SECTION II: UCSB POLICIES, PROCEDURES AND RESOURCES

Introduction to Section II: UCSB Policies, Procedures and Resources:

Section II addresses the campus policies, procedures and resources which are core/universal and apply to all/most labs. In order to free lab supervisors from independently having to address these issues in their CHPs, they are provided herein. In Section I of this *Chemical Hygiene Plan* the *laboratory-specific* issues/Standard Operating Procedures for a particular lab must be addressed.

The issues summarized here are a formal part of the *UCSB Chemical Hygiene Plan*. Therefore, all lab personnel are responsible for being familiar with this information and following the prescriptions therein as they apply to their work. Virtually all of the issues addressed herein are based on current regulations and codes, such as those of the California Occupational Safety and Health Administration (Cal-OSHA); Cal-EPA; California Fire Code, etc.

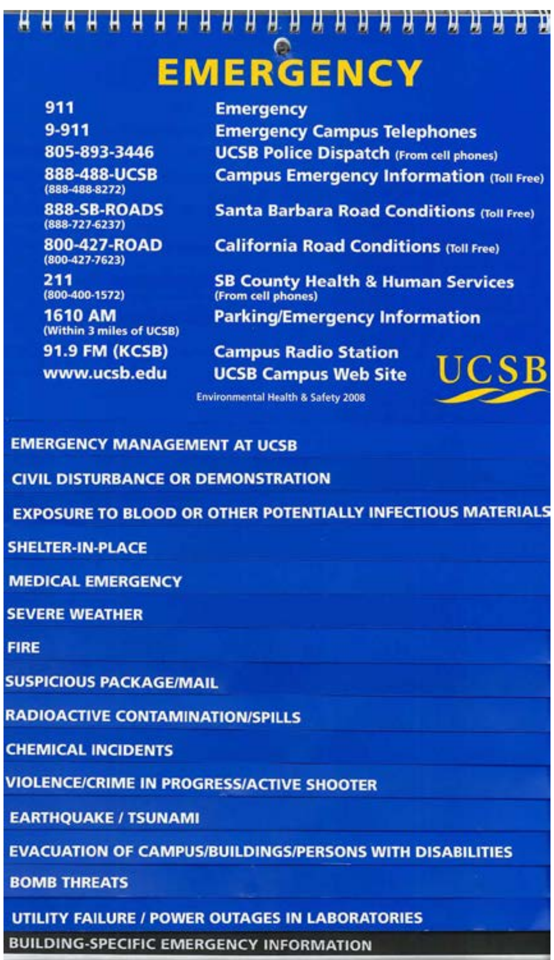
An important aspect of the Cal-OSHA CHP safety standard is that it requires the addressing of *chemical* safety issues, but not other laboratory hazards. For example, biological and radiological hazards, electricity, high/low temperature and pressure, etc. Therefore, these issues are largely not addressed here. However, supervisors are free/encouraged to address these issues in their CHP. Additional information on these non-chemical safety topics can be found on the EH&S website: http://www.ehs.ucsb.edu/units/labsfty/labsafety.html

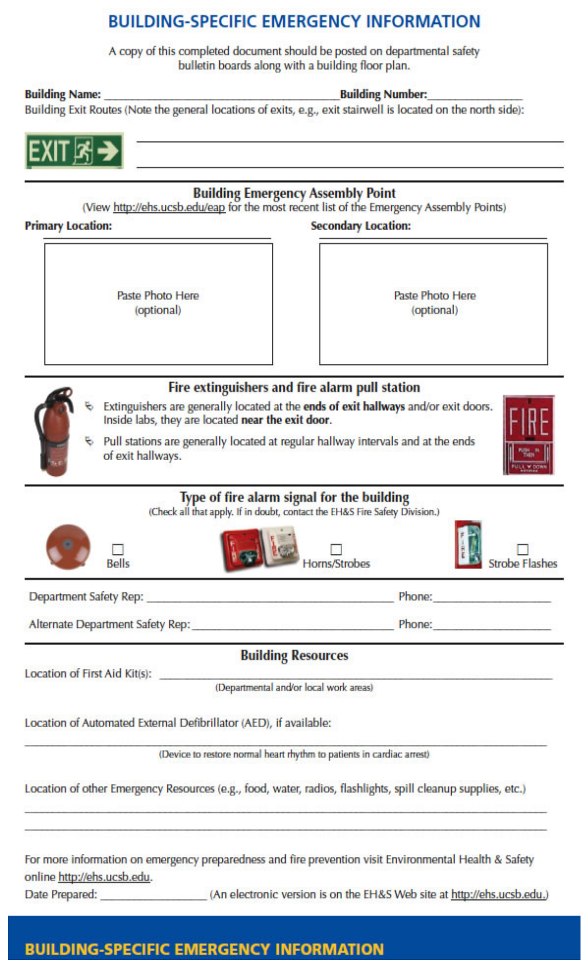
Some of the terms used in this document and other safety documents such as Safety Data Sheets (formerly MSDS) may be unfamiliar to some. To aid in clarifying these terms, a **Glossary of Safety Terms** is provided in App. R of this document: http://www.ehs.ucla.edu/ChemicalHygienePlan.pdf

