDS applies to the concentrated standard used to make laboratory solutions and any solution that contains more than 10% but less than 33% Hydrochloric acid. For diluted product, see MSDS for Hydrochloric Acid (less than 10%). For saturated solution
CAS No.: 7647-01-0
Molecular Weight: 36.46
Chemical Formula: HCl in H2O
Product Codes:
J.T. Baker: 0323, 0327, 0365, 4654, 4657, 5618, 5619
Mallinckrodt: 2609, 2625, H151, H168, V035

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Hydrogen Chloride	7647-01-0	10 - 33%	Yes
Water	7732-18-5	67 - 90%	No

MSDS, Example 2

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

This section explains the hazards associated with this particular chemical, including the potential for fire, explosion, and physical harm.

MSDS, Example 3

Potential Health Effects

Inhalation:
Corrosive! Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death.
Ingestion:
Corrosive! Swallowing hydrochloric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea, and in severe cases, death.
Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and discolor skin.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

This section discusses health hazards, both immediate and long-term.

MSDS, Example 4

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

This information is useful in the event of an exposure.
It contains special first aid instructions.

MSDS, Example 5

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard. May react with metals or heat to release flammable hydrogen gas.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Water or water spray. Neutralize with soda ash or slaked lime.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving hydrochloric acid. Stay away from ends of tanks. Cool tanks with water spray until well after fire is out.

This section is self-explanatory. Some of this information is meant for emergency responders, but employees can also benefit from this knowledge.

MSDS, Example 6

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

These sections contain additional precautions and guidelines.

MSDS, Example 7

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Hydrochloric acid:
- OSHA Permissible Exposure Limit (PEL):
5 ppm (Ceiling)
- ACGIH Threshold Limit Value (TLV):
2 ppm (Ceiling), A4 Not classifiable as a human carcinogen

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece respirator with an acid gas cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

See text on next slide.

Material Safety Data Sheets

The previous slide discussed exposure controls and personal protection. OSHA has established "permissible exposure limits" (PELs). These limits indicate maximum acceptable levels of exposure to particular chemicals.

- The ***employer*** is responsible for developing controls that ensure PELs are not exceeded.
- ***Employees*** are responsible for using protective measures provided by the employer and being alert to the potential for possible overexposures.

MSDS, Example 8

This section is self-evident, identifying how the substance looks and smells.

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Pungent odor.
Solubility:
Infinitely soluble.
Density:
1.05 @ 15C (59F)
pH:
For HCL solutions: 0.1 (1.0 N), 1.1 (0.1 N), 2.02 (0.01 N)
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
101 - 103C (214 - 217F)
Melting Point:
No information found.
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
No information found.

MSDS, Example 9

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
When heated to decomposition, emits toxic hydrogen chloride fumes and will react with water or steam to produce heat and toxic and corrosive fumes. Thermal oxidative decomposition produces toxic chlorine fumes and explosive hydrogen gas.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
A strong mineral acid, concentrated hydrochloric acid is highly reactive with strong bases, metals, metal oxides, hydroxides, amines, carbonates and other alkaline materials. Incompatible with materials such as cyanides, sulfides, sulfites, and formaldehyde.
Conditions to Avoid:
Heat, direct sunlight.

This section contains important information on how to store the chemical, incompatible substances, and decomposition hazards.

MSDS, Example 10

12. Ecological Information

Environmental Fate:
When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater.
Environmental Toxicity:
This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

This section includes disposal guidelines.

MSDS, Example 11

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Avoid breathing vapor or mist.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 8.

This section includes the label information, which is covered in the next section of this course.

Labels

Labels

Did you know that OSHA requires manufacturers, suppliers and importers to label containers of chemicals? The purpose of these labels is to provide an immediate hazard warning. Labels must contain:

- The name of the hazardous chemical, as it appears on the MSDS
- An appropriate hazard warning in English
- The name and address of the manufacturer, importer, or supplier

Labels

There are several labeling systems in use. They include:

- ANSI (American National Standards Institute)
- NFPA (National Fire Protection Association
- HMIS (Hazardous Materials Identification System)
- DOT (Department of Transportation)

The next slides will explain each of these systems.

Labels: ANSI

ANSI labels show the chemical name, a signal word (Danger, Warning or Caution), the hazards posed by the substance, and a precautionary statement.

Signal Words

ANSI Label

Labels: NFPA

NFPA labels are designed to protect emergency response personnel from the dangers of hazardous materials stored in stationary containers. They contain sections showing the degree of hazard for health, fire, reactivity, and specific hazard, such as water-reactive substances. Each chemical will have different values, depending on the degree of hazard in each category. (See next slide for an example.)

