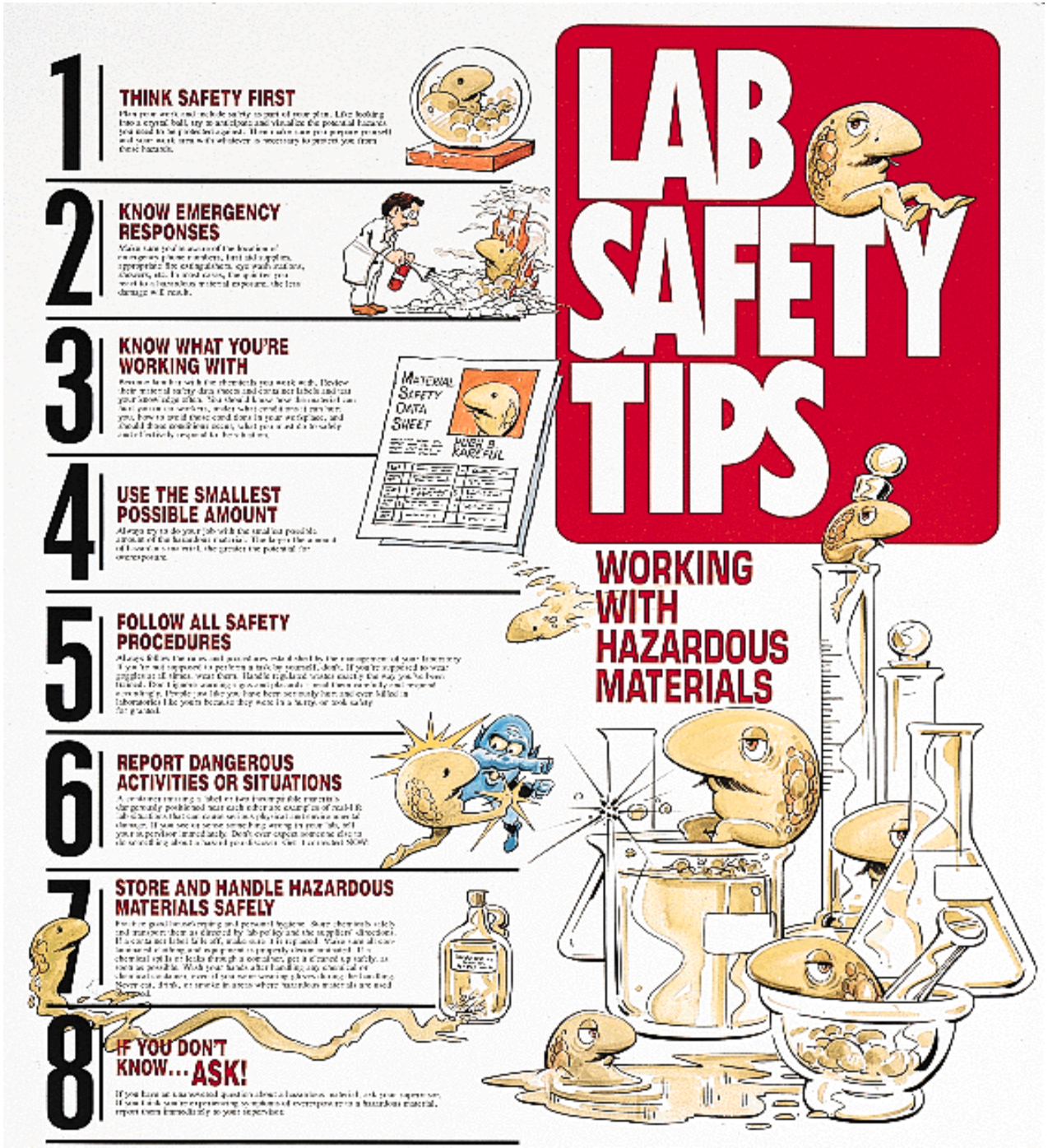
LAB SAFETY TIPS
WORKING WITH HAZARDOUS MATERIALS
1 THINK SAFETY FIRST
2 KNOW EMERGENCY RESPONSES
3 KNOW WHAT YOU'RE WORKING WITH
MATERIAL SAFETY DATA SHEET
4 USE THE SMALLEST POSSIBLE AMOUNT
5 FOLLOW ALL SAFETY PROCEDURES
6 REPORT DANGEROUS ACTIVITIES OR SITUATIONS
7 STORE AND HANDLE HAZARDOUS MATERIALS SAFELY
8 IF YOU DON'T KNOW... ASK!

