

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

A decorative flourish consisting of two symmetrical, flowing lines that curve upwards and outwards from a central point. The lines are colored in a gradient from purple at the top to red at the bottom, with a yellow diamond-shaped element at the very center containing a small, stylized symbol.

Chemical Safety

Basic Rules of Chemical Safety



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Objective

Hazardous chemicals are used in a wide variety of human operations and activities.

Our Chemical Safety Program addresses proper use, handling and storage of these materials.

Outlines

- Chemicals – helpful BUT harmful.
- Hazards materials.
- Hazards materials categories.
- Basic rules of chemical safety.
- Identification systems for the hazards materials.
- Material safety data sheets (MSDS).
- Chemical tracking system.
- Chemicals life cycle.
- Safety recommendations.

- Chemicals Safety

Use, handling, storage and disposing of hazardous chemicals.

- Biological Safety

Use of biological agents such as human, animal and plant pathogens; human blood and blood components; recombinant/synthetic nucleic acids; cell and tissue cultures; etc. in addition to the receipt, possession, use, and transfer of biological materials.

- Facilities and Construction Safety

Guidelines for construction and renovation for good health and safety practices, even for small construction or renovation projects.

- Fire Safety

The fire safety includes building evacuation, fire prevention methods and the use of portable extinguishers.

- Radiation Safety

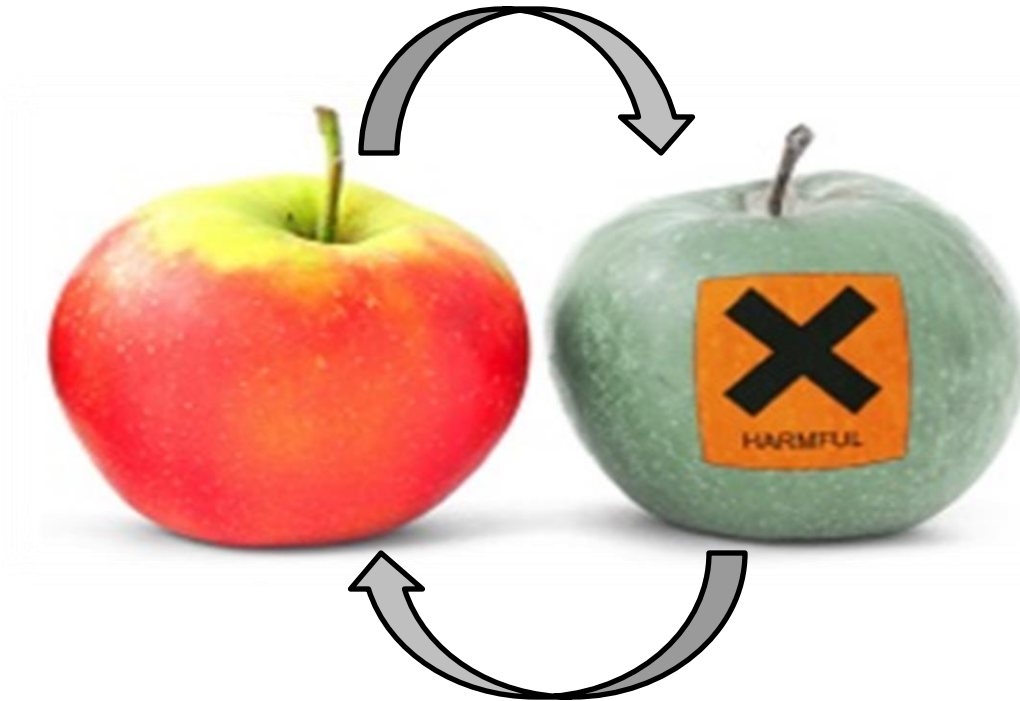
The use of sources of radiation in various teaching, research, and operating activities.

Chemicals – Helpful & Harmful



DANGER
Harmful
chemicals

Helpful chemicals could be Harmful, and vice versa



Depending on how they are controlled, handled and disposed; chemicals could be helpful or harmful

Basic Rules of Chemical Safety



Be Aware!

Be Alert!

Be Alive!



Hazards Materials

Any substance or compound that has the capability of producing adverse effects on the health and safety of humans. These are materials could result in personal injury, death, or other losses (including asset and structure losses).