Labels: NFPA

Fire Hazard

4- Very Flammable

3- Readily Ignitable

2- Ignited with Heat

1- Combustible

0- Will not Burn

Reactivity Hazard

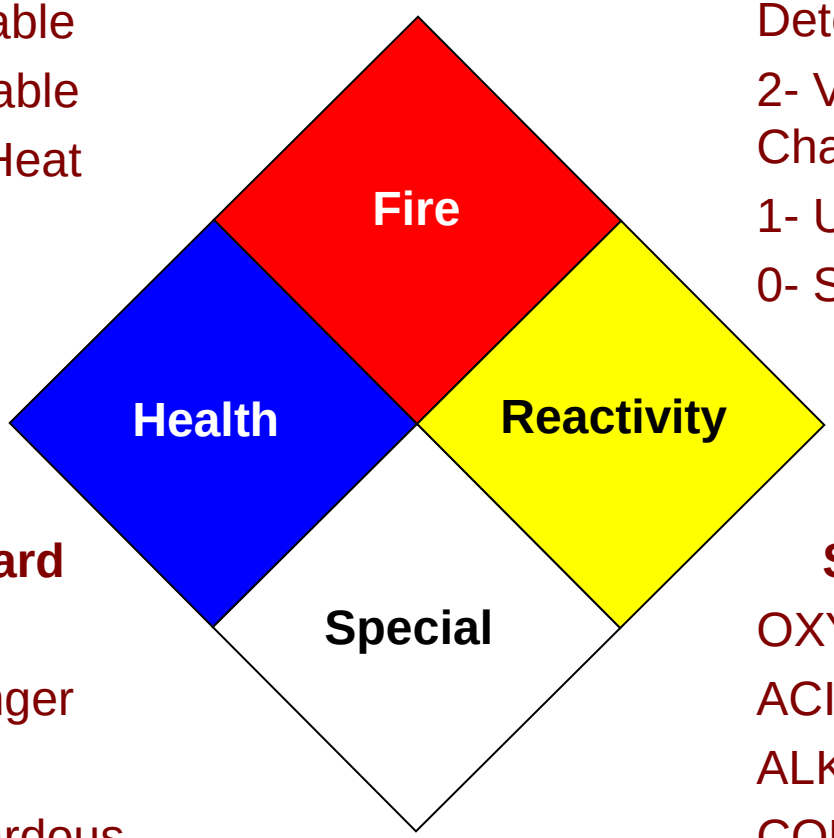
4- May Detonate

3- Shock & Heat May Detonate

2- Violent Chemical Change

1- Unstable if Heated

0- Stable



Health Hazard

4- Deadly

3- Extreme Danger

2- Hazardous

1- Slightly Hazardous

0- Normal Materials

Special Hazard

OXY - Oxidizer

ACID - Acid

ALK - Alkali

COR - Corrosive

~~W~~ – Use No Water

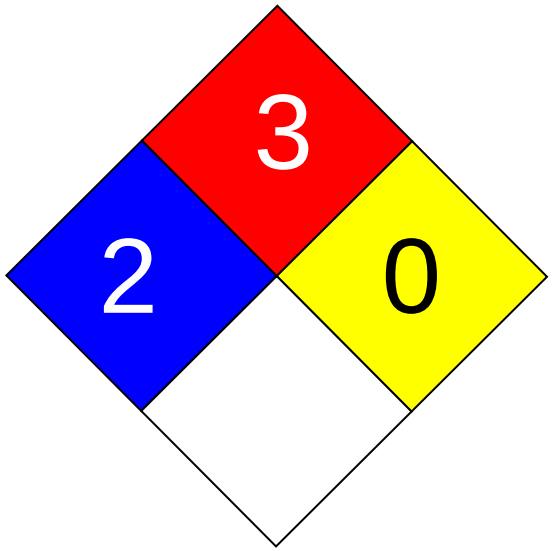
Labels: NFPA

Sample NFPA Label

This label for methanol shows a health hazard of 2, which means "Hazardous"; a fire hazard of 3, which means "Readily Ignitable"; and a reactivity hazard of 0, which means "Stable." There is no special hazard, so the white diamond is blank.

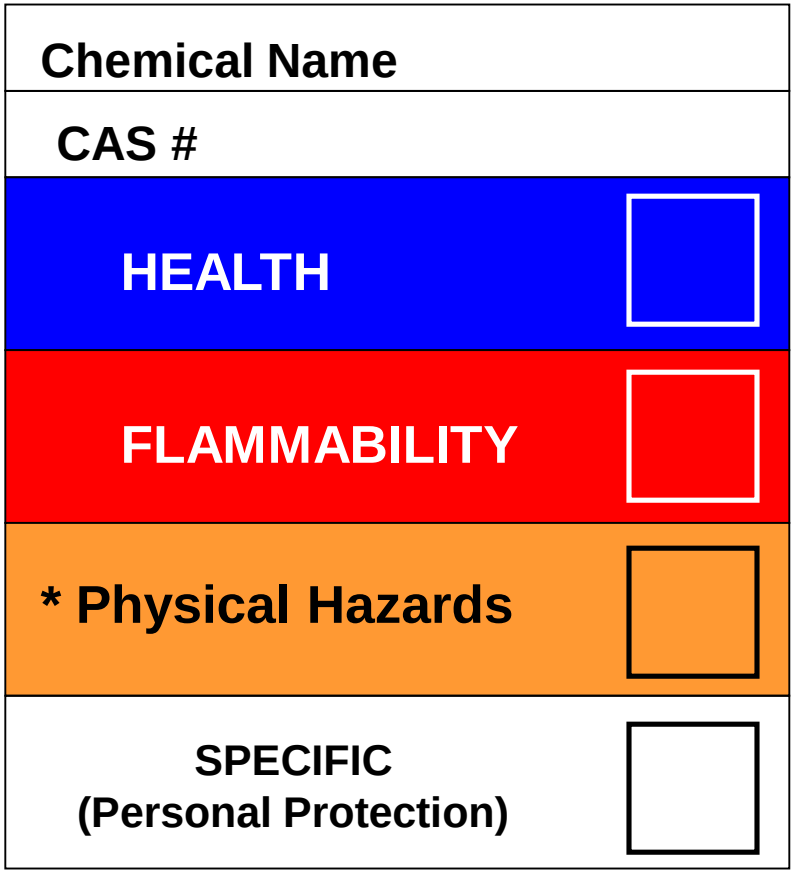
Methanol
(Wood Alcohol)

CAS Number: 67-56-1
Molar Mass: 32.042 g/mole
Density: 0.791 g/cm^3
Boiling Point: 65.5 ^{o} C
Precautions: Flammable, Toxic