Proper Chemical Storage

- Store in compatible groups. Consult above referenced SOP, manufacturer's recommendations and MSDS.
- Minimize chemicals purchased, especially flammables and reactives.
- Label storage areas, and label all chemicals being stored.
- Store hazardous liquids below eye level.
- Make sure chemical containers are in good condition and are compatible with contents.
- Lids should be tightly closed.
- Secondary containment for floor storage.
- Do not store solids with liquids
- Do not store items in working space of fume hoods.
- Do not store hazardous chemicals in cold rooms
- Annually discard unused, unwanted, and expired chemical

Common Problems

- Oxidizing acids stored with organic acids, e.g. Nitric acid and acetic acid.
- Oxidizers stored with flammables.
- Acids stored with bases.
- Flammables stored in non-flammable refrigerator.
- Large quantities of flammables stored outside flammable cabinets.
- Corrosives (acids and bases) or other liquids stored above eye level.
- Stock chemicals stored in fume hood.
- Reactives stored with incompatible chemicals.
- Liquids stored with solids that are incompatible with liquids, e.g. cyanides.
- Anhydrides not stored with secondary containment.

If you have a specific problem or question regarding chemical storage, please contact EHS at 2-3477.

Chemical Storage Table Supplement for Chemical Storage Scheme One SOG (3-09)

Flammable Toxic **Reactive** Corrosive

Group	Properties	Important Notes	Storage	Examples
Group 1 **Flammables and Combustibles (Includes organic acids)** AKA: organics, solvents	Flammable liquids have a flashpoint (FP) below 100^{0}F (38^{0}C). Combustible liquids have a flashpoint above 100^{0}F and below 140^{0}F Flashpoint is the lowest temperature at which a liquid gives off enough vapor to ignite.	The MSDS provides the flashpoint for flammable and combustible liquids. Ignition sources include spark from electrical outlet, vacuum pumps, and static electricity.	FP $\leq$ 140^{0}F (60 ^{0}C) store in a metal flammable cabinet that is completely enclosed. If vented, the vent must have a flash arrestor. NO cardboard shipping boxes in the cabinet. Never store in cold rooms or refrigerators (unless the refrigerator is explosion-proof). Do not store with oxidizers or inorganic acids.	All alcohols: butanol, ethanol, methanol, isopropanol, etc. Acetone, acetaldehyde, acetonitrile, amyl acetate, benzene, cyclohexane, dimethyldichlorosilane, dioxane, ether, ethyl acetate, hexane, hydrazine, methyl butane, picolene, pyridine, all silanes, tetrahydrofuran, toluene, triethylamine, xylene, etc. Combustibles: dimethylformamide, formaldehyde
Peroxide-formers Generally, Group I	Highly flammable. May form low-power explosives that are very sensitive to shock, sparks, light, strong oxidizing and reducing agents, friction, and high temperatures.	Read Peroxide-Forming Chemicals SOP Distillation, evaporation, or other concentration can present a high risk of explosion. Test for peroxide formation monthly.	Store with flammables. Date when received and when opened. Dispose of as hazardous waste after 12 months.	Ether (diethyl and isopropyl), tetrahydrofuran, acetaldehyde, etc.
Group II (volatile) and VII (non-volatile) Toxics AKA: poisons, organics, halogenated solvents, carcinogens, mutagens, reproductive toxins	Chronic exposure is a health hazard. Avoid inhalation, skin contact. Many toxic solvents are highly volatile. Non-flammable (some are combustible).	Commonly mistaken for a flammable liquid.	OK to store with flammables in flammable cabinet. Alternative: Any enclosed cabinet or shelf to protect from accidental breakage. Store containers larger than 1 liter below bench level. Do not store with bases.	Volatile toxics: carbon tetrachloride, chloroform, dimethyl sulfate, halothane, mercaptoethanol, methylene chloride (dichlormethane), phenol Non-volatile toxics: acrylamide solutions, ethidium bromide, triethanolamine

Chemical Storage Table Supplement for Chemical Storage Scheme One SOG (3-09)

Flammable Toxic **Reactive** Corrosive

Group	Properties	Important Notes	Storage	Examples
Group III (oxidizing acids)	**Oxidizing acids are highly reactive, and may react with each other. Corrosive, burns skin and eyes.**	**Concentrated (> 70%) perchloric acid reacts with wood and paper and may ignite. Never store concentrated perchloric acid directly on wood shelves without a plastic tub. Also, see Group IV.**	**Oxidizing acids should be separated from each other by use of a plastic tub. Oxidizing acids can be stored with mineral acids but not organic acids.**	**Oxidizing inorganic acids: nitric, sulfuric, perchloric, chromic**
Group IV Mineral Acids and Organic Acids	Corrosive, burns skin and eyes. Organic acids are combustible (FP >100^{0}F<140^{0}F)	Acid mist escapes from closed bottles and builds up inside un-vented cabinets causing corrosion of labels, metal cabinets, etc.	Store in the vented cabinet under fume hood or in a vented stand alone cabinet. Do not store with bases. Store below eye level. It is a good idea to keep hydrofluoric acid in a separate tub or tray to avoid contamination of surfaces.	Mineral acids: hydrochloric, phosphoric, hydrofluoric Organic acids: acetic, acrylic, acetic anhydride, butyric, formic, glacial acetic, isobutyric, mercaptopropionic, trifluoroacetic, etc.
Group V **Liquid Inorganic Bases** **AKA: alkaline**	Corrosive burns skin and eyes.	Avoid contact with acids and volatile toxics.	Store in a separate cabinet. Alternative: store with other chemicals and keep in a separate tub or tray. Can be stored with flammables if no volatile toxic (halogenated organics) are present. Store below eye level.	Sodium hydroxide, ammonium hydroxide, calcium hydroxide, potassium hydroxide, aqueous ammonia

