Laboratory Safety and Waste Management

March 30, 2010

1. Safety in the laboratory is everyone's responsibility!

- Safe handling of chemicals (storage, use, labeling, etc).
- Safe handling of laboratory instrumentation.
- Safe chemical disposal procedure.

2. Awareness promotes Good laboratory Practices:

- Read the Material Safety Data Sheets (MSDS) for each chemical you use. This will help you easily identify hazardous chemicals and learn how to handle them.

Do not take chances with safety!

Major hazards could arise from the following:

1. Storing incompatible substances together.
2. Incorrect labeling/delivery of material.
3. Poorly managed chemical inventory and identification system for hazardous chemicals.
4. Use of non-intrinsically safe equipment.
5. Poor house keeping

Emergences:

Make sure you know the location and method of operation of the nearest:

1. First aid kit
2. Eye wash.
3. Safety shower
4. Fire extinguisher
5. Spill kit
6. Fire alarm pull station

Also, make sure that you know how to locate the following:

1. MSDS folders in the laboratory
2. Chemical inventories.
3. Safety cabinets and fume hoods
4. Hazardous waste disposal containers
5. Broken glass box

Guidelines for all chemical storage and handling

1. Chemical handling:

- Use bottle carriers to transport chemicals.
- Close caps securely.
- Pour all chemicals carefully: add acid to water, not water to acid.

2. Labels:

- Be sure all labels are securely attached and legible.
- Keep chemicals in their original containers if possible.
- Label all secondary containers to avoid unknown chemical or inadvertent reactions.
- Date all chemicals, which may become unstable over time.

Guidelines for all chemical storage and handling

3. Shelves:

- Do not store chemicals on hard-to-reach shelves.
- Labels on stored chemicals should be able to be read easily.
- Shelves should be made of a chemically resistant material and should have a 2-inch side rails.

4. Incompatible chemicals:

- Incompatible chemicals should not be store together.
- For each chemical, the hazardous nature must be considered individually and in relation to other chemicals in the area.
- For a list of incompatible chemicals, please refer to the BioTRU "Incompatible Chemical List" folder.

Incompatible Chemicals

Incompatible Chemicals

Inappropriate mixing of a strong oxidizing acid (nitric acid) with organic solvents inside a waste container within a fume hood.

Guidelines for all chemical storage and handling

5. Excessive storage:

- Avoid stockpiling chemicals.
- Use older stock first.
- Discard chemicals that are no longer needed or that have expired.

6. Fume hoods:

- In general, fume hoods should not be used for storage of chemicals.
- The exception is storage in a fume hood, which is specifically designed for that storage and where experimental procedures are not carried out.

General Laboratory Safety Procedure

Basic Precautions:

Awareness is the most fundamental rule of chemical safety. Take time to understand the safety and health hazards of the chemicals in the workplace. Every laboratory worker should take the following precautions:

1. Assume that unfamiliar chemicals are hazardous.
2. Review the safety and health hazard data of all chemicals used in the laboratory.
3. Know the signs and symptoms of overexposure and the physical and sensory characteristics (odor, appearance) of these chemicals.
4. Know appropriate procedures for emergencies, including the location and operation of all emergency equipment.
5. When working with hazardous materials, have a second person nearby, or, at minimum, maintain surveillance by telephone contact.
6. Avoid leaving experiments unattended.
7. Never use unlabeled chemicals or chemicals whose labeling is suspect.
8. Always order the least amount of chemical required.
9. Use appropriate personal protective equipment at all times.
10. Use hazardous chemicals in a chemical fume hood, whenever possible. Maintain equipment and inspect it regularly for proper function.

General Laboratory Safety Procedure

11. Use guards and shields where possible. All mechanical equipment sh
    adequate guarding.
12. Use safety shields when there is a possibility for explosion.

13. Store and handle chemicals in accordance with the guidelines contained in
    accordance with the chemical manufacturer's guidelines.
14. Store hazardous waste in a closed, labeled container in a designated satellite
    accumulation area.
15. Dispose of hazardous waste through the University Hazardous Waste Program??.
16. Avoid pouring chemical waste materials into the sink.