Characteristic hazardous wastes are materials that are known or tested to exhibit one or more of the following four hazardous traits:

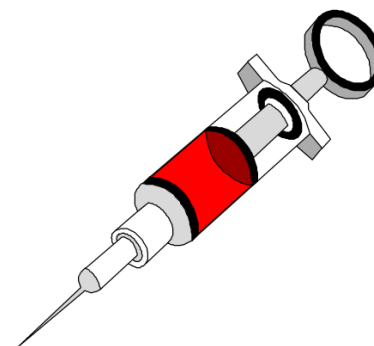
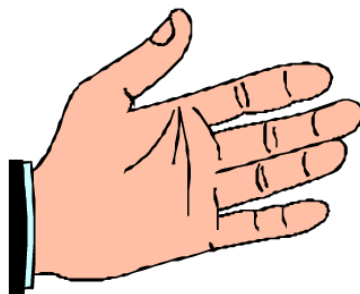
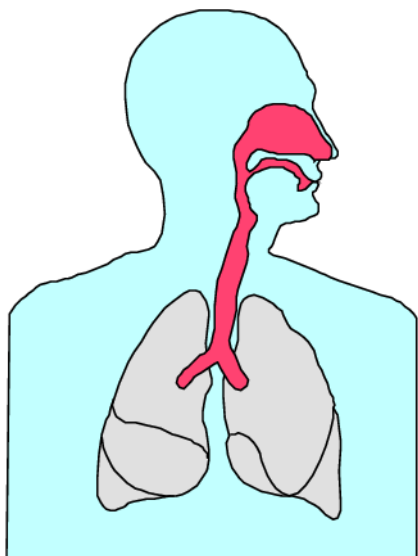
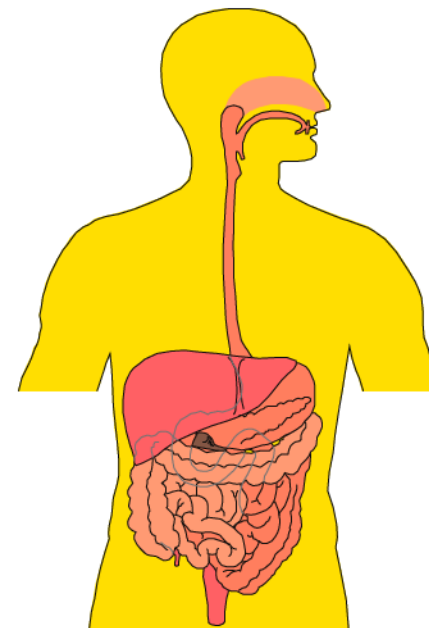
- Ignitability (i.e., flammable)
- Reactivity (explosions)
- Corrosivity
- Toxicity



قابلية الاشتعال (سريعة الاشتعال)
التفاعلية العالية (متفجرة)
آكلة أو حارقة
سامة








Ways that hazardous materials can enter the body:

- **Inhalation**; through breathing, most rapid way.
- **Absorption**; through touching skin or eyes.
- **Ingestion**; swallowing.
- **Injection**; penetrating skin.



Hazardous Materials Classes






Hazard Class 1 Explosives

Subsidiary classes / examples	Hazard symbol
1.1 mass explosion hazard (e.g., TNT, dynamite, nitroglycerine)	
1.2 blast/projection hazard	
1.3 minor blast hazard (e.g., rocket propellant, display fireworks)	  
1.4 major fire hazard (e.g., consumer fireworks, ammunition)	
1.5 blasting agents	  
1.6 extremely insensitive explosives	



Hazard Class 2

Gases

(compressed, liquefied or dissolved under pressure)


Subsidiary classes / examples	Hazard symbol
2.1 flammable gas (e.g., acetylene, hydrogen)	 A red diamond-shaped hazard symbol with a flame icon at the top, the text "FLAMMABLE GAS" in the center, and the number "2" at the bottom.
2.2 nonflammable gas (e.g., nitrogen, neon)	 A green diamond-shaped hazard symbol with a gas cylinder icon at the top, the text "NON-FLAMMABLE GAS" in the center, and the number "2" at the bottom.
2.3 poisonous gas (e.g., fluorine, chlorine, hydrogen cyanide)	 A white diamond-shaped hazard symbol with a skull and crossbones icon at the top, the text "POISON GAS" in the center, and the number "2" at the bottom.
	 A yellow diamond-shaped hazard symbol with a flame over a gas cylinder icon at the top, the text "OXYGEN" in the center, and the number "2" at the bottom.
	 A white diamond-shaped hazard symbol with a skull and crossbones icon at the top, the text "INHALATION HAZARD" in the center, and the number "2" at the bottom.