Chemical Storage Table Supplement for Chemical Storage Scheme One SOG (3-09)

Flammable Toxic **Reactive** Corrosive

Group	Properties	Important Notes	Storage	Examples
Group VI Oxidizing Liquids **(Excluding Oxidizing acids)** **AKA: reactives**	**Provides oxygen that feeds fires and makes fires very difficult to extinguish.** **Oxidizing liquids react with many things potentially causing explosions or corrosion of surfaces.**	**The oxidizer symbol (a burning O) may be mistaken for a flammable symbol (a flame).** **Oxidizers are considered ignitable for hazardous waste management purposes.**	**Store on a separate shelf. Do not store directly on wood shelf or paper.** **If stored near other chemicals, including other oxidizers keep in a separate tub or tray.** **Do not store with flammables.**	**Ammonium persulfate, hydrogen peroxide ≥ 30%**
Group VIII **Pyrophorics and Water Reactives**	**Ignite spontaneously in air. Water reactives can react with moisture in the air to produce a flammable gas.** **Metal hydrides react violently with water, some ignite spontaneously in air.**	**Read Pyrophoric and Water Reactives SOP**	**Waterproof double containment (the shipping container may be an appropriate second container).** **Isolate from other chemicals. OK to store with dry chemicals.** **Do not store with liquid chemicals (oxidizers, flammables, acids, bases, toxics etc.)**	**Metal hydrides: sodium borohydride, calcium hydride, lithium aluminum hydride, etc.** **Pyrophorics: borane, diborane, dichloroborane, lithium, phosphorous, 2-furaldehyde, diethyl aluminum chloride, trimethyl aluminum, etc.** **Water Reactives: aluminum chloride anhydrous, calcium carbide, acetyl chloride, chlorosulonic acid, sodium, potassium, phosphorous pentachloride calcium, aluminum tribromide, calcium oxide, acid anhydrides etc.**

Chemical Storage Table Supplement for Chemical Storage Scheme One SOG (3-09)

Flammable Toxic Reactive Corrosive

Group	Properties	Important Notes	Storage	Examples
Group IX Dry Solids	Varies. They are dry, but when wet, may have different properties, depending on the material.	Keep Dry. Indicate where the more toxic materials are located. (See SOP)	Cabinets are suggested, but shelves are O.K. Store above liquids and separate from liquids.	Benzidine, cyanogens, bromide, oxalic acid, potassium hydroxide.
Chemicals with no great storage options, e.g. anhydrides	These materials react with many things.	Keep isolated in some way by using secondary containment. Minimize quantities on hand.	Will depend on specific chemical. Call EHS for guidance.	Acetic anhydride, trichloro acetic anhydride

For more information see the Chemical Storage SOP and App A – Storage Scheme One of the SOP. Go to: http://web.mit.edu/environment/ehs/chemical_storage.html

Basic Rules	Common Problems
▪ Store in compatible groups. Consult above referenced SOP, manufacturer's recommendations and MSDS. (To obtain MSDS, Google search: chemical name MSDS, or type MSDS on MIT Home page search to see link to MIT MSDS link page.) ▪ Minimize chemicals purchased, especially flammables and reactives. ▪ Label storage areas, and label all chemicals being stored. ▪ Store hazardous liquids below eye level. ▪ Make sure chemical containers are in good condition and are compatible with contents. ▪ Lids should be tightly closed. ▪ Secondary containment for floor storage. ▪ Do not store solids with liquids ▪ Do not store items in working space of fume hoods. ▪ Do not store hazardous chemicals in cold rooms ▪ Annually discard unused, unwanted, and expired chemical	▪ Oxidizing acids stored with organic acids, e.g. Nitric acid and acetic acid. ▪ Oxidizers stored with flammables. ▪ Acids stored with bases. ▪ Flammables stored in non-flammable refrigerator. ▪ Large quantities of flammables stored outside flammable cabinets. ▪ Corrosives (acids and bases) or other liquids stored above eye level. ▪ Stock chemicals stored in fume hood. ▪ Reactives stored with incompatible chemicals. ▪ Liquids stored with solids that are incompatible with liquids, e.g. cyanides. ▪ Anhydrides not stored with secondary containment.

Note: The compatibility groups are guidelines. There are other options for chemical storage. There are some options for combining chemical groups, as well. Chemtracker uses a different storage system, referred to as Storage Scheme Two, also shown in the Chemical Storage SOP. If you have a specific problem or question regarding chemical storage, please contact EHS at 2-3477, and let them know you have a chemical storage question.