EHS CHEMICAL FACTSHEETS

(COMPILED FOR CBE LAB USERS)

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IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

https://www.ehs.iastate.edu/sites/default/files/uploads/publications/policies/incchemicals.pdf

Chemical Storage Guidelines

Use these guidelines to determine appropriate storage locations for the chemicals in your area. The tables below show examples of chemicals within each group, but are NOT all inclusive. For more information about storing chemicals, refer to your Safety Data Sheets, the Laboratory Safety Manual, or contact an EH&S Laboratory Safety Specialist.

Acids (pH < 7.0)

Mineral acid	Organic acid	Oxidizing acid
Hydrochloric acid	Acetic acid	Nitric acid
Phosphoric acid	Formic acid	Perchloric acid

Storage: Store in a corrosives cabinet, if available, or in compatible secondary containment.

Incompatibility information: Acids should be segregated from bases and flammables. Oxidizing acids are incompatible with most chemicals, especially organics.

Specific combinations to avoid:

- **Acetic acid** with chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, or permanganates
- **Chromic acid** with acetic acid, naphthalene, camphor, glycerin, turpentine, alcohol, (especially ethanol) or flammable liquids
- **Nitric acid** with acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, or any heavy metals
- **Perchloric acid** with acetic acid, acetic anhydride, bismuth and its alloys, alcohol, paper, wood, ether, oils or grease

Bases (pH > 7.0)

Inorganic base	Organic base
Potassium hydroxide	Diethylamine
Sodium hydroxide	Piperidine

Storage: Store in a corrosives cabinet, if available, or in compatible secondary containment.

Incompatibility information: Bases should be segregated from acids, flammables, and reactives.

Flammables

Flammable liquid	Flammable solid
Acetone	Napthalene
Ether	Paraformaldehyde

Storage: Flammable liquids totaling more than 10 gallons must be stored in a flammable cabinet.

Incompatibility information: Flammables should be segregated from acids, bases and oxidizers.

Specific combinations to avoid:

- **Flammable liquids** with ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide and halogens (fluorine, chlorine, bromine, iodine).

Oxidizers

Examples of -ates	Examples of -ites	Peroxide examples
Calcium nitrate	Potassium nitrite	3-Chloroperoxybenzoic acid
Potassium dichromate	Sodium hypochlorite	Hydrogen peroxide

Incompatibility information: Oxidizers should be segregated from bases, flammables, and reactives. Oxidizers should also be segregated from reducing agents such as ammonia, activated carbon, metals and metal hydrides.

Specific combinations to avoid:

- **Ammonium nitrate** with acids, metal powders, flammable liquids, chlorates, nitrites and sulfur and finely divided organic or combustible materials.
- **Hydrogen peroxide** with alcohols, acetone, aniline, copper, chromium, iron, phosphorus, nitromethane, organic materials and other metals and their salts.
- **Hypochlorites** with acids, activated carbon and sulfuric and other acids.
- **Nitrates** with acids, activated carbon and sulfuric and other acids.
- **Nitrites** with acids.
- **Potassium chlorate** with sulfuric and other acids.
- **Potassium permanganate** with benzaldehyde, ethylene glycol, glycerin and sulfuric acid.

Poisons/Toxics

Acutely toxic	Organic poison	Inorganic poison
Hydrogen cyanide	Acrylamide	Lead chloride
Sodium azide	Ethidium bromide	Mercuric iodide

Incompatibility information: See individual Safety Data Sheets (SDS) for incompatibility information.

Specific combinations to avoid:

- **Azides** with acids, heavy metals and their salts and oxidizing agents.
- **Cyanides** with acids.
- **Sulfides** with acids

Reactives

Air reactive (pyrophoric)	Water reactive
Butyllithium	Acetic anhydride
White phosphorus	Sodium metal

Storage: See individual SDSs for storage information.

Incompatibility information: Reactives should be segregated from acids, bases, and oxidizers.

Specific combinations to avoid:

- **Alkali metals** (i.e. lithium, sodium, potassium, rubidium, and cesium) with carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, and water.
- **Anhydrides** with water.
- **White phosphorus** with air, alkali metals, reducing agents, and strong bases.

Low Hazard Chemicals

Liquids	Solids
Buffer solutions	Carbonates, Phosphates, Sulfates
Weak acids/bases (i.e. citric acid)	Salts (i.e. calcium or sodium chloride)

https://www.ehs.iastate.edu/sites/default/files/uploads/publications/factsheets/pfc.pdf

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Peroxide-Forming Chemicals (PFC) - Safe Handling Precautions

All laboratory personnel should complete Laboratory Safety – Core Concepts Training.