Labels: HMIS

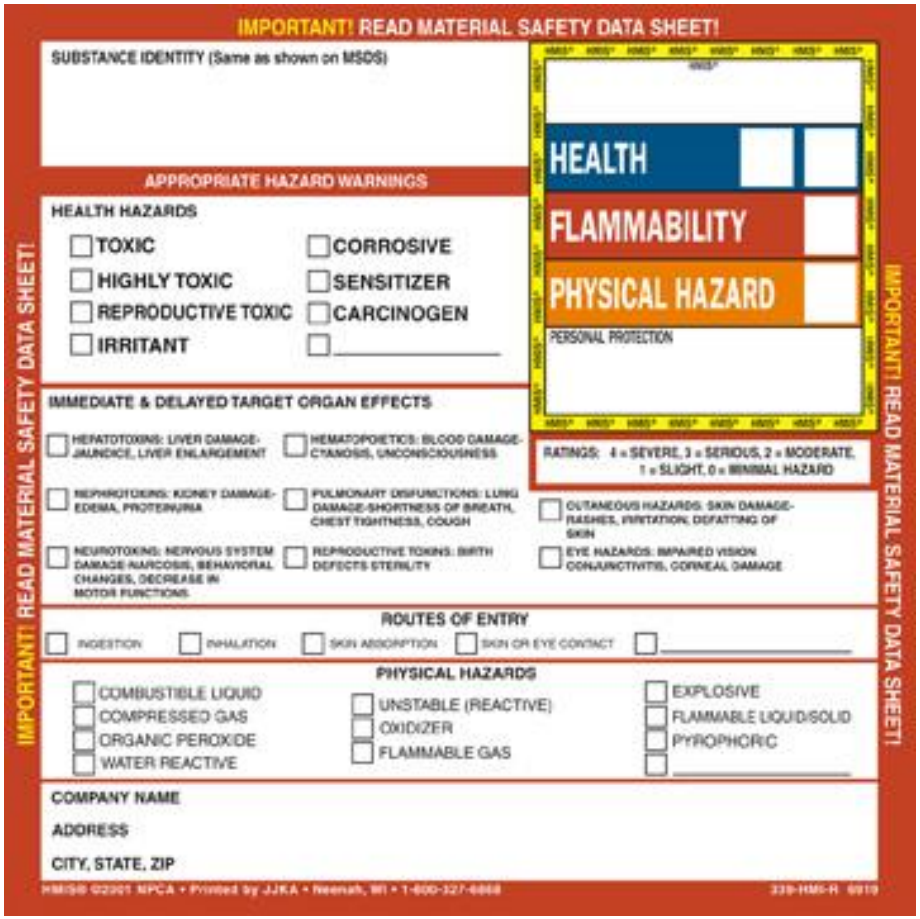
HMIS labels were originally designed for the paint and coatings industry. They use the same color codes and numerical ratings as the NFPA diamond labels. The categories are similar to those used by NFPA.



*** The orange section titled "Physical Hazards" was formerly colored yellow and titled "Instability" until April of 2002, when HMIS III standards were adopted..**

Labels: HMIS

HMIS labels are proprietary, and are not used by all vendors. Some employers use hybrids of the two systems. (OSHA permits use of any labeling system as long as it meets their labeling performance requirements.)



Blank HMIS III Label

Labels: Summary of HMIS Label Categories

Number ratings for each category indicate the following degrees of hazard:

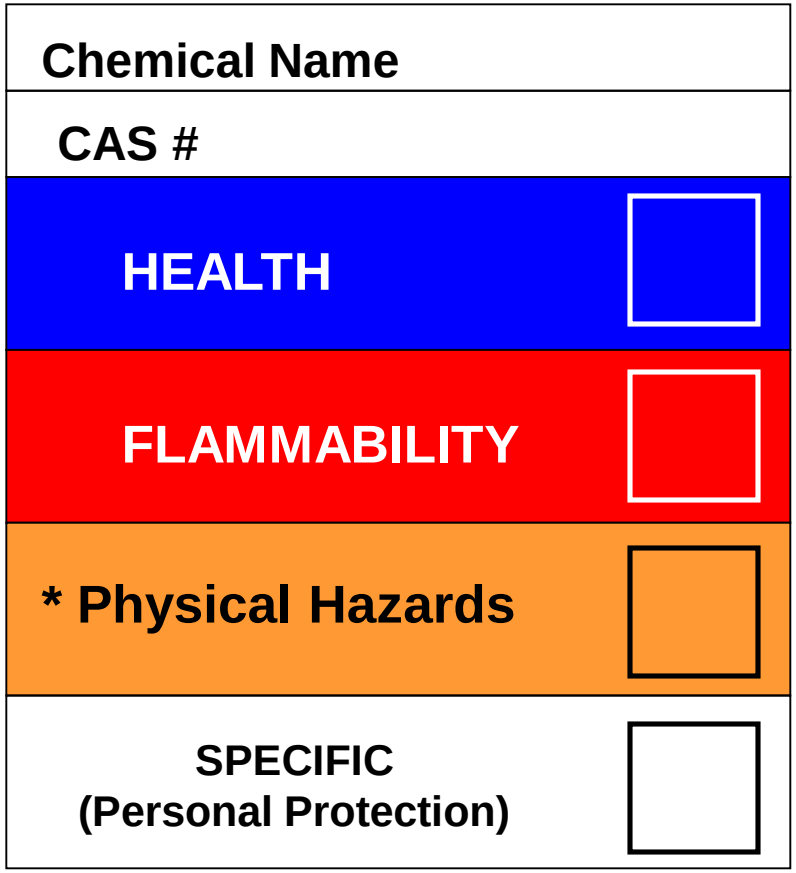
0: Minimal Hazard

1: Slight Hazard

2: Moderate Hazard

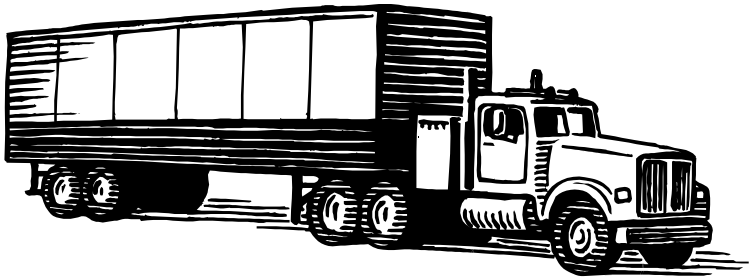
3: Serious Hazard

4: Severe Hazard



Labels: DOT

All hazardous chemicals transported on public highways must have a Department of Transportation (DOT) label which must not be removed until containers are emptied and cleaned. DOT has divided hazardous material into nine classes, which are illustrated by the labels on the following slides.
NOTE: Some classes may include sub-divisions.



