Guide to Safe Handling & Storage of Hazardous Materials

I. ACIDS

- Store acids on low shelves, or in acid cabinets.
- Segregate oxidizing acids from organic acids as well as flammable or combustible materials (SEE LISTS BELOW).
- Use bottle carriers for transporting acid bottles.
- Have spill control materials available which will absorb and neutralize an acid spill.

<table>
<thead>
<tr>
<th>STRONG OXIDIZING ACIDS</th>
<th>ORGANIC ACIDS</th>
<th>OTHER COMMON ACIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>Acetic acid</td>
<td>Hydrochloric acid</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>Acetic anhydride</td>
<td>Phosphoric acid</td>
</tr>
<tr>
<td>Chromic acid</td>
<td>Phenol</td>
<td>Formic acid</td>
</tr>
<tr>
<td>Perchloric acid</td>
<td>Trichloroacetic acid</td>
<td>Maleic acid</td>
</tr>
<tr>
<td>Hydrobromic acid</td>
<td>Trifluoroacetic acid</td>
<td>Phosphotungstic acid</td>
</tr>
</tbody>
</table>

II. BASES (CAUSTICS)

- Store bases on low shelves, or in designated caustics cabinets.
- Segregate bases from acids.
- Have spill control materials available which will absorb and neutralize a base spill.

COMMON BASES
- Ammonium hydroxide
- Potassium hydroxide
- Sodium hydroxide
- Calcium hydroxide
- Bicarbonate salts (potassium bicarbonate, sodium bicarbonate, etc.)
- Carbonate salts (calcium carbonate, sodium carbonate, etc.)

III. FLAMMABLES

- Store volumes greater than one gallon (four liters) in approved safety cans.
- Store in flammable storage cabinets.
- Keep away from heat and ignition sources (burners, heat-producing equipment, sunny windows, etc.).
- Keep firefighting equipment such as extinguishers accessible and unobstructed.
- Have flammable spill materials available. Activated charcoal absorbent is recommended.
- If flammables must be kept cold, use only a lab-safe refrigerator or freezer (electrical components are mounted on the outside), or keep flammables on ice for as long as they are needed cold.
- Never store flammables in cold rooms. Most cold rooms do not have sprinklers, and all have re-circulating air, which can allow dangerous levels of ignitable fumes to build up.

**FLAMMABLE SOLIDS**

- Benzoyl peroxide
- Picric acid

**FLAMMABLE GASES**

- Acetylene
- Ethane
- Hydrogen sulfide
- Ammonia
- Ethylene oxide
- Methane
- Butane
- Formaldehyde
- Propane
- Carbon monoxide
- Hydrogen
- Propylene

**FLAMMABLE LIQUIDS**

- Acetaldehyde
- Furans
- Naphtha solvents
- Acetone
- Gasoline
- Octane
- Acetyl chloride
- Hexane
- Piperidine
- Alcohols
- Hydrazine
- Propanol
- Benzene
- Isopentane
- Pyridine
- Butanol
- Isopropyl ether
- Sigmacote
- p-dioxane
- Methanol
- Styrene
- Ethanol
- Methyl acrylate
- TEMED
- Ethyl acetate
- 2-Methylbutane
- Tetrahydrofuran
- Ethylamine
- Methyl butyl ketone
- Toluene
- Ethyl benzene
- Methyl ethyl ketone
- Turpentine
- Ethyl ether
- Methyl methacrylate
- Vinyl acetate
- Ethyl formate
- Morpholine
- Xylene

**IV. OXIDIZERS**

- Store in a cool, dry place.
- Keep away from flammable and combustible materials.
- Keep away from reducing agents, such as zinc, alkaline metals, and formic acid.
- Dispose of as hazardous waste.

**OXIDIZING LIQUIDS**

- Bromine
- Hydrogen peroxide
- Perchloric acid
- Chromic acid
- Nitric acid
- Sulfuric acid

**OXIDIZING SOLIDS**

- Ammonium dichromate
- Iodates, salts of
- Potassium permanganate
- Ammonium perchlorate
- Iodine
- Potassium persulfate
- Ammonium persulfate
- Magnesium perchlorate
- Silver nitrate
- Benzoyl peroxide
- Manganese dioxide
- Sodium chlorite
- Calcium hypochlorite
- Nitrates, salts of
- Sodium dichromate
- Chlorates, salts of
- Periodic acid
- Sodium nitrite
- Chromium trioxide
- Peroxides, salts of
- Sodium perborate
- Ferric nitrate
- Potassium dichromate
OXIDIZING GASES
Chlorine  Nitrogen dioxide  Ozone
Chlorine dioxide  Nitrogen oxide
Fluorine  Oxygen

V. WATER REACTIVE CHEMICALS
(React strongly with water, yielding flammable or toxic gases or other hazardous condition).
- Store in a cool, dry place.
- Do not store on shelves over sinks or water baths, or near any other sources of moisture.
- In case of fire, keep water away.
- Dispose of as hazardous waste.