Emergency Response Procedures

The primary informational tool for response to campus incidents is the *UCSB Emergency Information Flipchart* pictured below. This document **should already be posted** in, or near, every laboratory, as well as in many offices. If you want a copy for your work area, contact EH&S at x-4899. A Spanish language version of the flipchart is also available.

The last page (at right) should already be customized to include your *local* building information –such as the locations of the following: your building's Emergency Assembly Point, fire extinguishers and fire alarm pull stations, first-aid kits, AEDs, etc. If it is not customized contact your local Department Safety Rep. Please familiarize yourself with the layout and general content of the flipchart. It can also be viewed online at:
http://www.ehs.ucsb.edu/homepage/hprsc/203655_Emerg_Flipchart.pdf




BUILDING-SPECIFIC EMERGENCY INFORMATION

A copy of this completed document should be posted on departmental safety bulletin boards along with a building floor plan.

Building Name: ____________ Building Number: ____________
Building Exit Routes (Note the general locations of exits, e.g., exit stairwell is located on the north side):

EXIT

Building Emergency Assembly Point
(View http://ehs.ucsb.edu/eap for the most recent list of the Emergency Assembly Points)
Primary Location: ____________ Secondary Location: ____________
Paste Photo Here (optional) Paste Photo Here (optional)

Fire extinguishers and fire alarm pull station
- Extinguishers are generally located at the **ends of exit hallways** and/or exit doors. Inside labs, they are located **near the exit door**.
- Pull stations are generally located at regular hallway intervals and at the ends of exit hallways.

FIRE

Type of fire alarm signal for the building
(Check all that apply. If in doubt, contact the EH&S Fire Safety Division.)
☐ Bells ☐ Horns/Strobes ☐ Strobe Flashes

Department Safety Rep: ____________ Phone: ____________
Alternate Department Safety Rep: ____________ Phone: ____________

Building Resources
Location of First Aid Kit(s): ____________
(Departmental and/or local work areas)
Location of Automated External Defibrillator (AED), if available:
____
(Device to restore normal heart rhythm to patients in cardiac arrest)
Location of other Emergency Resources (e.g., food, water, radios, flashlights, spill cleanup supplies, etc.)
____

For more information on emergency preparedness and fire prevention visit Environmental Health & Safety online http://ehs.ucsb.edu.
Date Prepared: ____________ (An electronic version is on the EH&S Web site at http://ehs.ucsb.edu.)

BUILDING-SPECIFIC EMERGENCY INFORMATION

Recommended Chemical Spill Cleanup Procedures

You should NOT clean up a spill if:

- You don't know what the spilled material is
- You lack the necessary protection or equipment to do the job safely
- The spill is too large to contain
- The spilled material is highly toxic
- You feel any symptoms of exposure

Instead contact: **x3194** EH&S (24 hr line – after-hours may have to wait up to 30 min for response to campus). OR, if immediately health-threatening call **9-911** (campus phone)

Spill Response Scheme:

Evaluate and Notify

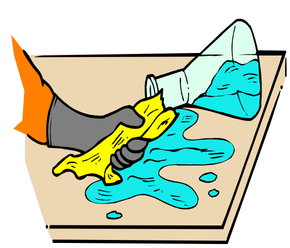
- Assess the toxicity, flammability, or other properties of material (see label & MSDS)
- For flammables, remove or turn off ignition sources such as motors, pumps, fridges.
- Determine if there is an immediate health threat to you or your neighbors. If so, alert neighbors, isolate the area and call for help using the phone numbers above.
- If spill is minor, begin cleanup following steps below

