



## Risk Services Best Practices Bulletin Bulletin #5: Chemical Storage for Earthquake Preparedness

Presented by Office of the President Risk Services — November 17, 2009



### Flammable and Combustible Liquids [includes most solvents]

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- Avoid oxidizers
- Store flammable liquids in a well-ventilated, approved flammable storage cabinet
- Limit quantities in accordance with Fire Code (see EH&S Fact Sheet #38 *Flammable and Combustible Liquids Storage in Campus Laboratories*); no more than 10 gal. outside cabinet
- Refrigerators must be approved for storage of flammable liquids (spark-free interior)
- Prevent spills with chemically-compatible secondary containment trays: polypropylene [#5; PP] or stainless steel preferred – especially for large amounts (>1/2 gallon)

#### Common Examples of Flammable and Combustible Liquids:

acetone	glycerol
DMSO	isopropyl alcohol
ethanol	oil
formaldehyde (also toxic & carcinogen)	toluene

### Highly Reactive Liquids and Solids

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- Materials in this group may cross-react with each other: evaluate compatibilities for each individual chemical using its MSDS
- Use chemically-compatible secondary containment trays to prevent spills

#### Highly Unstable (including organic peroxides)

- Contact EH&S for special storage guidance (do not store these all together)
- Explosives must be stored in an approved magazine
- Secure on lower shelves to avoid shock (from potential fall) and heat

#### Pyrophoric (Air-Reactive) or Water-Reactive (except water-reactive corrosives)

- Store in original container
- Avoid storage with aqueous solutions

#### Non-Acid Oxidizers (react with other chemicals)

- Avoid flammables and combustibles
- Store hydrogen peroxide in its own secondary containment; may store with oxidizing acid
- Store halogen solutions (bromine, iodine, etc.) in their own secondary containment

- Bleach (sodium hypochlorite solution) is an *alkaline* oxidizer; store separate from other oxidizers

**Common Examples of Highly Reactive Chemicals:**

benzoyl peroxide – <i>reactive</i> (also <i>flammable &amp; oxidizer</i> )	cyanogen bromide – <i>reactive</i> (also <i>highly toxic</i> )
nitromethane – <i>reactive</i> (also <i>flammable</i> )	sodium – <i>water reactive</i>
sodium azide – <i>reactive</i> (also <i>water-reactive &amp; highly toxic</i> )	white phosphorus – <i>pyrophoric</i> (also <i>highly toxic</i> )
formaldehyde (also <i>toxic &amp; carcinogen</i> )	hydrogen peroxide – <i>oxidizer</i>
	bleach – <i>caustic oxidizer</i>

**Tips for Toxic and Carcinogenic Chemicals (Health Hazards)**

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- Aqueous solutions (such as nickel and copper solutions) – store in secondary containment, on lower shelves to minimize spill spread
- Organics (such as chloroform and carbon tetrachloride) – store in ventilated cabinet, with flammables/solvents
- Mercury – keep tightly contained, in ventilated storage, separate from ammonia, acids, halogens, and other metals.
- Prevent fire and/or poisonous atmosphere
- Minimize lost research time
- Gas cylinders are seismically restrained, and solids on shelves with lip
- Focus on High-Hazard Liquids, and Highly Toxic and/or Reactive Solids
- Liquid Categories:
  - Oxidizing Acids
  - Non-Oxidizing Acids (mostly organic acids)
  - Corrosive Bases/Caustics
  - Flammables (mostly solvents)
  - Reactives
- Use secondary containment trays

**Oxidizing Acids**

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- Avoid flammables/combustibles (including wood shelves) and bases
- Store large quantities in a well-ventilated, approved corrosives cabinet
- Store below eye-level
- Separate individual oxidizing acids *from each other* by use of secondary containment
- Prevent spills with chemically-compatible secondary containment: Pyrex or high-density polyethylene [#2; HDPE] preferred – especially for large amounts (>1/2 gal)
- Avoid metals, cyanides, and sulfides

**Common Examples of Oxidizing Acids:**

chromic acid (also <i>toxic &amp; carcinogenic</i> )	sulfuric acid ( <i>also toxic &amp; water reactive</i> )
nitric acid (also <i>toxic</i> )	
perchloric acid	

## **Non-Oxidizing Acids (includes combustible organic acids)**

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- Avoid oxidizers and bases
- Store large quantities in a well-ventilated, approved corrosives cabinet
- Store below eye-level
- Prevent spills with chemically-compatible secondary containment trays: polypropylene [#5; PP] or high-density polyethylene [#2; HDPE] preferred – especially for large amounts (>1/2 gallon)
- Avoid metals, cyanides, and sulfides

### **Common Examples of Non-Oxidizing Acids:**

acetic acid (also *combustible*)

formic acid (also *combustible*)

hydrochloric acid

Hydrofluoric acid (also *toxic*)

phenol (also *combustible & toxic*)

phosphoric acid

## **Corrosive Bases/Caustics**

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- Avoid acids, oxidizers and metals
- Store large quantities in well-ventilated, approved corrosives cabinet
- Store below eye-level
- Prevent spills with chemically-compatible secondary containment trays: poly-propylene [#5; PP] (or stainless steel) – especially for large amounts (>1/2 gallon)
- Avoid metals, cyanides, and sulfides

### **Common Examples of Corrosive Bases:**

ammonium hydroxide (also *toxic*)

ethanolamine (also *combustible*)

potassium hydroxide (also *toxic*)

sodium hydroxide (also *toxic*)

phosphoric acid