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Chemical Storage Guidelines		
Investigator: General Safety	Location: EHS	Revision: 1.0

1.0 PURPOSE:

Proper storage is needed to minimize the hazards associated with accidentally mixing incompatible chemicals. Due to the diverse individual properties of chemicals that may be located in a chemical use area, proper storage may be complicated. This SOP provides general safety procedures for chemical storage. Specific instructions on chemical storage may be obtained from the MSDS, container label, or by contacting OES.

2.0 SCOPE:

This procedure applies to all Louisiana State University Personnel that use and handle chemicals. It is the intent of this guideline to provide information on the safe storage of chemicals and afford employee protection from potential health and physical hazards associated with accidentally mixing incompatible chemicals.

3.0 RESPONSIBILITIES:

Only trained and qualified personnel shall be allowed to handle hazardous materials. Supervisors are responsible for ensuring that personnel are trained to handle chemicals and that all chemical are store in a safe manner. The chemical incompatibilities discussed below are by no means exhaustive. As a result, it is important for laboratory personnel to thoroughly research the properties of the chemicals they are using. Material Safety Data Sheets (MSDSs) have sections on chemical incompatibility. The container's label should also provide storage guidelines

4.0 DEFINITIONS:

- 4.1 Pyrophoric Substance - Materials which will react with the air to ignite when exposed, e.g., white phosphorus.
- 4.2 Oxidizing Agent – Reactive material that oxidizes another substance and is reduced.
- 4.3 Acid – Corrosive material that that produces H+ (aq) ions in aqueous solution. Strong acids ionize completely or almost completely in dilute aqueous solution. Weak acids ionize only slightly.
- 4.4 Base – Corrosive material that produces OH (aq) ions in aqueous solution. Strong bases are soluble in water and are completely dissociated. Weak bases ionize only slightly.
- 4.5 Flammable - A liquid as defined by NFPD and DOT as having a flash point below 37.8°C (100°F).

5.0 REFERENCES:

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Manufacturing Chemists' Association, Guide for Safety in the Chemical Laboratory, pp. 215-217, Van Nostrand Reinhold, 2nd Edition

"Safe Chemical Storage: A Pound of Prevention is Worth a Ton of Trouble" by David Pipitone and Donald Hedberg, Journal of Chemical Education, Volume 59, Number 5, May 1982

"Fire Protection Guide on Hazardous Materials," NFPA, 1978

6.0 MATERIALS and/or EQUIPMENT:

Personal Protective Equipment

7.0 PROCEDURES:

7.1 Know the properties of the chemicals used.

7.2 In general, chemicals should be separated according to the following categories:

7.2.1 Solvents, which include flammable/combustible liquids and halogenated hydrocarbons (e.g., acetone, benzene, ethers, alcohols) Note: Store glacial acetic acid as a flammable liquid

7.2.2 Inorganic mineral acids (e.g., nitric, sulfuric, hydrochloric, and perchloric acids).

7.2.3 Bases (e.g., sodium hydroxide, ammonium hydroxide)

7.2.4 Oxidizers

7.2.5 Poisons

7.2.6 Explosives or unstable reactives, such as picric acid. Store separately outdoors in flammable storage cabinets. An inventory of all chemicals must be maintained. Inventories must include the full chemical name, location of storage, and associated hazard (e.g. corrosive or flammable

7.3 Inventories must be updated annually and signed by the person performing the update. Chemicals purchased throughout the year must be added to the inventory as soon as they are brought into the work area. Post chemical inventories inside the room with a hazard summary posting on the door for emergency response purposes.

7.4 Ensure that all containers are in good condition, properly capped, and labeled. If you are using short hand names or acronyms on any solutions, reagents, or aliquots of chemicals, you must maintain a cross-reference sheet that defines the short hand name or acronym in use such as EtOH = ethanol or PBS=phosphate buffered saline. Review this list annually to ensure that all short hand names or acronyms in use are recorded.

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- 7.5 Store all hazardous liquid chemicals in drip trays that are chemically resistant. Photo trays provide good containment and are widely used at the Lab. Install Plexiglas lips or use equivalent means to prevent materials from falling off storage shelves.
- 7.6 Avoid storing chemicals on countertops or in fume hoods except for those being currently used.
- 7.7 Avoid storing chemicals above eye level. Select low shelves or cabinets for heavy containers. Never store chemicals or any other item closer than 18" to the ceiling. Storing an item close to the ceiling will impede the effectiveness of automatic fire suppression systems.
- 7.8 Do not store chemicals on the floor. Chemical containers could present a tripping hazard or could be knocked over causing a spill.
- 7.9 Label all containers (squeeze bottles and Nalgene bottles) to which hazardous materials are transferred with the identity of the substance and its hazards. Be aware that squeeze bottles and Nalgene bottles have varying resistances to different chemicals.
- 7.10 Limit the amount of chemicals stored to the minimum required.
- 7.11 Avoid exposure of chemicals to heat or direct sunlight. This may lead to the deterioration of storage containers as well as the degradation of the chemicals.
- 7.12 Use approved corrosive storage cabinets (constructed of chemically resistant components) for storing acids and bases.
- 7.13 Use flammable storage cabinets to store flammable liquids.
- 7.14 Refrigerators used for storing chemicals, samples or media must be labeled with words to the effect as follows: "Caution – Do Not Store Food Or Beverages In This Refrigerator". Refrigerators used for food storage in or near work areas (shops and labs) must be labeled with words to the effect as: "Notice – Food May Be Stored In this Refrigerator". Labels may be fabricated by users provided they are legible and securely affixed to the refrigerator. Refrigerators used for food and beverage which are located in lunch rooms and office buildings, where there is no shop or lab type chemical usage do not require any posting.
- 7.15** Refrigerators and freezers for storing flammable liquids (including ethanol) must be designed, constructed and approved for that purpose. Domestic refrigerator/freezers as well as units that have been modified to remove spark sources are not acceptable alternatives.