Hazard Class 3 Flammable Liquids

Subsidiary classes / examples	Hazard symbol
<p>Packing Group I b.p. less than 35°C, any f.p. (e.g., diethyl ether or carbon disulfide)</p>	 
<p>Packing Group II b.p. greater than 35°C, f.p. less than 23°C (e.g., gasoline, acetone)</p>	
<p>Packing Group III Packing Group I or II are not met, (e.g., such as kerosene, diesel)</p>	


Hazard Class 4

Flammable Solids


Subsidiary classes / examples	Hazard symbol
4.1 flammable solids (e.g., nitrocellulose, magnesium)	 <p>The image displays three diamond-shaped hazard symbols for Class 4. The top-left symbol is for 'FLAMMABLE SOLID', featuring a black flame icon on a background of vertical red and white stripes, with the number '4' at the bottom. The top-right symbol is for 'SPONTANEOUSLY COMBUSTIBLE', featuring a black flame icon on a white background with a red bottom half, with the number '4' at the bottom. The bottom-center symbol is for 'DANGEROUS WHEN WET', featuring a white flame icon on a blue background, with the text 'DANGEROUS WHEN WET' and the number '4' at the bottom.</p>
4.2 spontaneously combustible (e.g., aluminium alkyls, white phosphorus)	
4.3 dangerous when wet (e.g., sodium, calcium, potassium, calcium carbide)	

Hazard Class 5


Oxidizers and Organic Peroxides

Subsidiary classes / examples	Hazard symbol
5.1 oxidizer (e.g., calcium hypochlorite, ammonium nitrate, hydrogen peroxide, potassium permanganate)	
5.2 organic peroxide (e.g., benzoyl peroxides, cumene hydroperoxide)	

Hazard Class 6 Toxic Materials


Subsidiary classes / examples	Hazard symbol
<p>6.1 poison (e.g., potassium cyanide, mercuric chloride, pesticides, methylene chloride)</p>	
<p>6.2 infectious agents (biohazard) (e.g., virus cultures, pathology specimens, used intravenous needles)</p> <ul style="list-style-type: none">-Category A: Infectious affecting humans and animals (capable of causing permanent disability or life-threatening or fatal disease).-Category B: Infectious affecting animals only (generally not capable of causing permanent disability of life-threatening or fatal disease).-Category C: Biological substance transported for diagnostic or investigative purposes-Regulated Medical Waste: waste or reusable material derived from medical treatment of an animal or human, or from biomedical research.	

Hazard Class 7 Radioactive Materials


Subsidiary classes / examples	Hazard symbol
Radioactive I, II and III (e.g., uranium, plutonium)	 The image shows a diamond-shaped hazard label for Radioactive II materials. The top half of the diamond is yellow with a black radiation symbol (three black blades around a central circle). Below the symbol, the text "RADIOACTIVE II" is printed in bold black letters. Underneath, there are fields for "NET WEIGHT" and "ACTIVITY". At the bottom, there is a box for "TRANSPORT INDEX" and a large black number "7". The diamond has a white border with small text around the edges: "RADIOACTIVE II" on the left, "RADIOACTIVE II" on the right, and "7" at the bottom.

Hazard Class 8
Corrosive Materials

(destruction of the human skin, corrode steel and certain metals)

Subsidiary classes / examples	Hazard symbol
8.1 acids (e.g., sulfuric acid, hydrochloric acid)	
8.2 alkalis (e.g., potassium hydroxide, sodium hydroxide)	

Hazard Class 9 **Miscellaneous**

Subsidiary classes / examples	Hazard symbol
<p>Do not fall into the other categories (e.g., asbestos, air-bag inflators, self inflating life rafts, dry ice)</p>	

Hazardous Materials Warning Labels

CLASS 1 Explosives:
Divisions 1.1, 1.2, 1.3, 1.4, 1.5, 1.6



CLASS 2 Gases:
Divisions 2.1, 2.2, 2.3



CLASS 3 Flammable Liquid



CLASS 4 Flammable Solid, Spontaneously Combustible, and Dangerous When Wet:
Divisions 4.1, 4.2, 4.3



CLASS 5 Oxidizer, Organic Peroxide: Divisions 5.1 and 5.2



* Include compatibility group letter.

