Safety and Risk Management

Safe Storage of Incompatible Chemicals

1. **PURPOSE:** To provide a guideline on the safe storage requirements of hazardous chemicals in the VCU community.

2. **SCOPE/APPLICABILITY**: This guideline is applicable to all users of hazardous chemicals at VCU.

3. **TABLE OF CONTENTS:**

4. **BACKGROUND**: This guideline was created as a tool to assist VCU personnel on the safe storage of hazardous chemicals to minimize the potential for chemical spills, chemical reactions and potential exposures.

5. **RESPONSIBILITIES:** It is the responsibility of all VCU personnel working with hazardous chemicals to adhere to this guideline when storing any hazardous chemicals. All safe chemical storage guidelines must be delineated within the lab specific Chemical Hygiene Plan (CHP). A copy of the CHP can be downloaded from this website..

6. **GUIDELINES FOR SAFE CHEMICAL STORAGE:**
   a. Maintain a chemical inventory. Safe chemical handling requires regular inspections of chemical storage areas and maintenance of stringent inventory control.
   b. Read all chemical labels and Safety Data Sheets (SDS) for specific storage instructions
   c. Ensure all chemicals are properly labeled and time sensitive chemicals are dated.
   d. Return chemical containers to the proper storage location after use.
   e. Do not store hazardous chemicals above eye level.
   f. Chemical storage area should have a cool, dry atmosphere, sufficient lighting in all areas, a ventilation system that exhausts to the outside
   g. Chemical storage areas should be secure and have sufficient shelving and unobstructed aisles with no blind areas.
   h. Do not overcrowd shelving.

7. **SEPARATING HAZARDOUS CHEMICALS**: Chemicals should be segregated and stored according to their physical or health hazard class as delineated by the OSHA Hazard Communication Standard (29CFR1910.1200). Do not store chemicals alphabetically as this may place incompatible chemicals next to each other. The general hazard classes are:

a. Flammables/Self Heating (liquids, gasses or solids)
b. Corrosives (acids and bases should be stored separately)
c. Oxidizers (liquids, gasses, solids or mixtures such as Piranha solutions)
d. Carcinogens/acute toxins/mutagens/reproductive toxins/aspiration toxins
e. Water reactive chemicals
f. Pyrophoric/Self Reactive (liquids, gases or solids)
g. Explosives/Organic Peroxides

Additionally for safe hazardous chemical storage:

a. Separate acids from bases and store on lower shelves
b. Separate acids from organic solvents
c. Isolate perchloric acid from organic materials
d. DO NOT store perchloric acid on a wooden shelf
e. Separate highly toxic chemicals and carcinogens from all other chemicals. This storage location must have a warning label and should be in a controlled or locked area.
f. DO NOT allow picric acid to dry out
g. Flammables should be stored in a flammable storage cabinet
h. If flammables need to be chilled, store in a laboratory-safe refrigerator. (Not a standard refrigerator)

8. INCOMPATABILITY TABLES:

Chemical	Reaction
Acetic acid and acetaldehyde	Polymerization of acetaldehyde
Copper (II) sulfide and cadmium chlorate	Explosive reaction
Hydrogen peroxide and iron (II) sulfide	Reacts vigorously
Sodium nitrite and sodium thiosulfate	Explosive when heated

Examples of Incompatible Chemicals

Chemical	Is Incompatible and Should Not Be Mixed or Stored With
Acetic acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Acetone	Concentrated nitric and sulfuric acid mixtures
Alkali and alkaline earth metals (such as powdered aluminum or magnesium, calcium, lithium, sodium, potassium)	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia (anhydrous)	Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid (anhydrous)
Ammonium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrates, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids
Bromine	See Chlorine
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chromic acid and chromium trioxide	Acetic acid, naphthalene, camphor, glycerol, alcohol, flammable liquids in general
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen,

	sodium carbide, benzene, finely divided metals, turpentine
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Fluorine	Everything
Hydrocarbons (such as butane, propane, benzene)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali
Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, combustible materials
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen, flammable liquids, solids or gases

Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxide, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids
Potassium perchlorate (see also chlorates)	Sulfuric and other acids
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartartic acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrate	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydrite, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)
Tellurides	Reducing agents

9. Reference: Introduction to Safety in the Chemical Laboratory, Academic Press