

APPENDIX D: STORING CHEMICALS SAFELY

Rules for Safely Storing Chemicals

1. Store like chemicals together and away from incompatible groups of chemicals. Do not store chemicals in alphabetical order. An easy way to store chemicals properly is to use the chemical manufacturer's color-coding system. (i.e. store reds with reds, blues with blues, etc.) Contact EH&S at 7-3129 for assistance, if needed.
2. Flammable materials should be stored in an approved, dedicated, flammable materials storage cabinet or room if the volume exceeds ten (10) gallons.
3. Liquids should be stored in unbreakable or double-contained packaging, or the storage cabinet should have the capacity to hold the contents if the container breaks.
4. Avoid floor chemical storage (even temporary).
5. Chemicals should be stored no higher than eye level and never on the top shelf of a storage unit.
6. Shelf assemblies should be firmly secured to the walls. Avoid island shelves.
7. Each shelf should have an anti-roll lip.
8. Store acids in a dedicated acid cabinet. Nitric acid may be stored there also, if it is kept isolated from the others.
9. Store severe poisons in a dedicated poison cabinet.
10. All chemicals should be labeled and dated.
11. Look for unusual conditions in chemical storage areas, such as:
 - * improper storage of chemicals
 - * leaking or deteriorating containers
 - * spilled chemicals
 - * temperature extremes (too hot or cold in storage area)
 - * lack of or low lighting levels
 - * blocked exits or aisles
 - * doors blocked open, lack of security
 - * trash accumulation
 - * smoking or open lights or matches
 - * fire equipment blocked, broken or missing
 - * lack of information or warning signs ("No Smoking", "Flammable Liquids", "Acids", "Corrosives", "Poisons", "Chemical Storage")

Any of these conditions should be corrected immediately. Routine inspections of chemical storage areas will prevent accidents.

Table VI Suggested Storage Limits For Common Peroxidizable Compounds

MOST DANGEROUS: Discard after 3 months . Peroxide formation hazard during storage.	
isopropyl ether	divinyl acetylene
vinylidene chloride	potassium metal
sodium amide	potassium amide
DANGEROUS: Discard after one year . Peroxide formation hazard during storage and on concentration (i.e. distillation) of compound	
diethyl ether	dicyclopentadiene
tetrahydrofuran	diacetylene
dioxane	methyl acetylene
acetal	cumene
methyl isobutyl ketone	tetrahydronaphthalene
ethylene glycol dimethyl ether	cyclohexene
vinyl ethers	methylcyclopentane
DANGEROUS: Discard after one year . Peroxide formation causes initiation of hazardous polymerization.	
methyl methacrylate	chlorotrifluoroethylene
styrene	vinyl acetylene
acrylic acid	vinyl acetate
acrylonitrile	vinyl chloride
butadiene	vinyl pyridine
tetrafluoroethylene	chloroprene
Safety Hints:	
1. Do not purchase these compounds in quantities greater than can be used in the specified storage time period.	
2. Ethers should be stored in the dark and under nitrogen if possible.	
3. Always check for the presence of peroxides before distilling any peroxide former.	
4. Consult safety references before working with peroxidizable compounds.	

**Table VII Short List of Incompatible Materials
DO NOT CONTACT**

ALKALI METALS , such as calcium, potassium, and sodium with: water, carbon dioxide, carbon tetrachloride, and other chlorinated hydrocarbons.	ACETIC ACID with: chromic acid, nitric acid, hydroxyl containing compounds, ethylene glycol, perchloric acid, peroxides, and permanganates.
ACETONE with: concentrated sulfuric acid and nitric acid mixtures.	ACETYLENE with: copper (tubing), fluorine, bromine, chlorine, iodine, silver, mercury, or their compounds.
AMMONIA, ANHYDROUS with: mercury, halogens, calcium hypochlorite, or hydrogen fluoride.	AMMONIUM NITRATE with: acids, metal powders, flammable liquids, chlorates, nitrates, sulfur, and finely divided organics or other combustibles.
ANILINE with: nitric acid, hydrogen peroxide, or other strong oxidizing substances.	BROMINE with: ammonia, acetylene, butadiene, butane, hydrogen, sodium carbide, turpentine, or finely divided metals.
CHLORATES with: ammonium salts, acids, metal powders, sulfur, carbon, finely divided organics or other combustibles.	CHROMIC ACID with: acetic acid, naphthalene, camphor, alcohol, glycerin, turpentine, and other flammable liquids.
CHLORINE with: ammonia, acetylene, butadiene, benzene and other petroleum fractions, hydrogen, sodium carbides, turpentine, and finely divided metals.	CYANIDES with: acids.
HYDROGEN PEROXIDE with: copper, chromium, iron, most metals or their respective salts, flammable liquids and other combustible materials, aniline, and nitromethane.	HYDROGEN SULFIDE with: nitric acid, oxidizing gases.
HYDROCARBONS , generally, with: fluorine, chlorine, bromine, chromic acid, or sodium peroxide.	IODINE with: acetylene or ammonia.