Containment/Cleanup

- Don appropriate gloves, eye protection, lab coat, etc.
- Contain and absorb spill using absorbents appropriate for the material*
- Protect floor drains with absorbents or barriers around them
- Package and label waste. Include contaminated clothes, rags, equipment, etc.
- Store temporarily in a fume hood if material is volatile

Followup

- Send Hazardous Materials/ Waste Pickup Request form to EH&S
- Reorder and restock cleanup materials used
- Inform EH&S if there were any personnel exposures, or release to the environment



**Self-help spill cleanup equipment are available using graduate master keys in some buildings:* http://www.ehs.ucsb.edu/units/labsfty/labrsc/emergency/spillcloset.htm

Fire Extinguishers, First-Aid Kits and Emergency Showers/Eyewashes

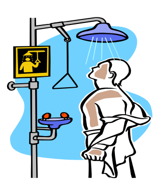
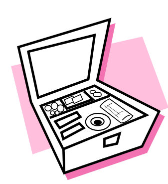
Fire Extinguishers: Extinguisher(s) are in every lab – typically by the exit door and are the **ABC** variety (dry powder, ammonium phosphate). EH&S conducts hands-on fire extinguisher training for most individuals who attend the EH&S General Laboratory Safety class. There is also an online extinguisher tutorial/video that individuals can complete and receive credit. All campus individuals are strongly encouraged to complete this tutorial and view as refresher training when needed.

Online Fire Extinguisher Usage Tutorial:
http://learningcenter.ucsb.edu/default.aspx
Need "UCSB Net ID" to login. Then search on "fire extinguisher"

First-Aid Kits: Individual laboratories should have their own 1st aid kit nearby in a location known to all. Supplies should be checked regularly. Departmental kits may not be accessible after-hours.

Emergency Showers and Eyewashs

- Know where your nearest unit is – they are typically within the lab, or in the corridor nearby. Units must be accessible always- no items should block access.
- In the case of chemical exposure to eyes or skin, flush the injury for a minimum of 15 minutes. Be sure to leave the eyes open under the water to flush them.
- Showers can also be used to extinguish a fire on an individual, or their clothing
- Consult the Safety Data Sheet (SDS) for material and show it to the doctor/nurse.
- Facilities periodically flushes emergency eyewash stations and showers. Lab personnel should also flush the eyewashes at least monthly as a precautionary measure. Call Facilities at x2661 if you have concerns regarding a specific unit.
- Eyewashes are plumbed with potable water - unlike the rest of the laboratory which is often on "industrial water"- and is considered safe to use on your body.
- Many eyewash/shower units are not equipped with a floor drain. This is because they are so infrequently used that they did not justify the cost of a drain when the building was constructed. Also, it is illegal to flush materials down the drain.

Campus Policy on Laboratory Personal Protective Equipment (PPE)

In July 2011 UCSB instituted a new policy on the use of personal protective equipment (PPE) in laboratories. The policy is intended to help protect lab workers from injury, meet regulatory requirements for worker protection and bring more consistency to PPE practices across the campus. All members of the lab community have responsibilities under the policy - particularly lab supervisors/faculty and lab workers. Full policy is at:

http://www.policy.ucsb.edu/policies/policy-docs/lab-personal-protective-equip.pdf

Key aspects of the policy are summarized on a wall poster which is mounted in all labs, or lab suites. A copy of the poster is presented on the following page. Other notable aspects of the policy are noted here, but the full policy should be consulted for details:

- The PPE requirements only apply when "handling" hazardous materials, not when an individual is simply in the same room with materials.
- Radiological and biological hazards are not covered by the policy. Instead, PPE for these is regulated by the Radiation and Biosafety Committees, respectively.
- Lab gloves must not be worn in public areas unless traveling to an adjacent lab space, or needed for protection while transporting materials between work areas – in which case clean gloves should be donned.
- Safety eyewear must meet American National Standards Institute (ANSI) requirements. This is denoted by the "Z87" stamp on the eyewear. Most reading glasses do **not** meet ANSI standards. Approved safety glasses can be worn over contact lenses, or splash goggles can be worn over reading glasses, or one can obtain prescription safety glasses.
- Contaminated lab coats should not be laundered at home. Some campus labs use a local vendor to provide routine lab coat laundering services. The service is inexpensive. See: http://www.ehs.ucsb.edu/units/labsfty/labrsc/factsheets/Lab_Coats_FS35.pdf