17. Do not eat, drink, smoke, chew gum or apply cosmetics in the laboratory.
18. Do not store food or beverages in the laboratory or in a chemical refrigerator.
19. Do not use chipped or cracked glassware.
20. Report all accidents, even if they do not result in injury, to the principal
    investigator.

Chemical Segregation

Any substance can have one or more hazards associated with it. There are three main pairs of hazards that must be segregated from each other:

1. Acids must be separated from bases
2. Oxidizers must be separated from flammables
3. Water reactives must be separated from water and everything else containing easily extracted protons, such as alcohols, acids (organic and inorganic), amines, etc.

Refer to the Chemical grouping properties
(BioTRU MSDS-1 folder)

Chemical Grouping properties

Group 1. Acids-non water reactive (e.g., hydrochloric acid).
Group 2. Acids-water reactive (e.g., phosphorus pentoxide)

Group 3. Bases-non water reactive (e.g., inorganic carbonates).
Group 4. Bases-water reactive (e.g., lithium)

Group 5. Oxidizers (e.g., peroxides, iodine, bleach).
Group 6. Flammable (e.g., solvents, nitrocellulose)

Group 7. Poisons-special (e.g., cyanides, sulfides, inorganic azides).
Group 8. Poisons-general (e.g., metallic mercury-thermometers)

Group 9. Cylinders (gaseous or liquid) (e.g., chlorine).
Group 10. Radioactive material

Flammable Liquid Safety Cabinet

How do I tell what's a safety risk?

- **NFPA** (National Fire Protection Association) classification system
  - The NFPA diamond is an easy way to determine the safety risks associated with hazardous materials. To determine a materials
    the diamond. A number in
    ity rating of the material.
    used to indicate

For example, An NFPA diamond on a can of gasoline would have a 3 in the red section indicating that gasoline could ignite at normal working temperatures.

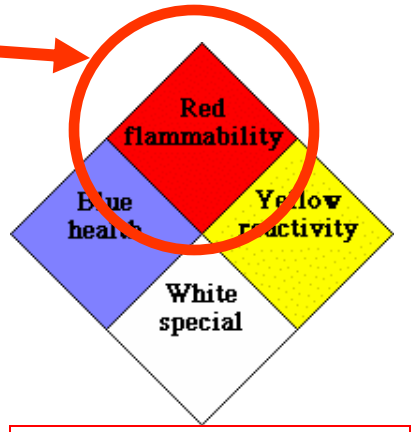
0- will not burn

1- must be preheated to burn

2-ignites when moderately heated

3-ignites at normal temperature

4-extremely flammable

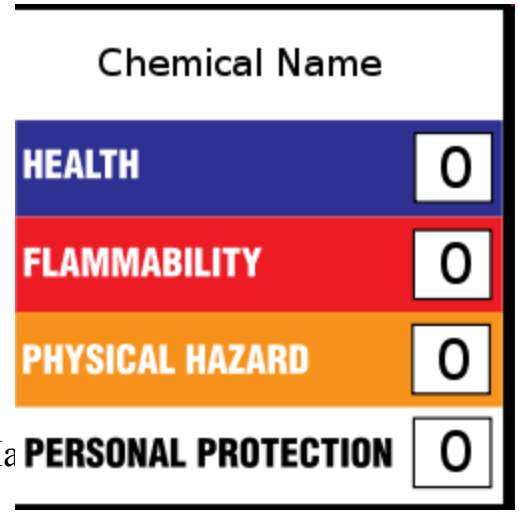


NFPA Diamond

NFPA Classification System Continued...

- Where can I find NFPA diamonds?
  - Product labels
  - Material Safety Data Sheets (ask your supervisor for them)
  - Products that do not use NFPA have risk information on product labels or product MSDS sheets.