MERCURY with: acetylene, fluminic acid, or hydrogen.	NITRIC ACID with: acetic, chromic, or hydrocyanic acids, aniline, carbon, hydrogen sulfide, flammable liquids or gases, or other substances which are readily nitrated.
OXYGEN with: oils greases, hydrogen, flammable liquids, solids, or gases.	OXALIC ACID with: silver or mercury
PERCHLORIC ACID with: acetic anhydride, bismuth and its alloys, alcohol, paper, wood, and other organic materials.	PHOSPHOROUS PENTOXIDE with: water.
POTASSIUM PERMANGANATE with: glycerin, ethylene glycol, benzaldehyde, or sulfuric acid.	SODIUM PEROXIDE with: any oxidizable substances, for instance: methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, furfural, etc.
SULFURIC ACID with: chlorates, perchlorates, permanganates, and water	

NOTE: This list is not a complete list of incompatible materials. It contains some of the more common incompatible materials. Always research the materials you work with in order to be safe.

Shock Sensitive Compounds

Acetylenic compounds - especially polyacetylenes, haloacetylenes and heavy metal salts of acetylenes (copper, silver, and mercury salts are particularly sensitive).

Acyl nitrates

Alkyl nitrates - particularly poly nitrates (i.e. nitrocellulose and nitroglycerine).

Alkyl and acyl nitrites

Alkyl perchlorates

Aminemetal oxosalts - metal compounds with coordinated ammonia, hydrazine or similar nitrogenous donors and ionic perchlorate, nitrate, permanganate or other oxidizing groups.

Azides - including metal, nonmetal and other organic azides.

Chlorite salts or metals (i.e. AgClO_2 and $\text{Hg}(\text{ClO}_2)_2$)

Diazo compounds (i.e. CH_2N_2)

Diazonium salts (when dry)

Fulminates - silver fulminate (AgCNO) can form in the reaction mixture from the Tollen' test for aldehydes if it is allowed to stand for some time; this can be prevented by adding dilute nitric acid to the test mixture as soon as the test has been completed.

Hydrogen peroxide - becomes increasingly treacherous as the concentration rises above 30%, forming explosive mixtures with organic materials and decomposing violently in the presence of traces of transition metals.

N-Halogen compounds (i.e. difluoroamino compounds and halogen azides).

N-Nitro compounds (i.e. N-nitromethylamine, nitrourea, nitroguanidine and nitric amide).

Oxo salts of nitrogenous bases - perchlorates, dichromates, nitrates, iodates, chlorites, chlorates and permanganates of ammonia, amines, hydroxylamine, guanidine, etc.

Perchlorate salts - most metal, nonmetal and amine perchlorates can be detonated and may undergo violent reaction in contact with combustible materials.

Peroxides and hydroperoxides

Peroxides (solid) - crystallized form or are left form evaporation of peroxidizable solvents.

Peroxides - transition-metal salts

Picrates - especially salts of transition and heavy metals (i.e. Ni, Pb, Hg, Cu and Zn); picric acid is explosive but less sensitive to shock or friction than its metal salts and is relatively safe as long as wetted and not dried out.

Polynitroalkyl compounds (i.e. tetranitromethane and dinitroacetonitrile)

Polynitroaromatic compounds - especially polynitro hydrocarbons, phenols and amines