Personal Protective Equipment ("PPE") Required for UCSB Laboratory Workers

This poster summarizes the key elements of the UCSB ***Laboratory Personal Protective Equipment Policy***. The full Policy can be found at: http://www.policy.ucsb.edu/policies/az/ (click on "L") The full Policy is too detailed to be fully shown here and should be consulted as needed. MINIMUM PERSONAL PROTECTIVE EQUIPMENT REQUIRED	CATEGORY 1: Significantly Hazardous Chemicals EXAMPLES[b]: • Corrosives (above 5% by weight acids/bases)[d] • Flammables/Combustibles above one liter • Materials Absorbed Through Skin • Skin and Eye Irritants • Highly Toxics and Neurotoxins • Strong Air or Water Reactives, e.g. Pyrophorics[e] • Strong Oxidizing Agents • Carcinogens and Reproductive Toxins	CATEGORY 2: Hazardous Chemicals Not in Category 1 EXAMPLES[b]: • Dilute Corrosives (below 5% by wt. acids/bases)[d] • Flammables/Combustibles less than one liter • Liquid Cryogens (LN_2; solvent/dry ice baths)	CATEGORY 3: Selected Physical Hazards EXAMPLES[b]: • Glassware under vacuum • Vessels under pressure • Mechanical hazards • Hazardous chemicals not in Category 1,2
"ANSI-Approved" Safety Eyewear[a] 	YES	YES	YES
Appropriate Laboratory Gloves[c] 	YES	YES	RECOMMENDED
Lab Coat, or Fire-Resistant Lab Coat 	YES (for flammables use fire-resistant coat)	RECOMMENDED	RECOMMENDED
Close-toed Shoes and Long Pants 	YES	RECOMMENDED	RECOMMENDED

The Policy prescribes the **minimum** PPE required, but can't foresee all circumstances. So, in some cases additional PPE may be needed to adequately protect workers and meet regulatory requirements. These requirements only apply when an individual is directly "handling" a material in such a way as to have a reasonable possibility of being exposed. Questions or feedback are welcome and should be directed to UCSB Environmental Health & Safety, x-4899, or x-8243.

Footnotes

a. Meet *American National Standards Institute* standards as indicated by "Z87" stamp on frame. Most "reading glasses" do **not** meet this standard. Eyewear in campus storerooms meet ANSI standards, as do prescription safety glasses from optometrists. Alternatively, safety goggles may be worn over glasses.
b. Consult container label or MSDS to verify "chemical hazard class(es)." Definitions and specific chemical examples are provided in the full Policy.
c. Consult container label, MSDS or a Glove Reference Chart to determine appropriate glove. Glove charts are available via the EH&S Website and other sites.
d. Definition of "dilute corrosive" as below 5% by weight is only for purposes of this Policy. Corrosives can have other properties requiring gloves at any concentration, e.g., HF acid is particularly penetrative/damaging to skin.
e. While handling flammable liquids (particularly pyrophorics), it is strongly recommended that synthetic clothing not be worn which is more ignitable than cotton.

Additional Policy Elements

⇒ Lab gloves should not be worn in public areas except where clearly needed for personal protection, e.g., during transportation of some particularly hazardous materials
⇒ PPE for infectious biological agents and radioactive materials are not covered by this Policy. They are regulated independently by the campus Biosafety and Radiation Safety Committees, respectively.

Campus Storerooms: Laboratory Personal Protective Equipment

You can buy supplies from any campus storeroom after establishing an account. The supplies noted below are only the basic PPE available. There are many more materials, styles and brands of PPE available thru safety products suppliers (e.g., *Fisher Scientific* and *Lab Safety Supply*)

Biological Sciences Storeroom, Bldg. 569, x-2537 or 3234

- **Gloves** - Nitrile; Latex (powdered); Vinyl examination; Wash gloves (Playtex); High/low temperature
- **Eyewear** - Goggles; Glasses; Goggles that fit over reading glasses
- **Lab coats -** Cotton (fire-resistant)
- **Sharps disposal -** Syringe/razor size; Broken glass box
- **Waste disposal bags -** Autoclaveable; Biohazard; Hazardous materials
- **First aid supplies -** Bandaids; Cotton

Chemistry Storeroom, room 1432, x-2563

- **Lab Coats -** Cotton (fire-resistant)
- **Gloves -** Nitrile; Latex; "Wash gloves"; Cleanroom glove (triple polymer)
- **Eyewear –** Safety Glasses; Goggles that fit over reading glasses
- **Sharps disposal -** Syringe/razor size
- **First aid supplies -** Bandages; Gauze pads; Burn cream