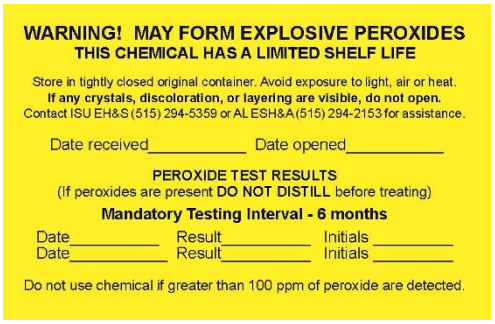
Hazards of Potentially Explosive Chemicals

Chemicals such as ethyl and isopropyl ether, tetrahydrofuran (THF), and 1,4- dioxane can form potentially explosive peroxides during use or in storage. Other chemicals such as picric acid and other di- and tri-nitro compounds are also potentially explosive. Always read the safety data sheet (SDS) and be aware of the hazards. The SDS provided by the manufacturer will disclose if a particular chemical is or is likely to become a PFC.

- Some chemicals are unstable in storage. They react with the oxygen in air to form hazardous compounds, called peroxides.
- Certain peroxides may explode with exposure to shock, heat, or sparks. They may also react violently with other chemicals.
- Once peroxides have formed, the container can explode when moved or opened, causing serious injury or death.
- Discoloration, layering, and formation of crystals in stored liquids are all indications that a serious hazard may exist. Do not disturb containers of PFCs that exhibit these characteristics.

Labeling

Labels are available at Chemistry Stores, (515) 294-0203 or by calling EH&S at (515) 294-5359.



Proper Storage

- Purchase only the amount you expect to use within a six-month period or less.
- Apply yellow peroxide warning label upon receipt, and record the date on it. Test opened containers every six months.
- Avoid exposure to light, air, and heat. Follow label directions for storage conditions. Consider using an inert gas blanket.

Testing for Peroxides

It is the user's responsibility to ensure his/her safety by assessing each bottle before use. **IMPORTANT!** Never test containers of unknown age or origin. Undated bottles may contain concentrated peroxides, or peroxides may have crystallized in the cap threads, which may explode when opening the bottle for testing.

- Dip strips are preferred for testing method for volatile solvents.
- Purchase dip strips from ISU Chemistry Stores. Follow the instructions.
- Test containers on or before their expiration date, or within one year of receipt.
- Test opened containers every six months.
- Always record your results on the PFC warning label.
- Test or re-test any PFC which will be used in a distillation or extraction, regardless of age. Do not concentrate if **any** level of peroxide is found.
- Dispose of reagent or treat peroxides when level exceeds 100 ppm

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Personal Protection Equipment

- Eye Protection - safety glasses with side shields (minimum); chemical goggles.
- Gloves - nitrile, latex, neoprene laminate, or as recommended by the manufacturer.
- Clothing - laboratory coat; consider using fire resistant clothing.

Handling Precautions

- Conduct all work in a laboratory hood. Use blast shields where appropriate.
- A nearly-empty bottle is more likely to be hazardous than a full one.
- If evaporation, extraction, or distillation is required, test first and monitor progress carefully.

NEVER DISTILL TO DRYNESS!

Disposal

Contact EH&S for disposal of unwanted hazardous materials.

Spill Management

Personal protective equipment (PPE) requirements for spill response may be greater than those for routine handling. Evacuate to a safe location and call for help if adequate PPE is not available.

- Get assistance with large spills by calling 911 and EH&S (515) 294-5359.
- Notify your supervisor of any spill that has occurred.
- Contact EH&S for disposal of spill materials.

Chemical Hygiene Plan

The Iowa State University Laboratory Safety Manual serves as the campus-wide Chemical Hygiene Plan. Research activities in laboratories must adhere to the safety requirements defined in the Laboratory Safety Manual.

References

- Potentially Explosive Chemicals (PECs): Guidelines for Safe Storage and Handling

Extracted from https://www.ehs.iastate.edu/publications/factsheets/pec.pdf

Appendix 1

Representative Peroxide Forming Compounds

The compounds subject to peroxide testing and/or disposal are ethers and olefins/alkynes. Ethers are generally more important sources of peroxides themselves. However, alkenes (olefins) and alkynes are subject to polymerization reactions that can be very exothermic and thus occasionally be explosive. Representative compounds are listed below, but THIS LIST IS NOT AND SHOULD NOT BE CONSIDERED EXHAUSTIVE.

NOTE: ***It is the researcher's responsibility to know whether a compound contains an ether or alkene functional group***.

Exceptions:
Despite its name "petroleum ether" is not an ether. Instead, it is a particular fraction of hydrocarbon distillate. It is thus NOT especially susceptible to peroxide formation.

Ethers

diethyl ether = ethyl ether
diisopropyl ether = isopropyl ether
tetrahydrofuran = THF
methyl *tert*-butyl ether = MTBE
allyl ether

Any other compound with the word "ether" in the name

phenetol or derivatives
anisole or derivatives
dioxane

Any compound with these word/prefixes:
- methoxy
- ethoxy
- propoxy
- butoxy

Olefins/Alkenes and Alkynes

Compounds containing the following words/segments:

- ethylene
- ethane
- acetylene
- propylene
- butene
- pentene
- hexane
- heptene
- octene
- nonene
- decene
- ethyne
- propyne
- butyne
- pentyne
- hexyne
- heptyne
- octyne
- nonyne
- decyne
- acrolein
- acrylate
- allyl
- diene
- enyne
- diyne
- propargyl
- vinyl