Labels: DOT Class 1 - Explosives

1.1: mass explosion hazard

1.2: projectile hazard

1.3: minor blast, projectile, fire

1.4: minor blast

1.5: insensitive explosives

1.6: very insensitive explosives

DOT labels contain the number of the particular hazard. For instance, the above label contains the number 1.1A, which indicates the substance is a mass explosion hazard, division A.

Labels: DOT Class 2 – Compressed Gases

Compressed gases are clearly labeled, as shown on the labels at left. The hazard divisions are:

2.1: Flammable gases

2.2: Non-flammable gases

2.3: Poisonous gases

Labels: DOT Class 3 – Flammable Liquids

Flammable liquids are classified by two hazard divisions:

Flammable (flash point below 141 degrees)

Combustible (flash point 141-200 degrees)

Labels: DOT Class 4 – Flammable Solids

Flammable solids are classified by three hazard divisions:

4.1: Flammable solids

4.2: Spontaneously combustible

4.3: Dangerous when wet

Labels: DOT Class 5 – Oxidizers and Organic Peroxides

Oxidizers and organic peroxides are clearly labeled:

5.1: Oxidizer

5.2: Organic Peroxide

Labels: DOT Class 6 – Toxic Materials

Toxic materials are labeled as to type:

6.1: Poisonous material

6.2: Infectious agent/substance

Labels: DOT Class 7 – Radioactive Material

Radioactive materials are classified into three levels. The higher the level number, the greater the precautions that must be taken for transportation and handling:

Radioactive I

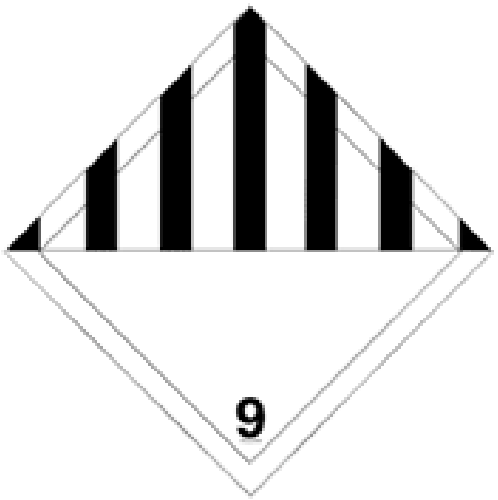
Radioactive II

Radioactive III

Labels: DOT Class 8 – Corrosive Material

This class of materials can destroy human skin, and can also corrode steel at a rate of 0.25 inches per year.

Labels: DOT Class 9 – Miscellaneous



These materials present a hazard during shipment, but do not meet the definitions of the other classes.

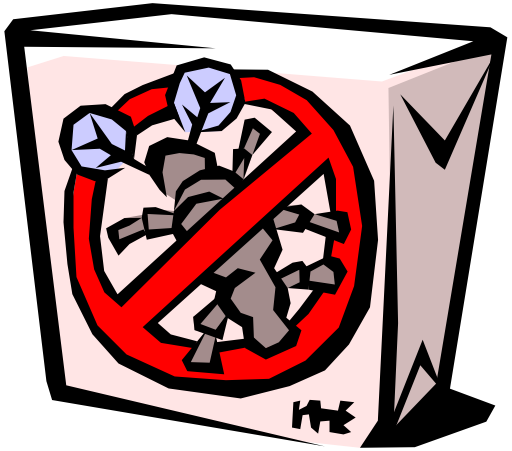
Labels: Proper Handling

Labels on incoming chemical containers must not be destroyed, removed or defaced, unless replaced with another label containing the required information.

If a portion of chemical is taken from a labeled container to another container for transfer, the transfer container must be labeled if not used within one work shift.

Labels: Special Notes

OSHA does not require labels for pesticides, TSCA-regulated substances, food, food additives, veterinary devices, distilled spirits for non-industrial use, consumer products, and agricultural or vegetable seed. This doesn't mean these substances don't require labels – just that they fall under labeling requirements of other government agencies, not under OSHA.



Labels: Summary

Point to Remember:

Labels give you an *IMMEDIATE HAZARD WARNING*

The label shown above gives an immediate hazard warning that the substance is poisonous.

DOT Placards

DOT Placards

Title 49 of the United States Code of Federal Regulations (49CFR), also known as the Federal Motor Carriers Safety Regulations (FMCSR), requires the use of hazardous materials placards when shipping hazardous materials cargo and dangerous goods in the United States. These placards have the same symbols and meanings as individual DOT labels.

DOT Placards

The DOT placard shows that the truck contains Class 2 compressed, flammable gas.

DOT Placards

The DOT placard shows that the truck contains Class 3 flammable liquid.

Categories,
Health Hazards, Methods of Detection, First Aid, Emergency Procedures, and Use of Personal Protective Equipment
(PPE)
[grouped by chemical categories]

Categories, Health Hazards, Methods of Detection, PPE, First Aid, & Emergency Procedures

When the term "hazardous" is mentioned, many people may think of an obvious substance such as acid. Actually, many substances can be hazardous. This section of the course will discuss these hazardous substances in greater detail.

Categories of Hazards: Flammables

A flammable substance is a material that is easily ignited and burns rapidly. In addition to the fire hazard, exposure to vapors from flammables can have serious health effects. A common flammable is gasoline.

Categories of Hazards: Flammables

Types of flammables include aerosols, gases, liquids and solids.

Flammable Aerosols

A flammable aerosol is an aerosol that yields a flame projection for more than 18" at full valve opening, or a flash back (a flame extending to the valve) at any degree of valve opening.

