WESTERN CONNECTICUT STATE UNIVERSITY

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CHEMICAL STORAGE AND COMPATIBILITY GUIDELINES

PROCEDURE S-118

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Please direct any questions or comments about the applicability of this document to Luigi Marcone, WCSU Department of Public Safety

1.0 INTRODUCTION

The chemical storage and compatibility guidelines have been developed to aid chemical users at Western Connecticut State University (WCSU) to meet the requirements of the Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA). They have been developed using references issued by the National Fire Protection Association (NFPA) and the Federal Department of Transportation (DOT). This is a guidance document and is not intended to address all potential chemical storage scenarios.

2.0 GENERAL OPERATING PRINCIPLES

- Minimize chemical storage in laboratories
- Utilize dedicated storage rooms and solvent storage areas
- Flammable storage in excess of 10 gallons must be in a flammable storage cabinet and cannot exceed 60 gallons per laboratory
- Storage cabinets must be vented to the outdoors or sealed
- All containers must be labeled with
    - Contents listed in plain English
    - Manufacturer's name
    - Primary hazard statement
- When in doubt, use secondary containment

3.0 CHEMICAL STORAGE AREA

- Chemical storage areas should be away from exits, heat and direct sunlight.
- Shelves shall be of substantial construction, resistant to chemicals and should have a 1-inch lip to prevent chemicals from falling.
- Chemicals should be stored at shoulder height (of the average employee) or below.
- Proper ventilation of the area needs to be supplied and special ventilation may be required.
- Secondary containment **shall** be provided for liquids that are flammable, corrosive, highly toxic or highly volatile. It should be provided for all other aqueous solutions.
- Flammable chemicals require an approved storage cabinet if more than 10 gallons is present at any one time. A maximum of 60 gallons may be stored in a flammables cabinet at any one time.
- Flammables cabinets and flammable chemicals may not be stored in the path of egress.
- Bench tops shall not be used as chemical storage areas.
- If refrigeration is required, then an approved refrigerator for flammable of explosive storage (and proper signage) must be provided.
- Chemicals shall not be stored on the floor.
- Gas cylinders shall be stored away from heat sources, in an upright position and individually secured with a chain or strap to ensure that it will not fall over.

- Area should be inspected regularly for leaking or defective containers and chemicals that have been placed back in the wrong place.
- Chemicals must be inventoried annually. Maximum quantities on hand at any one time shall be included in this inventory procedure.

4.0 CHEMICAL CONTAINERS AND GAS CYLINDERS

- Containers shall be constructed of a material that is compatible with the chemical it will contain.
- Containers and cylinders shall be physically sound with no rusting or bulging.
- All containers shall be labeled with the contents and hazards of the chemical. For chemicals that have been transferred to a secondary container, a label must be applied indicating contents, manufacturer, and primary hazard.
- Gas Cylinders must have the cap installed when not in use.
- Gas cylinder storage tags must be used at all times (see Appendix 1).

5.0 COMPATIBILITY

Chemicals must be stored in such a manner to avoid interaction between incompatible chemicals. There are many systems to ensure proper storage and many are based on color-coding the chemical's labels, with compatibles being the same color. Once segregated into compatible groups the chemicals can be put in alphabetical order.

In general, flammables must be stored together and away from other chemicals. Flammable chemicals with an NFPA rating of 2 or above (flash point above 100°F) should be stored in a flammables cabinet.

Toxics or poisons are often indicated by a blue label and may need to be stored in a separate, secured area.

General use chemicals without significant incompatibilities may be stored together using an alphabetical system and are usually indicated by an orange or gray label.

General guidelines for the storage of acids and bases include the following:

- Acids and bases shall be stored separately.
- Secondary containment is required for all liquid corrosives. Each grouping may share the same secondary containment, but each group listed below must be in separate secondary containment.
- Secondary containment shall be able to contain 110% of the acids being stored within the containment. Secondary containment shall not react or become compromised if it comes in contact with the acid. Polyethylene tubs are recommended.
- Separate and store acids according to the guidance below. Any acid not listed below should follow the J.T. Baker system which may be found at http://www.jtbaker.com (or its equivalent)

Acids in Compatibility Group	Hazard family
Picric Acid Propionic Acid Butyric Acid Acrylic Acid	Flammable hazard
Formic Acid	Incompatible with other acids and alcohols, Flammable
Phosphoric Acid Hydrochloric Acid Hydrofluoric Acid Hydroiodic Acid Hydrobromic Acid Oxalic Acid Dichloroacetic Acid Fluoboric Acid Acetic Acid	Contact hazards, Corrosive
Lactic Acid	Incompatible with other acids, contact hazard, corrosive
Nitric Acid Perchloric Acid Sulfuric Acid Chromic Acid	Reactivity hazard, strong oxidizer

Note[1]: The red group acids can be stored in a flammable storage cabinet as long as they are stored in a secondary containment. OSHA does not consider all acids listed in the red group to be flammable. This means that they are not required to be stored in a flammable storage cabinet as long as less than 20 gallons per 110 ft^2 are being stored. Twenty gallons per 100 ft^2 is used for a non-instructional laboratory unit per NFPA 45.

Note[2]: It is recommended that Hydroflouric acid be stored by itself in a separate cabinet due to the extreme nature of the contact hazard. All containers used with or around Hydroflouric acid must be plastic or nalgene and NOT glass.

COMMON CHEMICAL INCOMPATIBILITIES

The following are additional examples of common laboratory chemicals and their incompatibilities. This list is by no means exhaustive and should be used as guidance only. For specific chemicals of concern, refer to the Chemicals Material Safety Data Sheet (MSDS).

Chemical	Incompatibilities
Acetic Acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates.
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury.

Chemical	Incompatibilities
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 (in manometers, for example), chlorine, calcium hypochlorite, iodine, bromine, hydrogluoric acid (anhydrous).
Ammomium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrites, sulfur, finely divided organic 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 slats, acids, powdered metals, sulfur, finely divided organic or combustible materials.
Chromic acid and chromium	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	All other chemicals (such as butane, propane, benzene).
Hydrocarbons	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 slats, alcohols, acetone, organic materials, aniline, nitromethane, combustible materials.
Hydrogen sulfide	Fuming nitric acid, oxidizing gases.
Hypochlorites	Acids, activated carbon.

Chemical	Incompatibilities
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.
Nitrates	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.
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold.
Phosphorus (white)	Air, oxygen, alkalies, 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 nitrite	Ammonium nitrate and other ammonium salts.
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, 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.

Appendix 1

Gas Cylinder Storage Tag or Equivalent