## APPENDIX 3.2 CHEMICAL STORAGE

### NFPA Hazard Codes

The National Fire Protection Association developed a standard label to display chemical hazard ratings (see Appendix 3-3). The NFPA label is required by many institutions, industries, and municipalities, and is found on most new chemical reagent containers. The left diamond is printed in blue and indicates toxicity (health hazard), the top diamond is printed in red and indicates flammability, the right diamond is printed in yellow and indicates reactivity. The bottom diamond is printed in white and is reserved for special warnings such as radioactivity or reactivity with water.

### Material Safety Data Sheets (MSDS)

Chemical manufacturers provide material safety data sheets (MSDS) with the chemicals they sell. These sheets include pertinent safety and health information compiled from OSHA (Occupational Safety and Health Administration), the EPA (Environmental Protection Agency) and the National Library of Medicine. Instructors should keep this information in an appropriate location and should be aware of the possible dangers of the chemicals they use.

### Fire and Fire Extinguisher Codes

The National Fire Protection Association (NFPA) classifies fires as follows:

Class A fires ordinary combustibles such as wood, paper, cloth, etc. Such fires can be extinguished by the heat absorbing effect of water.

Class B fires involve flammable and combustible liquids, greases, and similar materials. Such fires are best extinguished by smothering them with non-combustible gases like carbon dioxide or halon.

Class C fires involve electrical equipment and should be extinguished with a material that is electrically non-conducting to avoid shock hazard.

Class D fires involve combustible metals like magnesium, and must be extinguished by a heat absorbing material that does not react with the burning metal.

Fire extinguishers are classified by the fires they extinguish. For example, an ABC extinguisher could be used on class A, B, and C fires.

### Chemical Storage Categories:

Explosions, fires, toxic fumes, and other hazards can arise if incompatible chemicals are accidentally mixed. To minimize the possibility of such hazards, the fronts of all chemical storage shelves should be equipped with horizontal bars so chemicals will not fall in the event of an earthquake. To minimize the potential of such hazards, chemicals should be stored with other compatible chemicals and separated by appropriate distances from incompatible chemicals. The following is a storage classification system suggested by the California State Department of Education[1].

> **Metals**: All metals, except mercury, can be stored together. Metals should be stored separate from all oxidizers, halogens, organic compounds and moisture.

[1] California State Department of Education. 1987. Science Safety Handbook For California High Schools.

**Oxidizers** (except ammonium nitrate). Oxidizers include such chemicals as: nitrates, nitrites, permanganates, chromates, dichromates, chlorates, perchlorates, and peroxides. They should be separated from metals, acids, organic materials, and ammonium nitrate. They should be separated from flammable liquids by a one-hour fire wall or a distance of 8 meters.

**Ammonium nitrate**: Ammonium nitrate should be stored in isolation from all other chemicals.

**Bases**: All strong bases, such as sodium hydroxide or potassium hydroxide should be stored in a dedicated corrosive chemicals cabinet that is coated with corrosion-resistant material.

**Acids**: All inorganic acids (except nitric acid), and all regulated organic acids should be stored in a cabinet constructed of corrosion resistant material. Acids may be stored with bases, but fumes from acids and bases may produce an annoying coating of salt crystals on the outside of reagent containers. Nitric acid should be stored separately from acetic acid. Fuming nitric acid should never be used in the school laboratory.

**Flammables**: Flammables should be stored in a dedicated wooden flammable materials cabinet, 8 meters away from all oxidizers. The cabinet should be coated with flame retardant paint, and should be appropriately labeled with the notice: FLAMMABLE LIQUID STORAGE. KEEP FIRE AWAY!

**Poisons**: Highly toxic substances such as cyanides should never be used in a school laboratory. Poisons approved by state and district education boards should be stored in a locked cabinet away from the acids cabinet.

**Compressed Gases**: Compressed gas cylinders should be strapped to the wall. Oxidizing gases such as oxygen should be stored far away from flammable liquids, gases, and metals. Flammable gases should be separated from oxidizers and oxidizing gases by a one-hour fire wall or a distance of 8 meters.

**Low Hazard Chemicals**: Many weak bases, oxides, sulfides, indicators, amino acids, sugars, stains and carbonates are classified as low-hazard chemicals. These chemicals may be stored on open shelves with bars to prevent accidental spillage.

**Storage Codes**:
Some manufacturers provide color-coded labels to categorize chemicals for storage purposes. Chemicals with a common storage color may be stored together, except when indicated otherwise. Chemicals with different storage color labels should be stored in different areas. The following is a commonly accepted code.

| | | |
|---|---|---|
| R | Storage code **Red** | **Flammable**. Store in area designated for flammable reagents. |

| | | |
|---|---|---|
| Y | Storage code **Yellow** | **Reactive and oxidizing**. May react violently with air, water, or other substances. Store away from flammable and combustible materials. |
| B | Storage code **Blue** | **Health hazard**. These chemicals are toxic if inhaled, ingested, or absorbed through the skin. They should be stored in a locked cabinet. |
| W | storage code **White** | **Corrosive**. These chemicals may harm skin, eyes, mucous membranes. They should be stored away from red, yellow, and blue-coded reagents. |
| G | storage code **Gray** | **Moderate or minimal hazard**. According to current data, these chemicals do not pose more than a moderate hazard in any category. |