** Include division number and compatibility group letter.

CLASS 6 Poison (Toxic), Poison Inhalation Hazard, Infectious Substance: Divisions 6.1 and 6.2



CLASS 7 Radioactive



CLASS 8 Corrosive



CLASS 9 Miscellaneous Hazardous Material



Subsidiary Risk Label



For Aircraft Only



Cargo Aircraft Only



Standard System for the Identification of the Hazards Materials for Emergency Response

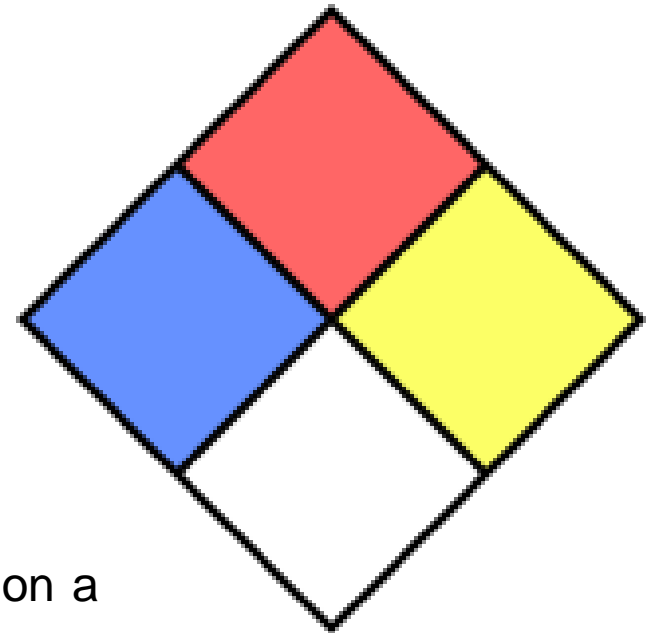
NFPA 704 National Fire Protection Association

Fire diamond used by emergency personnel to quickly and easily identify the risks posed by hazardous materials.

The four divisions are typically color-coded with

- red indicating flammability,
- blue indicating level of health hazard,
- yellow for chemical reactivity, and
- white containing codes for special hazards.

Each of health, flammability and reactivity is rated on a scale from 0 (no hazard) to 4 (severe risk).



4. Deadly

3. Extreme
Danger

2. Hazardous

1. Slightly
Hazardous

0. Normal
Material

4. Below 73°F

3. Below 100°F

2. Above 100°F not
exceeding 200°F

1. Above 200°F

0. Will not burn

**HEALTH
HAZARD**

**FIRE
HAZARD**
Flash Points

2

1

3

REACTIVITY

**SPECIFIC
HAZARD**

ACID	Acid
ALK	Alkali
COR	Corrosive
OXY	Oxidizer
	Radioactive
	Use No Water

4. May Detonate

3. Shock & Heat
may detonate

2. Violent Chemical
Change

1. Unstable if
heated

0. Stable

Example: Acetone fire diamond



Flammability code 3

Ignited under almost all ambient temperature conditions. Flash point between 23 and 38 °C

Health code 1

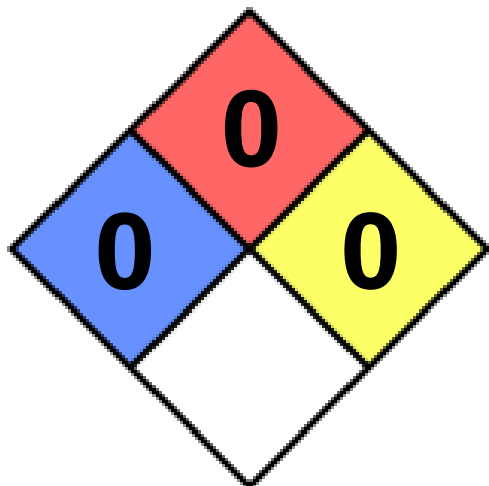
Exposure would cause irritation but only minor residual injury

Reactivity code 0

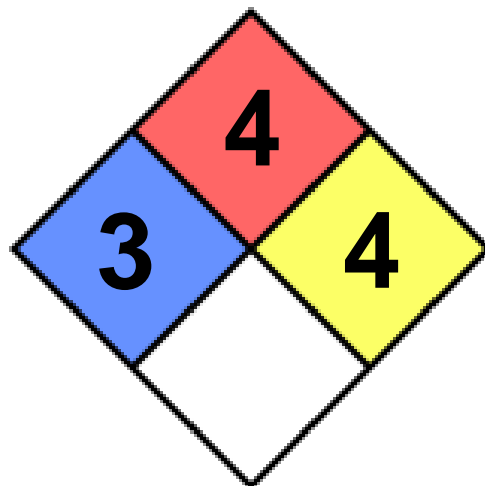
Normally stable, even under fire exposure conditions and is not reactive with water