Categories of Hazards: Flammables

Flammable Gas

A flammable gas is a compressed gas with:

- a lower explosive limit (LEL) at or below 13% by volume
- a flammability range greater than 12% regardless of the lower limit

Remember – the LEL and other flammability information can be found on the MSDS.

Categories of Hazards: Flammables

Flammable Gas - Physical Properties and Hazards

Remember that gases expand several times their volume when released.

It may be necessary to crawl out to avoid gas that has risen.

Some gases may be lighter than air, like hydrogen or methane, and will rise

Some gases may be heavier than air, like butane or propane, and will settle in low areas

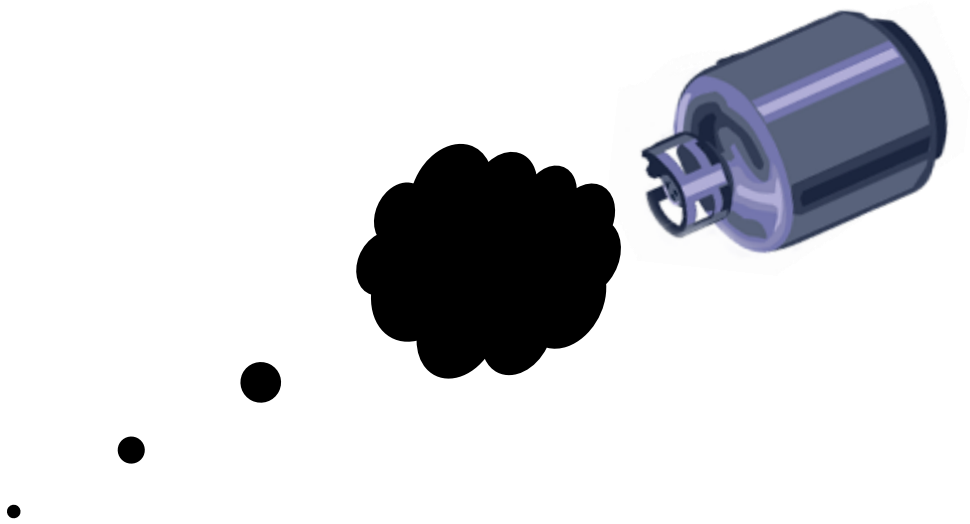
Categories of Hazards: Flammables

Flammable Gas - Physical Properties and Hazards, continued

Remember that gases:

- do not always have an odor
- are often colorless
- are dangerous if the cylinders they are in are damaged, because damaged valves may cause cylinders to "rocket"

Rocketing



When its valve is damaged, a cylinder can be violently and rapidly propelled through the air by the escaping gas. This is called "rocketing", which can lead to painful collision injuries, fires and explosions.

Categories of Hazards: Flammables

Flammable Gas – Health Hazards

All flammable gases are simple asphyxiants. This means they may displace oxygen to a level below that needed for normal body functions, leading to death from lack of oxygen. One flammable, hydrogen sulfide, is also toxic, with acute effects that can result in death.

Categories of Hazards: Flammables

Flammable Gas – Methods of Detection

- Odors are often added to flammable gases to aid detection and, therefore, prevent injury. NOTE: When people are exposed to some gases, their sense of smell can quickly become deadened.
- Large volumes of gas escaping often make a hissing sound.
- Professionals may use a soap solution to detect leaks. They may also use air monitoring instruments to detect flammable gas leaks.

Categories of Hazards: Flammables

Flammable Gas – Emergency Procedures

If gas leaks:

- use adequate ventilation and respiratory protective equipment
- turn off any ignition valve
- shut off the main cylinder valve

Respiratory equipment can mean the difference between life and death

Categories of Hazards: Flammables

Flammable Gas –Handling Procedures

Remember to:

- Transport & store cylinders with valve cap on
- Never drag or roll cylinders – use hand carts

(continued on next slide)

Photo: Use a hand cart for transporting gas cylinders

Categories of Hazards: Flammables

Flammable Gas –Handling Procedures

- Secure cylinders near the top with straps or chains
- Keep cylinders upright
- Store oxygen and flammable gas cylinders separately

Picture: Store cylinders upright and secured.

Categories of Hazards: Flammables

Flammable Gas –First Aid Procedures

Inhalation: Remove victim to fresh air. If unconscious, maintain an open airway. Restore breathing if necessary. Seek medical attention.

Eyes: Hold eyelids open and flush eyes for 15 minutes with large quantities of water. Seek medical attention.

Skin: Wash with large quantities of water. Seek medical attention.

Categories of Hazards: Flammables

Flammable Liquids

A flammable liquid is a substance with a flash point below 100° F (37-38° C). What's a flash point? It's the minimum temperature at which sufficient vapors are given off to support a flame when a source of ignition is present.

Note: While being transported, liquids are placarded as "flammable" if they have a flash point of less than 140° F.

Categories of Hazards: Flammables

Flammable Liquids – Physical Properties and Hazards

Flammable liquids:

- Vaporize quickly at room temperature
- Some are water-soluble (e.g. alcohols)
- Some are insoluble in water (e.g. xylene)
- Some are soluble in organic solvents or acids
- Have a variety of odors. For instance, acetone smells sweet.
- Have a variety of colors, but are often clear

Categories of Hazards: Flammables

Flammable Liquids – Physical Properties and Hazards, continued

Flammable liquids:

- Most have a specific gravity less than 1, which means they will float on top of water.
- Their vapors are heavier than air, which means they may settle in low areas.
- They can react violently with oxidizers and halogen (e.g. chlorine and fluorene).

Categories of Hazards: Flammables

Flammable Liquids – Health Hazards

In addition to flammability, flammable liquids can be health hazards:

- Skin contact – may cause reddening or drying
- Inhalation – may cause dizziness, nausea or headaches, or may irritate the respiratory tract
- Alcohols (flammable liquids, ending in –ol) are mild irritants. Methanol, when swallowed, may cause blindness.
- Ketones (flammable liquids ending in –one) are slightly more toxic than alcohols.