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7.16 Avoid mixing incompatible waste materials. A number of serious laboratory accidents have occurred when people have poured incompatible waste materials into hazardous waste containers. Use separate waste containers for each type of waste.

8.0 STORAGE ACCORDING TO HAZARD CLASSES

The following guidelines are provided for the safe storage of hazardous materials in accordance with their hazard classes:

8.1 Acids

8.1.1 Segregate acids from reactive metals such as sodium, potassium, magnesium.

8.1.2 Segregate oxidizing acids from organic acids, flammable and combustible materials.

8.1.3 Segregate acids from chemicals which could generate toxic or flammable gases upon contact, such as sodium cyanide, iron sulfide, calcium carbide

8.1.4 Segregate acids from bases.

8.2 Bases

8.2.1 Segregate bases from acids, metals, explosives, organic peroxides and easily ignitable materials.

8.3 Solvents (Flammable and Halogenated Solvents)

8.3.1 Store in approved safety cans or cabinets.

8.3.2 Segregate from oxidizing acids and oxidizers.

8.3.3 Keep away from any source of ignition: heat, sparks, or open flames.

8.4 Oxidizers

8.4.1 Store in a cool, dry place.

8.4.2 Keep away from combustible and flammable materials.

8.4.3 Keep away from reducing agents such as zinc, alkali metals, and formic acid.

8.5 Cyanides

8.5.1 Segregate from acids and oxidizers.

8.6 Water Reactive Chemicals

8.6.1 Store in a cool, dry place away from any water source.

8.6.2 Make certain that a Class D fire extinguisher is available in case of fire.

8.7 Pyrophoric

8.7.1 Store in a cool, dry place making provisions for an airtight seal.

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8.8 Light Sensitive Chemicals

8.8.1 Store in amber bottles in a cool, dry, dark place.

8.9 Peroxide Forming Chemicals

8.9.1 Store in airtight containers in a dark, cool, and dry place.

8.9.2 Label containers with receiving, opening, and disposal dates.

8.9.3 Periodically test for the presence of peroxides.

8.10 Toxic Chemicals

8.10.1 Store according to the nature of the chemical, using appropriate security where necessary.

9.0 CONTINGENCIES:

9.1 In case of a fire, explosion, or gas leak evacuate individuals from the area and call the emergency response (911). Notify supervision and adjacent personnel as quickly as possible. Observe appropriate procedures for personal injury or fire as provided in EHS Web site.

9.2 In case of a chemical spill, alert others in the immediate vicinity and notify your supervisor. Determine the severity of the spill and proceed as appropriate. Small spills may be cleaned up by laboratory personnel. For large spills, notify EHS (578-5640) and Campus Police (911 or 578-3231). If possible to do so safely (without risk of over-exposure), take action to stop the release. Ensure that extraneous personnel remain at a safe distance until the spill is completely cleaned-up

10.0 REVIEWS AND REVISIONS:

This procedure shall be reviewed for compliance and effectiveness and revised as necessary on an annual basis.

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11.0 ATTACHMENTS and REFERENCE FORMS:

The following incompatibility matrix and table contains examples of incompatible chemicals:

Chemical Incompatibility Matrix

	Acids, Inorganic	Acids, Oxidizing	Acids, Organic	Alkalis (Bases)	Oxidizers	Poisons, inorganic	Poisons, organic	Water reactives	Organic solvents
Acids, Inorganic			X	X		X	X	X	X
Acids, Oxidizing			X	X		X	X	X	X
Acids, Organic	X	X		X	X	X	X	X	
Alkalis (Bases)	X	X	X				X	X	X
Oxidizers			X				X	X	X
Poisons, inorganic	X	X	X				X	X	X
Poisons, organic	X	X	X	X	X	X			
Water reactives	X	X	X	X	X	X			
Organic solvents	X	X		X	X	X			

X = Not compatible – do not store together

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CHEMICAL	KEEP OUT OF CONTACT WITH
Acetic Acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetone	Concentrated nitric and sulfuric acid mixtures, and strong bases
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Alkali Metals	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, the halogens
Ammonia, anhydrous	Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid
Ammonium Nitrate	Acids, metal powders, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenic materials	Any reducing agent
Azides	Acids
Bromine	Same as chlorine
Calcium Oxide	Water
Carbon (activated).	Calcium hypochlorite, all oxidizing agents
Carbon tetrachloride	Sodium

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CHEMICAL	KEEP OUT OF CONTACT WITH
Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organic or combustible materials
Chromic Acid and Chromium trioxide	Acetic acid, naphthalene, camphor, glycerol, glycerin, turpentine, alcohol, flammable liquids in general
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals
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
Hydrocarbons	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic Acid	Nitric acid, alkali
Hydrofluoric Acid	Ammonia, aqueous or anhydrous

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CHEMICAL	KEEP OUT OF CONTACT WITH
Hydrogen Peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, flammable liquids
Hydrogen Sulfide	Fuming nitric acid, other acids, oxidizing gases, acetylene, ammonia (aqueous or anhydrous), hydrogen
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 and oils

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CHEMICAL	KEEP OUT OF CONTACT WITH
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate and perchlorate	Sulfuric and other acids
Potassium Permanganate	Glycerin, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartaric 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 (or compounds with similar light metals, such as sodium, lithium, etc.)
Tellurides	Reducing agents