Title: Incompatible Chemical Storage

Lessons Learned Statement: During recent laboratory safety inspections, several issues regarding chemical storage were observed including incompatible chemicals being stored together. Incompatible chemical storage can lead to hazardous results.

Discussion: Segregation of incompatible chemicals usually means chemicals are kept in separate approved cabinets, lockers, bins, etc. For incompatible compressed gas cylinders, segregation by distance is allowed (e.g., hydrogen and oxygen are kept 20 feet apart). *A pdf of this lessons learned and some helpful chemical compatibility charts are available when you click the link below for the complete briefing. The attachment can be found at the end of the briefing.*

Key points for safe chemical storage include:

- Segregate flammable and combustible liquids from oxidizing acids and oxidizers.
- Segregate acids from bases.
- Acetic acid is a combustible liquid; store it in a flammable cabinet (not with other acids).
- Segregate acids from reactive metals such as sodium, potassium, and magnesium.
- Segregate oxidizing acids from organic acids and flammable and combustible materials.
- Segregate acids from chemicals that could generate toxic or flammable gases upon contact, such as sodium cyanide, iron sulfide, and calcium carbide.
- Do not store flammable gases (e.g., propane) in flammable storage cabinets with flammable liquids
- Remember to always store hazardous liquids in secondary containment trays.

The Chemical Hygiene and Safety Plan (CHSP), Work Process K "Chemical Storage", provides details on proper storage of chemicals, including help to ensure chemicals are compatible with each other when stored together. The attached chemical incompatibility charts/tables provide additional guidance for segregating incompatible chemicals. Material Safety Data Sheets (MSDSs), which are now called Safety Data Sheets or SDSs, are also useful resources. The CHSP and MSDSs may be accessed from the Lab's A-Z index.

If you have any questions regarding proper chemical storage contact your Division Safety Coordinator or Health and Safety Representative who provides service to your division.

Please contact the following subject matter experts if you have any questions regarding this briefing.

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Chemical Compatibility Chart*

	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			

* LBNL ES&H Manual, Chapter 45, “Chemical Hygiene Safety Plan”, Work Process K, Table K-1

X = incompatible materials (must segregate)

= compatible materials

Chemical Incompatibility Table*

Chemical	Keep out of Contact With
Acetic acid	Chromic acid, nitric acid, perchloric acid, peroxides, permanganates and other oxidizers
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, 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
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	Acids
Hydrofluoric acid	Ammonia, aqueous or anhydrous, bases and silica
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

Chemical Incompatibility Table*

Chemical	Keep out of Contact With
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
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, alkali metals, magnesium, calcium.
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

*LBNL ES&H Manual, Chapter 45, “Chemical Hygiene Safety Plan”, Work Process K, Table K-2
(Originally sourced from Manufacturing Chemists' Association, *Guide for Safety in the Chemical Laboratory*, pp. 215–217, Van Nostrand)