Categories of Hazards: Flammables

Flammable Liquids – Health Hazards, continued

- Aliphatic hydrocarbons (flammable liquids ending in –ane, such as hexane) may cause excitement, stupor, and confusion.
- Amines (flammable liquids with names that have –amine, -amid, or –nitro, such as n-butylamine) can cause liver, lung and kidney damage.
- Ethers (flammable liquids ending in –ether or –futan, such as anhydrousether) may cause unconsciousness, pneumonia, or death.
- Aromatics (flammable liquids ending in –ene, such as benzene) may cause convulsions, coma and death. Some are suspected carcinogens.

Categories of Hazards: Flammables

Flammable Liquids – Methods of Detection

All flammable liquids:

- Have detectable odors, although the sense of smell may quickly become deadened
- May cause tearing or redness of the eyes
- May be felt on the skin as an initial splash of liquid

Note: Health/safety professionals have several devices, called air-monitoring instruments, to detect leaks of flammable liquids.

Categories of Hazards: Flammables

Flammable Liquids – Personal Protective Equipment

When working with flammable liquids:

- wear an approved respirator as prescribed in the MSDS or where ventilation is inadequate
- wear splash goggles and a full face shield when necessary
- wear solvent-resistant gloves as prescribed in the MSDS
- wear a rubber apron or splash suit when working with an open container of flammable liquids

Categories of Hazards: Flammables

Flammable Liquids – Emergency and Handling Procedures

When working with flammable liquids:

- remove all sources of ignition
- be certain the area is well-ventilated
- NEVER pour or wash flammable liquids into sewers or drains
- when transferring flammable liquids, ground the containers

Categories of Hazards: Flammables

Flammable Liquids – First Aid Procedures

In the event of an overexposure:

- Inhalation: Remove victim to fresh air. Rescuers should be equipped with proper PPE before attempting rescue. If unconscious, maintain an open airway. Seek medical attention immediately.
- Eyes: Hold open eyelids and flush eyes with water for 15 minutes. Seek medical attention immediately.
- Skin: Immediately wash with soap and water or waterless cleanser. Remove contaminated clothing.

Categories of Hazards: Combustibles

A combustible is a substance capable of fueling a fire, but that will not burn as readily as a flammable. A common combustible is wood.

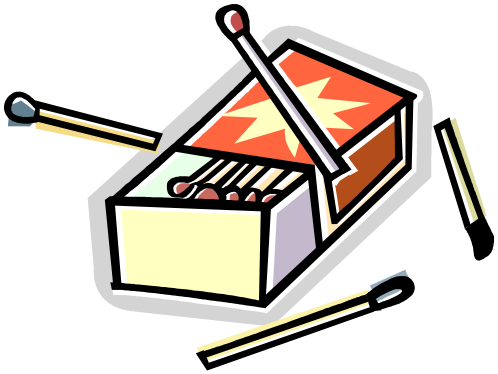
Categories of Hazards: Combustibles

We previously discussed flammable liquids. There is also a category of liquids called combustible liquids. They ignite less readily than flammable liquids. They have a flash point at or above 100° F, and below 200° F. A common combustible liquid is diesel fuel.

Categories of Hazards: Combustibles

There is also a category called flammable solids. They can cause a fire by self-ignition through:

- friction
- spontaneous chemical changes
- retained heat
- reactivity with air or water



Matches are a common, non-hazardous, flammable solid.

Categories of Hazards: Combustibles

Flammable Solids: Physical Properties and Hazards

Flammable solids:

- burn readily and persistently
- may generate chemical products, from air or water reactivity, that are corrosive, poisonous, or flammable
- require special extinguishing agents in a fire

Categories of Hazards: Combustibles

Flammable Solids: Health Hazards

Most flammable solids have potentially severe health effects:

- alkali metals (sodium, lithium, potassium) react with moisture on the body to cause severe burns to skin, eyes, nose and throat
- white phosphorus reacts with air to form phosphoric acid, which is corrosive to eyes, skin, nose, throat, and lungs
- azides – many are toxic, and are sensitive to heat, shock and friction.

Categories of Hazards: Combustibles

Flammable Solids: Methods of Detection and Emergency/Handling Procedures

If flammable solids begin to ignite, fume or bubble when exposed to air or water, evacuate all people to a safe distance immediately and notify emergency personnel.

Categories of Hazards: Combustibles

Flammable Solids: First Aid

In the event of an overexposure:

- Inhalation: Remove to fresh air. Restore breathing if necessary. Seek medical attention immediately.
- Eyes: Hold eyelids open and flush eyes for 15 minutes with large quantities of water. Seek medical attention immediately.
- Skin: Immediately wash area with large quantities of cold water. Keep affected area cold. Seek medical attention immediately.
- Ingestion (swallowing): Seek medical attention immediately.

Categories of Hazards: Corrosives

Corrosives, in the form of strong acids or strong caustics (bases), are widely used in industry. They are dangerous to the human body because they tend to dissolve body tissue. When in contact with the skin, they produce chemical burns. When corrosive mists are inhaled, they can damage the respiratory system.

Battery acid is a corrosive.

The general uses for corrosives are in water treatment, chemical processes, and in storage batteries.

Categories of Hazards: Corrosives

Corrosives: Physical Characteristics

Corrosives:

- may be in solid, liquid, or gaseous form
- may give off a corrosive mist when released into the air
- are usually soluble in water
- are normally non-flammable

Categories of Hazards: Corrosives

Corrosives: Health Effects

- Skin contact with corrosives may result in burns, open sores, or scarring. At first, contact with acids usually produces an itching sensation. Some acids may produce an immediate burning sensation.
- Eye contact can result in burns and serious damage.
- Inhalation can cause burns to the nose and throat, and cause lung damage.