Physics Storeroom, Broida Hall, room 1301, x-2747

- **Lab Coats -** Cotton (fire-resistant)
- **Gloves -** Nitrile; Neoprene; Latex; Vinyl; Wash gloves (Playtex); Canvas; Leather; Nylon; Finger cots (latex)
- **Eyewear -** Goggles; Goggles that fit over reading glasses; Glasses w/ side shields; "Neon"-colored glasses; "Malibu" glasses (wraparound)
- **Respirator -** Dust mask
- **Ear plugs -** foam type
- **Sharps disposal -** Broken glass box
- **Waste disposal** - Glass and plastic 1-gallon containers
- **First aid -** Bandaids

University Center Bookstore, x-3271

- **Eyewear -** Goggles; Glasses
- **Lab coats –** Cotton/polyester

Respiratory Protection

Typically, respiratory protection is not needed in a laboratory to eliminate exposures, or keep exposure levels below OSHA Permissible Exposure Limits. Under most circumstances, safe work practices, small scale usage, and engineering controls (fume hoods, biosafety cabinets, and general ventilation) adequately protect laboratory workers from chemical and biological hazards. Under certain circumstances, however, respiratory protection may be needed as determined by EH&S. These can include:

- An accidental spill such as:
  - a chemical spill outside the fume hood
  - a spill of biohazardous material outside a biosafety cabinet
- Performance of an unusual operation that cannot be conducted under the fume hood or biosafety cabinet
- When weighing powdered chemicals or microbiological media outside a glove box or other protective enclosure. Disposable filtering face-piece respirators are generally recommended for nuisance dusts. If the chemicals are toxic, contact EH&S for additional evaluation
- When exposure monitoring indicates that exposures exist that cannot be controlled by engineering or administrative controls
- As required by a specific laboratory protocol or as defined by applicable regulations

Affected individuals must enroll in the *UCSB Respiratory Protection Program* which is designed to fully meet Cal-OSHA requirements (CCR, Title 8, 5144). Because there are numerous types of respirators available, and each has specific limitations and applications, respirator selection and use requires pre-approval by EH&S. For either required or voluntary use of a respirator, the worker must contact EH&S (x-8787, or x-3743). After an evaluation of the work situation, if a respirator is deemed necessary, EH&S will provide the required medical evaluation (questionnaire), training and quantitative fit-testing.

Selecting the Proper Gloves

The correct gloves protect the hands against chemicals; the wrong gloves enhance chemical contact. The type of glove used should be chosen to be compatible with the particular chemicals being used. **There is no universal glove that protects you from all chemicals. To choose the correct glove, go to a Glove Reference Chart.** (links below).

Disposable gloves provide minimal protection and should be used with this in mind. If using concentrated solvents, corrosives or toxics, more heavy-duty gloves should be worn. These provide more protection, but have the drawback of being more cumbersome. Note also that about 15% of the population is allergic to latex http://www.cdc.gov/niosh/docs/97-135/ to some degree.

Check gloves before use for signs of wear or penetration. Disposable gloves can be inflated by mouth to check for pinholes. When removing gloves, be careful to avoid touching the outside of the gloves with your bare hands. Always remove gloves before leaving the lab.

All gloves are permeable, only the permeation rate varies, depending on the chemical, the glove material and thickness, temperature, concentration gradient, etc. However, once a material begins to permeate the glove, it will continue until an equilibrium is reached. You must, therefore, decide when it is appropriate to discard contaminated gloves.

Glove Reference Charts (No guarantees are made regarding the accuracy of these charts. Recommend cross-checking at least two sites.)

http://www.microflex.com/Products/~/media/Files/Literature/Microflex%20Chemical%20Resistance%20Guide.ashx (Microflex)

http://www.bestglove.com/site/chemrest/default.aspx (Best Co.)

http://www.ansell-edmont.com/download/Ansell_7thEditionChemicalResistanceGuide.pdf

http://www.mapaglove.com/ChemicalSearch.cfm?id=0 (MAPA Professionals)

Exposure Limits For Laboratory Chemicals

Below are airborne chemical concentration limits above which you can not legally be exposed at work. These limits are administered by the California Occupational Safety and Health Administration (Cal-OSHA). The materials listed here are a fraction of the total number (500+) of OSHA exposure limits – for the complete list, see: http://www.dir.ca.gov/Title8/5155table_ac1.html If workers have reason to believe they might be exposed any hazardous materials, contact EH&S, x-4899, or x-8243. All workers should strive to maintain their chemical exposures to as low as reasonably achievable at all times, regardless of the legal exposure limits. Given the volatility of these materials, they should always be used in a properly functioning fume hood, or glove box, or in completely-sealed systems. The "S"notation indicates material is also readily skin absorbed.