HMIS (Hazardous Materials Identification System)



← Reactivity removed in April 2002

NFPA

NFPA Hazard Identification System

Blue Colour (Health hazard)

0	Material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material.	Peanut oil
1	Material that on exposure would cause irritation but only minor residual injury.	Turpentine
2	Material that on intense or continued but not chronic exposure could cause temporary incapacitation or possible residual injury.	Ammonia gas
3	Material that on short exposure could cause serious temporary or residual injury.	Chlorine gas
4	Material that on very short exposure could cause death or major residual injury.	Hydrogen cyanide

NFPA Hazard Identification System

Red Colour (flammability)

0	Material will not burn	Water
1	Material must be pre-heated before ignition can occur.	Corn oil
2	Material must be moderately heated or exposed to relatively high ambient temperature before ignition can occur.	Diesel fuel oil
3	Liquids and solids that can be ignited under almost all ambient temperature conditions.	Gasoline
4	Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature, or that are readily dispersed in air and that will burn readily.	Propane gas

NFPA Hazard Identification System

Yellow Colour (**Reactivity** or Susceptibility of Material to Burning)

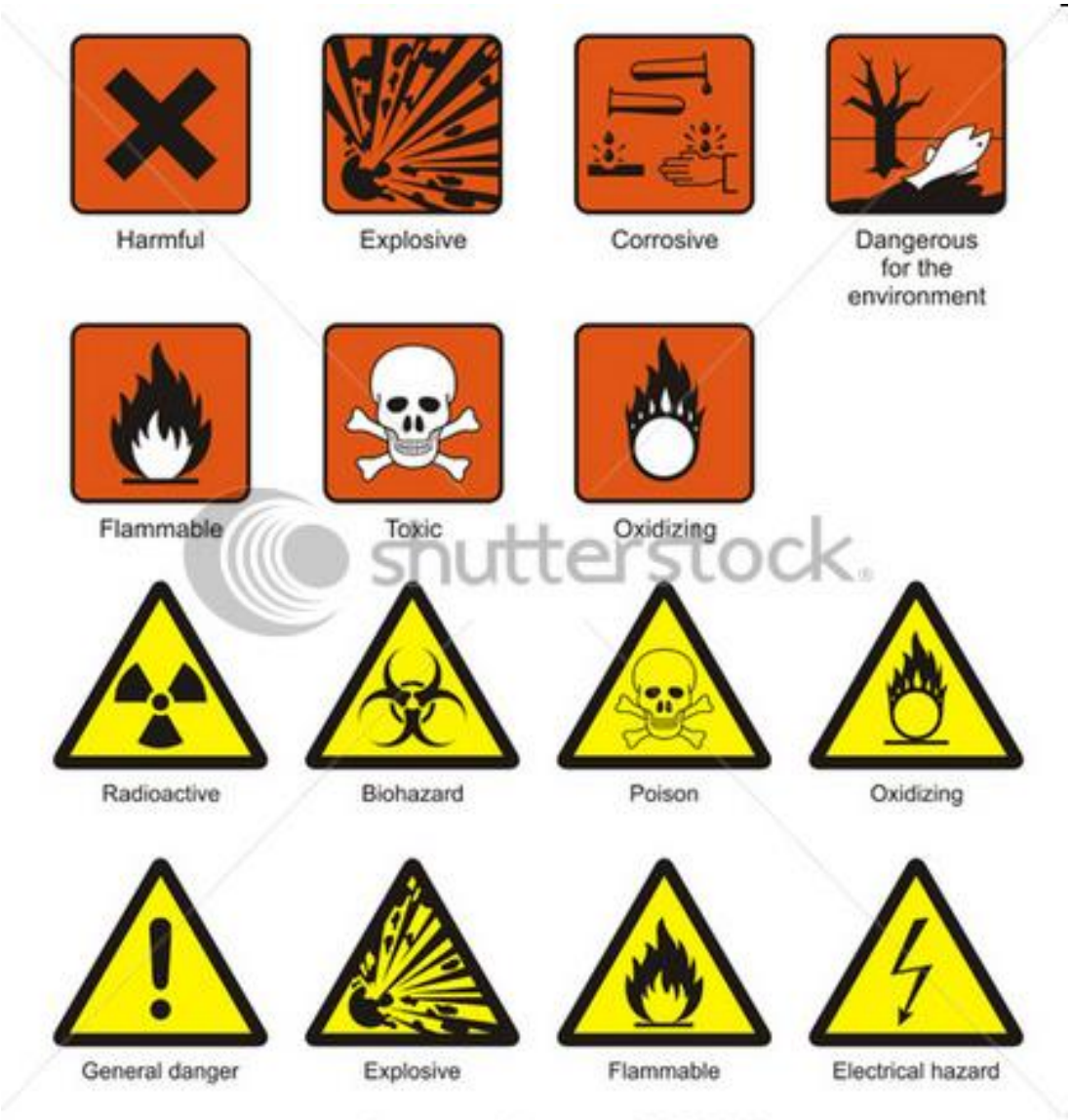
0	Material that in itself is normally stable, even under fire exposure conditions, and is not reactive with water.	Liquid nitrogen
1	Material that in itself is normally stable, but which can become unstable at elevated temperatures and pressures.	Phosphorus
2	Material that readily undergoes violent chemical change at elevated temperatures and pressures or which reacts violently with water or which may form explosive mixtures with water.	Calcium metal
3	Material that in itself is capable of detonation or explosive decomposition or reaction but requires a strong initiating source or which must be heated under confinement before initiation or which reacts explosively with water.	Fluorine gas
4	Material that in itself is readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.	Trinitrotoluene (TNT)