Categories of Hazards: Corrosives

Corrosives: Health Effects, continued

- Ingestion can cause burns to the mouth, throat and stomach. It can also cause nausea and ulceration.
- Over a period of time, corrosives can cause bronchitis, inflammation of the eye, and digestive problems.

Categories of Hazards: Corrosives

Corrosives: Methods of Detection

Initial detection may be from:

- observation of spills or leaks
- watering of eyes
- skin irritation

Categories of Hazards: Corrosives

Corrosives: Personal Protective Equipment (PPE)

Appropriate PPE is recommended in the MSDS. This may include:

- rubber apron and rubber gloves
- splash goggles
- full face shield
- respirator with approved cartridge (if excessive airborne levels are anticipated)

Categories of Hazards: Corrosives

Corrosives: First Aid

In case of exposure, refer to MSDS for specific instructions. General first aid procedures are:

- Skin: flush with large quantities of cold water. Remove any contaminated clothing. Seek medical attention.
- Eyes: flush eyes for 15 minutes with large quantities of water. Seek medical attention.

Categories of Hazards: Corrosives

Corrosives: First Aid, continued

General first aid procedures are:

- Inhalation: if overexposure or difficulty in breathing occurs, remove victim to fresh air. Restore breathing, if necessary. See medical attention.
- Ingestion (swallowing): seek medical attention immediately. DO NOT INDUCE VOMITING. Why? Because if you induce vomiting, the victim may be burned again from corrosives that are regurgitated.

Categories of Hazards: Reactive Chemicals

Reactive chemicals, other than blasting agents or explosives, are liable to cause fire through friction, absorption of moisture, spontaneous chemical changes or retained heat from manufacturing or processing, or can be ignited readily and when ignited burn so vigorously and persistently as to create a serious hazard. Flammable solids, which we previously discussed, belong to this class. Additionally, other reactive chemicals are oxidizers and organic peroxides. These materials readily yield oxygen, which may result in the ignition of combustible materials. Their primary characteristic is reactivity and their ability to start a fire or explosion.

Categories of Hazards: Reactive Chemicals

Reactive Chemicals: Physical Properties and Hazards

- Reactive chemicals may be solids or liquids
- Reactive chemicals may be air or water reactive
- Chemical products produced from air or water reactivity may be corrosive, poisonous, or flammable. Them may be shock, heat, or friction sensitive, and may result in a fire or explosion when in contact with combustible materials.
- Oxidizers may react with metals to form hydrogen gas.

Categories of Hazards: Reactive Chemicals

Reactive Chemicals: Health Hazards

- Many reactive chemicals are corrosive and can destroy human tissue. Overexposures may result in:
- Alkali metals (sodium, lithium, potassium) react with body moisture to cause severe burns to skin, eyes, nose, and throat.
- White phosphorus reacts with air to form phosphoric acid, which is severely corrosive.
- Azides may be poisonous, in addition to being unstable and sensitive to heat, shock and friction.

Categories of Hazards: Reactive Chemicals

Reactive Chemicals: Health Hazards, continued

- Hydrazines, which are oxidizers, may irritate eyes, skin and respiratory tract. They are suspected carcinogens.
- Nitrates may cause dizziness, vomiting, convulsions and death.
- Chlorates irritate the eyes, nose and respiratory tract. In confined spaces, free chlorine can cause asphyxiation and death.
- Metal peroxides can be irritating to the eyes, nose and respiratory tract.

Categories of Hazards: Reactive Chemicals

Reactive Chemicals: Methods of Detection

Methods of detection include:

- Sight: if material begins to ignite, fume or bubble when exposed to air or water, immediately evacuate personnel to a safe distance and notify emergency personnel.
- Smell: some oxidizers have odors (chlorates and chlorine) that may be smelled. Note to remember: The sense of smell may be quickly deadened by even small amounts of gas.
- Air monitoring: health professionals use specific monitoring equipment to detect leaks of reactive chemicals.

Categories of Hazards: Reactive Chemicals

Reactive Chemicals: Personal Protective Equipment (PPE)

Handling of many reactive chemicals requires special PPE:

- Gloves should be worn, since moisture from the skin may cause materials to react.
- Splash goggles and a full-face shield may be needed to protect the eyes.
- Certain reactive chemicals require use of an air-supplied respirator or self-contained breathing apparatus (SCBA) when handling the materials.
- Fire-retardant or fire-impervious clothing may be required for handling if a reaction has occurred.

Categories of Hazards: Reactive Chemicals

Reactive Chemicals: Emergency and Handling Procedures

- Spills: if air or moisture reactive, evacuate personnel.
- Fire: notify emergency personnel. If fire becomes larger or more violent, evacuate the area.
- Follow all written safety procedures.

Categories of Hazards: Reactive Chemicals

Reactive Chemicals: First Aid Procedures

If overexposure occurs, always seek medical attention immediately. General first aid procedures are:

- Skin: flush with large quantities of cold water. Keep affected area cold.
- Eyes: hold eyelids open and flush eyes for 15 minutes with large quantities of water.
- Inhalation: remove to fresh air. Restore breathing, if it has stopped.
- Ingestion (swallowing): seek medical attention immediately.

Categories of Hazards: Toxic Chemicals

Chemicals are often harmless in small doses. The size of the dose and the effect it has on the body determine whether a chemical is called toxic. "Toxic" means poisonous. Toxic chemicals cause adverse health effects that can be either acute or chronic. As an example, carcinogens are toxic chemicals that cause cancer. Carcinogens may also be teratogens, which means they can harm a fetus.

Teratogens are substances that can harm a fetus and cause birth defects.

Categories of Hazards: Toxic Chemicals

Chemical manufacturers and importers determine if chemicals are health hazards, and indicate the type and degree of hazard on the MSDS. Chemicals that are classed as flammable/combustible, corrosive, and reactive can also be toxic.