Chemical Abstracts Registry Number [(a)]	*Skin*[(b)]	*Name*	*Permissible Exposure Limit* [(d)]		*Ceiling Limit*[(g)]	*Short-term Exposure Limit* [(o)]	
			ppm[(e)]	*mg/M*[3(f)]		*ppm*[(e)]	*mg/M*[3(f)]
64197		Acetic acid	10	25	40 ppm	15	37
67641		Acetone	500	1200	3000 ppm	750	1780
75058	S	Acetonitrile	40	70		60	105
79061	S	Acrylamide	--	0.03			
7664417		Ammonia	25	18		35	27
62533	S	Aniline	2	7.6			
7440371		Argon	(h)				
		Arsenic and inorganic arsenic compounds	--	0.01			
71432	S	Benzene	1			5	--
7726956		Bromine	0.1	0.7	C		
7440439		Cadmium metal dust, as Cd		0.005			
630080		Carbon monoxide	25	29	200 ppm		
7782505		Chlorine	0.5	1.5		1	3
67663		Chloroform; trichloromethane	2	9.78			
110827		Cyclohexane	300	1,050			
287923		Cyclopentane	600	1,720			
75343		1,1-Dichloroethane	100	400			
68122	S	Dimethylformamide; DMF	10	30			
74840		Ethane	(h)				
141786		Ethyl acetate	400	1,400			
64175		Ethyl alcohol; ethanol	1,000	1,900			
74851		Ethylene	(h)				
60297		Ethyl ether	400	1,200		500	1500
50000		Formaldehyde	0.75	--		2	--
75127	S	Formamide	10	18			
64186		Formic acid	5	9		10	19
7440597		Helium	(h)				
142825		n-Heptane	400	1,600		500	2000
110543	S	n-Hexane	50	180			

1333740		Hydrogen	(h)				
10035106		Hydrogen bromide	3	10	C		
7647010		Hydrogen chloride; muriatic acid	5	7	C		
7664393		Hydrogen fluoride, as F	3	2.5		6	--
7722841		Hydrogen peroxide, as H_2O_2	1	1.4			
7783064		Hydrogen sulfide	10	14	50 ppm	15	21
26675467		Isoflurane	2	15			
67630		Isopropyl alcohol	400	980		500	1225
7439976	S	Mercury, metallic and inorganic compounds as Hg	--	0.025	0.1 mg/M^3		
67561	S	Methyl alcohol; methanol	200	260	1000 ppm	250	325
75092		Methylene chloride; dichloromethane	25	87		125	435
7697372		Nitric acid	2	5		4	10
10102439		Nitric oxide	25	30			
7727379		Nitrogen	(h)				
75525		Nitromethane	2	5			
1321126,	S	Nitrotoluene	2	11			
111659		Octane	300	1,450		375	1800
8012951		Oil (mineral) mist, particulate		5			
20816120		Osmium tetroxide, as Os	0.0002	0.002		0.0006	0.006
10028156		Ozone	0.1	0.2		0.3	0.6
109660		Pentane	600	1,800			
127184		Perchloroethylene	25	170	300 ppm	100	685
108952	S	Phenol	5	19			
7664382		Phosphoric acid	--	1		--	3
1310583		Potassium hydroxide; caustic potash	--	2	C		
110861		Pyridine	5	15			
61790532		Silica, amorphous, total dust	-	6			
61790532		Silica, crystalline; quartz total dust	-	0.3			
1310732		Sodium hydroxide; caustic soda	--	2	C		
7664939		Sulfuric acid	--	1		--	3
109999		Tetrahydrofuran	200	590		250	735
108883	S	Toluene; toluol	50	188	500 ppm	150	560
76039		Trichloroacetic acid	1	5			
1330207		Xylene; xylol; dimethylbenzene	100	435	300 ppm	150	655