Special hazards

No code



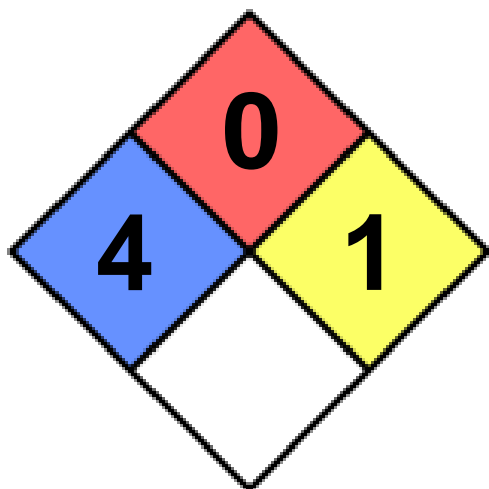
Water



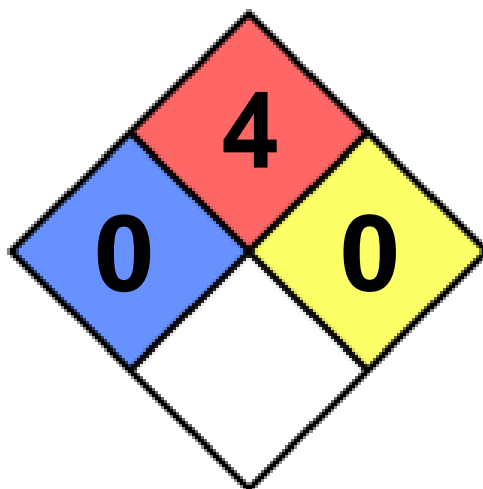
Picric Acid



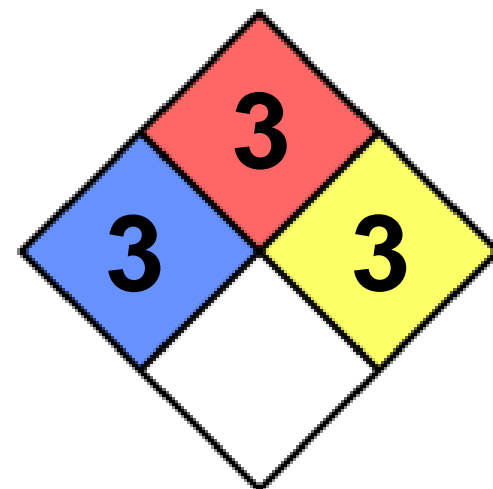
Hydrogen Cyanide



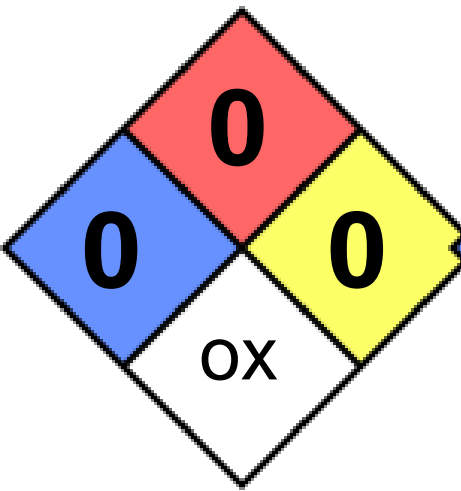
Hydrogen Fluoride



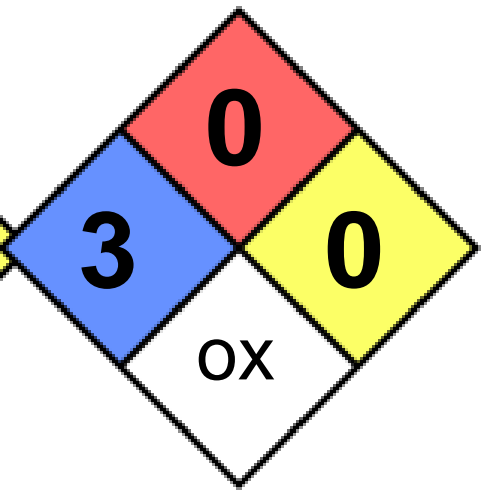
Hydrogen, gas



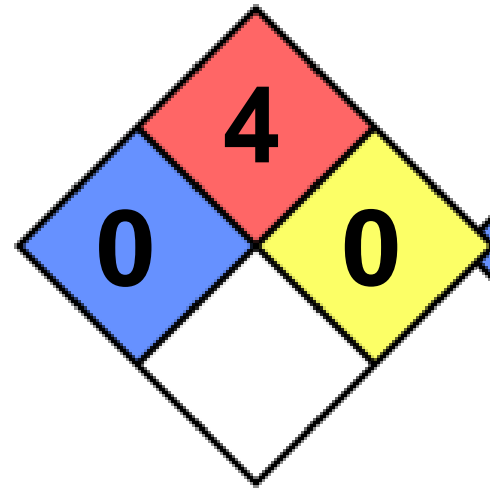
Hydrazine



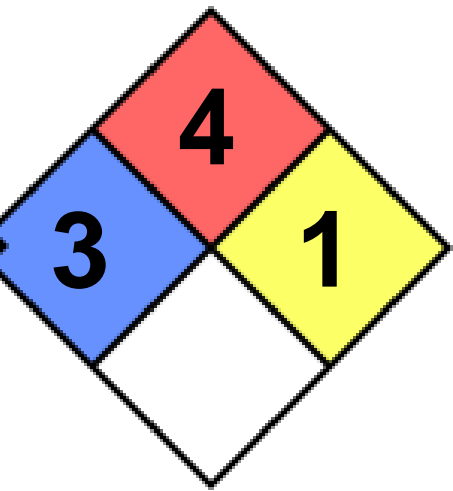
Oxygen, gas



Oxygen, liquid



Natural Gas, gas



Natural Gas, liquid



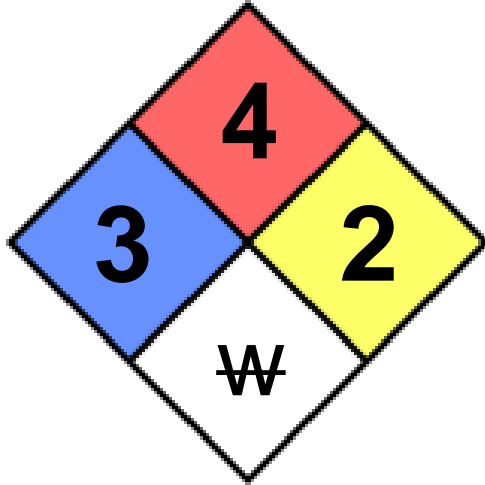
Hydrogen Peroxide (35-52%)



Hydrogen Peroxide (>52%)

Special hazards notice (white)

Standard Symbols



Aluminum Phosphide

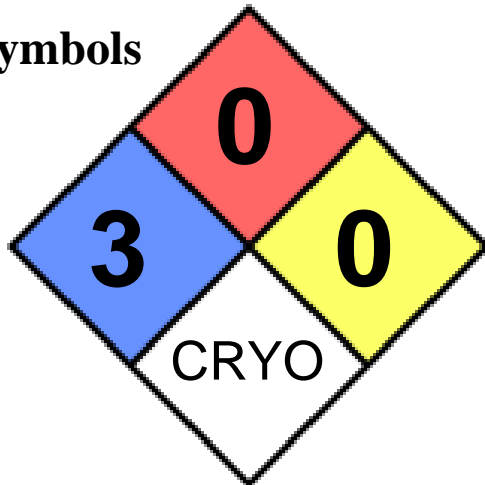


Chlorine



Bromine Trifluoride

Non-Standard Symbols



Liquid Nitrogen



Plutonium

Material Safety Data Sheet (MSDS)

MSDS is an important component of product stewardship and occupational safety and health. MSDS is a detailed fact sheet summarizing information about a chemical's hazardous ingredients.

Occupational safety and health documents used MSDS to describe a products ingredients, what they are, are they hazardous, how to store them, reactivity, storage, disposal, toxicity, health affects, what should be done if there is an accident, regulatory issues, fire hazards, emergency procedures and first aid etc.



Vendors have to undertake manufacturing, distribution, use and disposal of hazardous materials and chemicals to complete these documents. The objective of an MSDS is to concisely inform you about the hazards of the materials you work with so that you can protect yourself and respond to emergency situations.

MSDS formats can vary from source to source within a country depending on national requirements.

MSDS includes the following information:

SECTION 1 - product and company identification

SECTION 2 - composition and information on ingredients

SECTION 3 - hazards identification including emergency overview

SECTION 4 - first aid measures

SECTION 5 - firefighting measures

SECTION 6 - accidental release measures

SECTION 7 - handling and storage

SECTION 8 - exposure controls and personal protection

SECTION 9 - physical and chemical properties

SECTION 10 - stability and reactivity data

SECTION 11 - toxicological information

SECTION 12 - ecological information

SECTION 13 - disposal considerations

SECTION 14 - transport information

SECTION 15 - regulatory information

SECTION 16 - other information

Sections 12-15 may be included in the SDS, but are not required by OSHA.