Categories of Hazards: Toxic Chemicals

Toxic Chemicals: Physical and Health Hazards, Methods of Detection, Personal Protective Equipment, Emergency and Handling Procedures, and First Aid

All of the aspects listed above vary widely, since many different substances are identified as toxic health hazards. The best way to study each substance is to examine the relevant MSDS .

Knowledge Assessment

This section contains 22 questions about material presented in this course. Read each question, then click anywhere on the slide and the answer will appear. Click each page again to go to the next question.

Assessment, page 1

1. Our agency's hazard communication program is based on Hazard Communication Standards (HCS) from which federal agency?

1. Answer: OSHA

Assessment, page 2

2. Employees have the right to examine which two types of hazardous material documentation?

2. Answer: The Chemical Inventory List (CIL) and the Material Safety Data Sheet (MSDS) for each hazardous substance.

Assessment, page 3

3. Offenders do not have the right to review the CIL and the MSDS.

3. Answer: False

Assessment, page 4

4. Each hazardous chemical comes with an MSDS.

3. Answer: True

Assessment, page 5

5. What form should an employee look at to obtain information about a hazardous substance?

5. Answer: The MSDS

Assessment, page 6

6. Employees are responsible for using protective measures provided by the employer and being alert to the potential for possible hazardous material overexposures.

6. Answer: True

Assessment, page 7

7. Labels on hazardous chemicals have one main purpose. What is that purpose?

7. Answer: To provide an IMMEDIATE hazard warning.

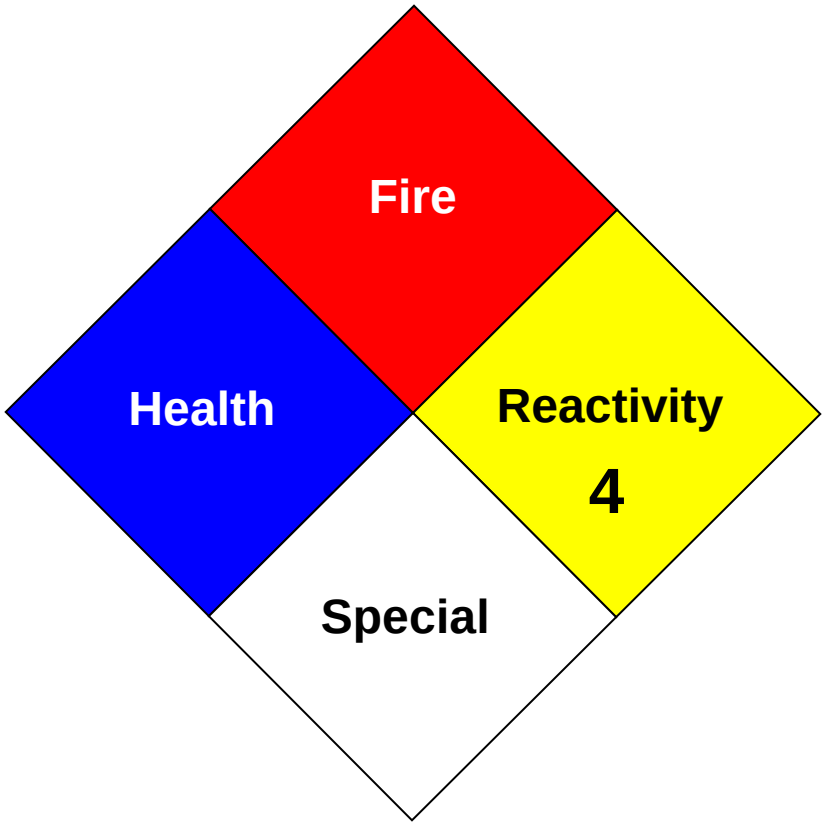
Assessment, page 8

8. There is only one type of hazardous labeling system in use in the United States.

8. False. Four common labeling systems are ANSI, NFPA, HMIS, and DOT.

Assessment, page 9

9. Does the number 4 in this NFPA label in the "Reactivity" diamond indicate the substance "May Detonate", or does it indicate the substance is "Stable"?



9. Answer: The number 4 indicates the substance may detonate.

Assessment, page 10

10. DOT labels for toxic substances show which two types of chemicals?

10. Answer: Poisonous substances and Infectious substances.

Assessment, page 11

11. Labels give you an _____ hazard warning.

11. Answer: Immediate

Assessment, page 12

12. Flammable substances include which four types?

12. Answer: Aerosols, gases, liquids, and solids.

Assessment, page 13

13. When gas is released, its volume lessens.

13. Answer: False – its volume expands.

Assessment, page 14

14. Gases do not always have an odor.

14. Answer: True – some gases are odorless.

Assessment, page 15

15. Inhalation of flammable gases, even if they're not burning, can lead to death.

15. Answer: True – the gases can displace oxygen to a level below that needed for the body to live, leading to death.

Assessment, page 16

16. A large volume of escaping gas often makes a noise that sounds like _____.

16. Answer: Hissing.

Assessment, page 17

17. Oxygen and other flammable gas cylinders can be safely stored together.

17. Answer: False – oxygen cylinders should be stored separately from other cylinders of flammable gas.

Assessment, page 18

18. All flammable liquids have a "sweet" odor.

18. Answer: False – flammable liquids have a variety of odors.

Assessment, page 19

19. It is safe to pour flammable liquids into a sewer or drain.

19. Answer: False

Assessment, page 20

20. If flammable solids begin to ignite, fume or bubble when exposed to air, what two things should be done immediately?

20. Answer: Evacuate all people and notify emergency personnel.

Assessment, page 21

21. Corrosive chemicals are normally flammable.

21. Answer: False

Assessment, page 22

22. If someone swallows corrosives, you should induce vomiting as a first-aid treatment.

22. Answer: False – this may cause the victim to be burned again from corrosives that are regurgitated.

Conclusion

Thank you for completing this course. Be sure and fill out a training roster, than give it to your training officer so credit may be granted for this course.

Stay alert, and stay safe!