Footnotes to Table. Footnotes have been edited for clarity. For the complete Cal-OSHA Table and complete footnotes, see: http://www.dir.ca.gov/Title8/5155table_ac1.html (b) The substances designated by "S" in the skin notation column indicates material may be absorbed into the bloodstream through the skin, the mucous membranes and/or the eye, and contribute to the overall exposure. Appropriate protective clothing shall be provided for and used by employees as necessary; (d) Permissible Exposure Limit (PEL) = the maximum permitted 8-hour time-weighted average concentration of an airborne contaminant; (e) Parts of gas or vapor per million parts of air by volume at 25^oC and 760mm Hg pressure; (f) Milligrams of substance per cubic meter of air at 25^oC and 760mm Hg pressure; (g) Ceiling Limit = the maximum concentration of an airborne contaminant to which an employee may be exposed at any time. A numerical entry in this column represents a ceiling value in addition to the PEL values. A “C” notation means the value given in the PEL columns are also ceiling values; (h) A number of gases and vapors, when present in high concentrations, act primarily as asphyxiants without other adverse effects. A concentration limit is not included for each material because the limiting factor is the available oxygen. (Several of these materials present fire or explosion hazards.); (o) Short-Term Exposure Limit = a 15-minute time-weighted average airborne exposure which is not to be exceeded at any time during a workday even if the 8-hour time-weighted average is below the PEL.

Safety Data Sheets (formerly known as MSDS)

What is a Safety Data Sheet? SDS –formerly known as Material Safety Data Sheets - are a summary of the health hazards of a chemical material and associated recommended safe work practices. SDS are required by OSHA under the Lab Safety Standard and Hazard Communication Standard (CCR, Title 8, 5194) to be made readily available by chemical vendors to the purchasers of their chemicals. The use and relevance of SDS are covered in the mandatory EH&S Fundamentals of Laboratory Safety class. If you work in a lab, then OSHA says you should:

- be aware of what an SDS is and their relevance to your health and safety
- be aware of how to access SDS for your work area
- maintain SDSs that are received with incoming chemical shipments and ensure that they are readily accessible to lab employees during each work shift when they are in their work area(s). Electronic access per below is acceptable with a printer**.**

SDS Sources

University of California-MSDS Database

Laboratory Chemical Safety Summaries (not MSDS, but quality info aimed at labs)

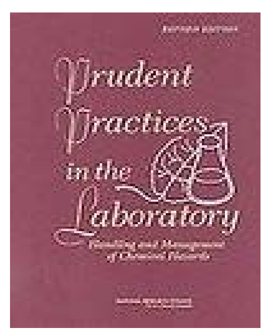
Fisher Scientific MSDS

Vermont Safety Information Resources, Inc. (SIRI)

Sigma-Aldrich MSDS

MSDS Provider (Manufacturer-direct access)

Matheson's Gases



Another Information Resource: The book entitled: *Prudent Practices in the Laboratory* by the National Research Council is widely considered to be a definitive reference. It can be purchased, but is also available **free** on-line in a searchable format. Strongly recommended that all lab workers have ready access to this important reference.

CHEMICAL LABELING

Under the Cal-OSHA Hazard Communication Standard (CCR, Title 8, 5194) all chemical containers must be properly labeled – unless a material is temporarily put into a new container for immediate use and is not going to be stored after that immediate use.

Labeling requirements for all hazardous substances are summarized as follows:

- All containers of hazardous materials must be labeled with the identity of the hazardous substance
- The label must contain all applicable hazard warning statements, e.g. flammable, carcinogen
- For commercial products the name and address of the chemical manufacturer or other responsible party must be present
- Manufacturer's product labels must remain on all containers, and must not be defaced in any way.
- Labels must be legible, in English, and prominently displayed
- Secondary containers (such as spray bottles) must be labeled with the identity of the substance and appropriate hazard warnings

New synthesized compounds, or commercial products that are repackaged, must be labeled with the appropriate hazard warnings based on the knowledge of the chemical and physical properties of that substance.

Identification & Classification of Hazardous Chemicals

Chemicals can be divided into different hazard classes. The class will help determine how these materials should be stored and handled and what special equipment and procedures are needed to use them safely. **See also "Safe Storage of Chemicals" section.**

It is essential that all laboratory workers understand the types of hazards, recognize the routes of exposure, and are familiar with the major hazard classes of chemicals. In many cases, the specific hazards associated with new compounds and mixtures will not be known, so it is recommended that all chemical compounds be treated as if they were potentially harmful and to use appropriate eye, inhalation and skin protection equipment.