Chemical Tracking System

Chemical tracking systems are a chemical database which is used to characterize the life of chemicals used in the laboratory. They should cover the history of the chemical. The following tracking fields are recommended:

1. Date of inventory.
2. Date chemical received.
3. Specific amount of each chemical.
4. Name, formula and grade of each chemical.
5. Chemical hazard of each item [Safety Data Sheet (SDS) information and National Fire Protection Association (NFPA) hazard code].
6. Chemical Abstract Service (CAS) registry number.
7. Source (supplier).
8. Container type.
9. Hazard classification.
10. Required storage conditions.
11. Expiration date.
12. Storage location of each chemical.
13. Amount of chemical in the container.

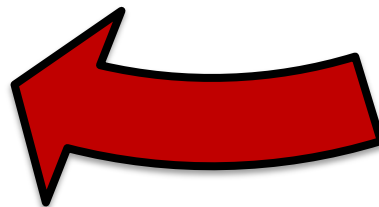
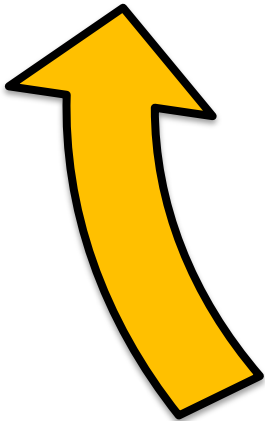
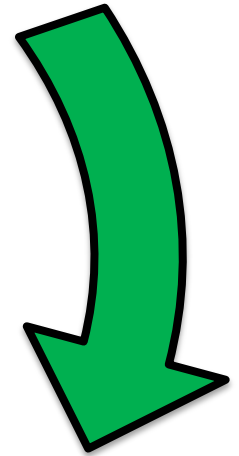
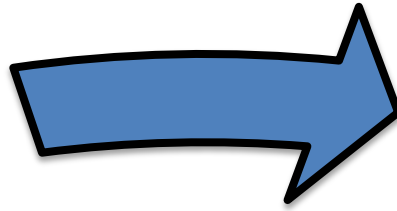
Disposal

Purchasing

Chemicals Life Cycle

Handling

Storage



The total chemical life cycle defines the stages of a chemical's **purchase**, **use**, and **disposal**.

Rule 1: Purchase of Chemicals

Don't buy or store chemicals you don't need.

Rule 2: Chemicals Storage

Store chemicals in their original containers.

Rule 3: Chemicals Handling

Always wear appropriate safety gear and work in a safe environment.

Rule 4: Chemicals Disposal

Always dispose of chemicals safely.

General Guidelines

Purchasing, Handling, Storing and
Disposing of Chemicals

Ordering & Receiving Chemicals

- Estimate the amount of chemicals needed based on inventory.
- Don't buy or store chemicals you don't need.
- Order only minimal amounts of chemicals.
- Make sure laboratory ventilation system and/or fume hood exhaust will meet the needs for chemical use.
- Make sure appropriate storage is available: flammable liquid cabinet, acid cabinet, chemical storeroom.
- Do not accept any chemicals without an Safety Data Sheets (SDS).
- Do not accept any chemicals without proper labeling.
- Transport gas cylinders one at a time using an appropriate hand truck. Do not remove valve cap until the cylinder is in the storage location.



Storage of Chemicals

- All chemical shelving needs front edge lips of approximately 9 centimeters in height.
- Storage areas are to have appropriate ventilation.
- All chemical storage shelving and cabinets are to be secured to the wall to prevent tipping over.
- Chemicals should not be stored above eye level.
- All chemicals containers must be properly labeled, dated and in good condition in preparation for storage.
- Never place large or heavy containers on high shelves.
- Never store chemicals on tops of cabinets or on floors or above each other.

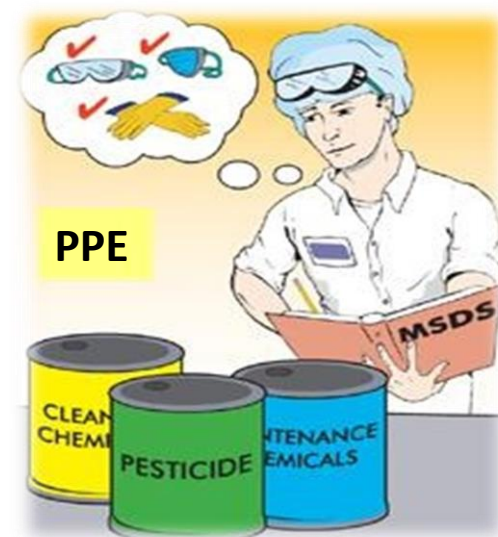


- Chemicals are to be organized by **compatibility**, not alphabetically. Incompatible chemicals are to be stored separately.
- Chemicals should be stored alphabetically within the same compatible groups.
- Segregate chemicals by hazard class
 - flammable compressed gases
 - nonflammable compressed gases
 - flammable liquids
 - combustible liquids
 - flammable solids
 - corrosive acids
 - corrosive bases
 - oxidizers
 - organic peroxides
 - spontaneously combustible reactives
 - water reactives
 - explosives
 - radioactives
- Flammable liquids should be stored in an approved safety cans and cabinets.
- Chemicals should not be exposed to direct heat, sunlight or highly variable temperatures.