SOLIDS
Aluminum chloride, anhydrous  Magnesium  Phosphorus pentasulfide
Ferrous sulfide  Maleic anhydride  Potassium*
Lithium*  Phosphorus  Sodium*
Lithium aluminum hydride  Phosphorus pentachloride  Sodium borohydride

* Lithium, potassium, and sodium should be stored under kerosene.

LIQUIDS
Acetyl chloride  Sigmacote  Sulfuryl chloride
Chlorosulfonic acid  Silicon tetrachloride  Thionyl chloride
Hydrofluoric acid  Stannic chloride  Titanium tetrachloride
Phosphoryl trichloride  Sulfur chloride  Triethylaluminum

VI. PYROPHORIC CHEMICALS
(Ignite spontaneously upon contact with air)
Boron  Diborane  Manganese*
Cadmium*  Dichloroborane  Nickel*
Calcium*  2-Furaldehyde  Phosphorus*
Chromium*  Iron*  Titanium*
Cobalt*  Lead*  Zinc*

* Finely divided metals form a pyrophoric hazard

VII. PEROXIDE FORMING CHEMICALS
(Chemicals that, over time, can auto-oxidize to form explosive levels of peroxides)
- Store in airtight containers in a dark, cool, and dry place.
- Label containers with date received, date opened, and date of recommended disposal.
- Dispose of peroxide forming chemicals on or before their expiration date. If no expiration date is listed, contact the Safety Office for assistance.
- Peroxide inhibitors, often added to these chemicals, may not be sufficient to control peroxide formation once a container has been opened.
- Test periodically for the presence of peroxides. Test strip kits are available from Lab Safety Supply; contact the EHS Office if needed.
- Do not attempt to open containers that are very old, visibly crystallized, or cracked.
- Dispose of as hazardous waste.

If testing for peroxides is not done, do not keep chemicals for longer than the following times.

3 Months: 12 Months: 12 Months:
Isopropyl ether Ethyl ether Diacetylene
Potassium metal Tetrahydrofuran Dicyclopentadiene
1,4-Dioxane (p-Dioxane) Butadiene
12 Months:
Cumene Acetal Vinyl acetate
Methyl butyl dimethyl ether Vinyl chloride
Vinyl ethers Vinyl pyridine

VIII. TOXIC CHEMICALS
(Chemicals that are dangerous or extremely dangerous to life and health when inhaled, ingested, or absorbed through skin contact)

- Identify storage areas with signage.
- Take proper precautions to avoid exposure.
- Dispose of as hazardous waste.

SOLIDS
Arsenic compounds Fluorides, salts of Phosphorus pentasulfide
Barium compounds Iodine Picric acid
Beryllium compounds Lead compounds Potassium
Cadmium compounds Mercury compounds Silver nitrate
Calcium oxide Naphthalene Sodium
Chromates, salts of Osmium tetroxide Sodium azide
Cyanides, salts of Phenol Sodium hydroxide
Diaminobezidine Phosphorus pentachloride Sodium hypochlorite

LIQUIDS
Acetonitrile p-Dioxane Methylene chloride
Benzene Ethylene glycol Nitric acid
Bromine Formaldehyde Perchloric acid
Carbon tetrachloride Formic acid Phenol
Chloroform Hydrazine Phosphorus trichloride
Chromic acid Hydrofluoric acid Pyridine
Dichloromethane Mercury Sulfuric acid

GASES
Carbon monoxide Fluorine Hydrogen sulfide
Chlorine Formaldehyde Nitrogen dioxide
Cyanogen Hydrogen bromide Ozone
Ethylene oxide Hydrogen chloride Sulfur dioxide
IX. CARCINOGENS
(Chemicals proven or suspected to cause cancer in humans)

- Label all containers ‘Carcinogen’ or ‘Cancer Suspect Agent’.
- Take proper precautions to avoid exposures.
- Dispose of as hazardous waste.

<table>
<thead>
<tr>
<th>Acrylonitrile</th>
<th>Chloroform</th>
<th>Formaldehyde</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimony compounds</td>
<td>Chromates, salts of</td>
<td>Hydrazine</td>
</tr>
<tr>
<td>Arsenic compounds</td>
<td>Diaminobenzidine</td>
<td>b-naphthylamine</td>
</tr>
<tr>
<td>Benzene</td>
<td>Dimethyl sulfate</td>
<td>Nickel carbonyl</td>
</tr>
<tr>
<td>Beryllium compounds</td>
<td>p-Dioxane</td>
<td>Vinyl chloride</td>
</tr>
<tr>
<td>Cadmium compounds</td>
<td>Ethylene dibromide</td>
<td></td>
</tr>
</tbody>
</table>

X. TERATOGENS
(Chemicals known or suspected to cause reproductive harm).

- Label all containers ‘Teratogen’ or ‘Reproductive Toxin’.
- Take proper precautions to avoid exposures.
- Dispose of as hazardous waste.

<table>
<thead>
<tr>
<th>Aniline</th>
<th>Carbon tetrachloride</th>
<th>Phosphorus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>Chloroform</td>
<td>Radioactive substances</td>
</tr>
<tr>
<td>Carbon disulfide</td>
<td>Lead</td>
<td>Toluene</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>Mercury</td>
<td>Turpentine</td>
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