NFPA Hazard Identification System

White Colour: **Special Precautions** .

W	Material shows unusual reactivity with water (i.e., do not put water on it).	Magnesium metal
OX	Material possesses oxidizing properties.	Hydrogen peroxide
ACID	Material is an acid.	HCl
ALK	Material is a base (alkaline).	NaOH
COR	Material is corrosive.	Sulfuric acid
	Material is radioactive.	^{32}P, ^{14}C, ^{35}S

Other labels used for hazards identification



Hazardous Waste Storage and Disposal

1. No hazardous wastes or chemicals should be disposed in sinks.
2. Hazardous wastes should be accumulated and stored in properly managed containers on sufficiently impervious surfaces (free of cracks, gaps, etc.)
3. Hazardous waste must be stored in satellite accumulation areas and clearly labeled.
4. Once a satellite accumulation area container is filled, it must be dated and shipped off-site in a short-time.
5. Waste container must be closed at all times, unless waste is being added or removed.
6. Containers must be compatible with hazardous waste store within them. When in doubt, use the original shipping container.
7. Waste containers must be in good condition. There may not be severe rusting or other conditions that may cause leaks.
8. Waste containers must be inspected weekly to ensure that they are in good condition.
9. Labeling of containers that accumulate and store hazardous waste:

- The words “Hazardous Waste”.
- The waste type: e.g., Ethiduim Bromide (mutagenic).
- The date upon which the container became filled.

Disposable of broken glass

Do not throw broken glass
in waste basket

An old milk cartoon is a good
Container for broken glass

Disposable of Ethidium Bromide

- Small amounts of EtBr are not considered hazardous and can be drained down the sink with large volume of water.

1. Electrophoresis gels

- Less than 0.1% EtBr, place in laboratory general waste trash.

- More than 0.1% EtBr, place in designated EtBr waste box.

2. EtBr solutions

- Solutions with less than 10 ug/ml EtBr can be released down the drain.

- More than 10 ug/ml, EtBr needs to be deactivated:

Armour Method

This is the simplest method, but is somewhat controversial.

- Combine equal amounts of ethidium bromide solution and household bleach.
- Stir constantly for four hours or let sit for 2-3 days at room temperature.
- Pour down drain with copious amounts of water.
- The EtBr is converted to the physiologically inactive product 2-carboxybenzophenone.

Laboratory Personnel:

Laboratory personnel are responsible for:

1. Participating in laboratory safety training sessions (e.g., this seminar).
2. Being aware of the hazards of the chemicals they are working around or with, and safe storage, handling and disposal procedures.
3. Planning and conducting each operation and experimental in accordance with established chemical hygiene procedures.
4. Using appropriate safe work practices, personal protective equipment and engineering controls at all times.
5. Reporting all accidents, even if they are small, to the person in charge of laboratory safety.

Laboratory Safety and Waste Management Committee

Responsibilities:

1. Development and evaluation of safety procedure.
2. Development of chemical and equipment inventories
3. Laboratory inspection and audits.
4. Training and information dissemination.
5. Hazardous waste disposal.
6. Hazard and exposure assessment.
7. Accident investigation
8. Maintaining records of lab inspection, personnel training, etc.
9. Emergency assistance
10. Providing regular reports to BioTRU administration for feedback and recommendations.