Handling & Using Chemicals

- Be aware of safety equipment location in case of a chemical splash or spill including the chemical spill cart.
- Review Safety Data Sheets (SDS) and labels for hazards associated with a chemical before using it.
- Use appropriate personal protective equipment (PPE): chemical splash goggles, hand protections, apron, closed toed shoes. Flip flops and sandals are inappropriate footwear in the chemistry lab.
- Do not eat, drink, smoke, chew gum, apply cosmetics, or pipette by mouth.
- Use the buddy system. Never work alone without another staff member present (especially beyond working hours).



**Do not
mouth pipet**



**No smoking,
eating or drinking**



- Never smell, taste or touch chemicals with bare hands.
- Remove only the quantity required for the current procedures.
- Never return a chemical to original container once it has been removed.
- Never leave hazardous chemicals or processes unattended.

• Use a fume hood for all work with volatiles and hazardous chemicals.

• Use good housekeeping practices. Keep areas clean and uncluttered.

• Always clean up after completing the laboratory activity.



- Always wash hands with soap and water after completing the laboratory activity.



- Do not work with hazardous chemicals at night, or weekends- especially when you are alone in the laboratory.
- Maintain clear access to exits, showers, and eyewashes. Be aware of all emergency procedures including building evacuation plans.

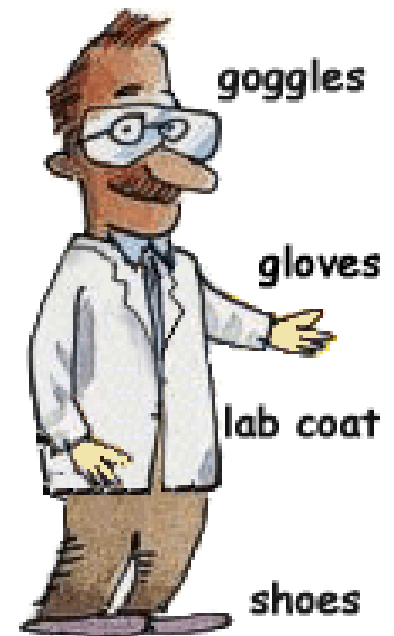


Safety Wears & Protective Equipment

Equipment worn to minimize exposure to serious workplace injuries and illnesses. It depends on the type of work, risk and chemicals.
















These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards.

- Eye protection
- Hear protection
- Respiratory protection
- Head and face protection
- Hand and arm protection
- Foot and leg protection
- Ear protection
- Body protection



Personal protective equipment (PPE) may include items such as gloves, safety glasses and shoes, earplugs or muffs, hard hats, respirators, or coveralls, vests and full body suits. PPE represent the last barrier of defense between the user and the hazard.

HAZARDOUS MATERIAL IDENTIFICATION GUIDE

CHEMICAL NAME		PERSONAL PROTECTION INDEX	
 HEALTH	 FLAMMABILITY  REACTIVITY  PERSONAL PROTECTION	A 	G 
B 		H 	
C 		I 	
D 		J 	
E 	K 		
F 	X Ask your supervisor for special handling instructions.		

HAZARD INDEX

- 4 - Extreme Hazard
- 3 - Serious Hazard
- 2 - Moderate Hazard
- 1 - Slight Hazard
- 0 - Minimal Hazard

Chemicals Disposal



- Chemicals are to be disposed of or recycled using environmentally safe procedures.
- The disposal procedures should aim to reuse, reduce and recycle of chemicals, as can as possible.



NOTICE
**IMPROPER DISPOSAL
OF CHEMICALS
IS PUNISHABLE BY
FINES AND IMPRISONMENT**

- Read Safety Data Sheets (SDS) for appropriate chemical disposal.
- No disposal of chemicals into any drain, sink or sewer.
- Keep container closed unless filling.



ATTENTION
DO NOT POUR
LIQUIDS DOWN
DRAIN



- Label the container with appropriate chemical information – content and volume or mass.
- Use only certified and approved **chemical waste contractors**.
- Place used chemicals or products in containers designed and labeled for that purpose.



Be Safe !!!!!!!