FLAMMABILITY HAZARDS

A number of highly flammable substances are in common use in campus laboratories. Flammable liquids include those chemicals that have a flashpoint of less than 100 degrees Fahrenheit. These materials must be stored in flammable storage cabinets in aggregate quantities of 10 gallons or more. Flame-resistant laboratory coats must be worn when working with large quantities (1 liter or more) of flammable materials and/or with procedures where a significant fire risk is present (e.g., when working with open flame, etc.). These materials can constitute a significant immediate threat and should be treated with particular care, even though the use of these materials is fairly common in the laboratory setting. Particular attention should be given to preventing static electricity and sparks when handling flammable liquids, i.e., when pumping flammable liquids between containers.

REACTIVE HAZARDS

Reactive substances are materials that decompose, or cause decomposition of other materials, under conditions of mechanical shock, elevated temperature, or chemical action, and release of large volumes of gases and heat. These materials must be handled with utmost care and individuals must thoroughly understand their properties. Reactive hazards fall into a number of categories:

1. Oxidizers - A material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of organic materials. Examples: nitric, chromic, and perchloric acids; nitrates; nitrites; hydrogen peroxide. Typically oxygen-rich materials.These are probably the most common laboratory reactive hazards. Oxidizers are generally not unstable themselves, but contact with combustible material (e.g., organic solvent) can result in violent reaction/fire.

2. Pyrophorics – a material that will spontaneously ignite in air below a temperature of 130^{o}C. Examples: t-butyllithium, silane, diborane, trimethylaluminum

3. Water Reactives – explodes; violently reacts; produces flammable, toxic, or other hazardous gases; or evolves enough heat to cause self-ignition upon exposure to water. Examples: sodium or potassium metal, aluminum alkyls, diethylzinc

4. Unstable Reactive – will vigorously polymerize, decompose or condense, becomes self-reactive, or otherwise undergo a violent chemical change under conditions of shock, pressure or temperature. Examples: picric acid, hydrogen peroxide greater than 50 percent, hydrazine, dinitrobenzene, nitromethane, acrolein

5. Organic Peroxides- an organic compound that contains the R-O-O-R structure. Some can present an explosion hazard, or they can be shock-sensitive or temperature sensitive. Examples: will have the term "peroxide" or "peroxy" in the chemical name.

6. Peroxide-formers- a chemical that when exposed to air, will form potentially explosive peroxides which are shock, pressure and temperature sensitive. Examples: ethers are the most common examples, but includes other types of solvents and materials. Peroxide formation is a complex subject because the rate of peroxidation and instability of the resulting peroxide vary widely depending on the starting material. For more information see: http://www.cchem.berkeley.edu/cchasp/?q=node/19

HEALTH HAZARDS

Cal/OSHA uses the following definition for health hazards:
The term 'health hazard' includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.

The major classes of "hazardous" and "particularly hazardous substances" and their related health and safety risks are detailed below.

Corrosive Substances

As a health hazard, corrosive substances cause destruction of, or alterations in, living tissue by chemical action at the site of contact. Major classes of corrosive substances:

- Strong acids – e.g., sulfuric, nitric, hydrochloric
- Strong bases – e.g., sodium hydroxide, potassium hydroxide and ammonium hydroxide
- Dehydrating agents – e.g., sulfuric acid, sodium hydroxide, phosphorus pentoxide and calcium oxide
- Oxidizing agents – e.g., hydrogen peroxide, chlorine and bromine.

Symptoms of exposure for inhalation include a burning sensation, coughing, wheezing, laryngitis, shortness of breath, nausea, and vomiting. For eyes, symptoms include pain, blood shot eyes, tearing, and blurring of vision. For skin, symptoms may include reddening, pain, inflammation, bleeding, blistering and burns. As a physical hazard, corrosive substances may corrode materials they come in contact with and may be highly reactive with other substances.

Irritants

Irritants are defined as non-corrosive chemicals that cause reversible inflammatory effects on living tissue by chemical action at the site of contact. A wide variety of organic and inorganic compounds, including many chemicals that are in a powder or crystalline form, are irritants. Consequently, eye and skin contact with all laboratory chemicals should always be avoided. Symptoms of exposure can include reddening or discomfort of the skin and irritation to respiratory systems.

Sensitizers

A sensitizer (allergen) is a substance that causes exposed people to develop an allergic reaction in normal tissue after repeated exposure to the substance. Examples of sensitizers include diazomethane, chromium, nickel, formaldehyde, isocyanates, arylhydrazines, benzylic and allylic halides, and many phenol derivatives. Sensitizer exposure can lead to all of the symptoms associated with allergic reactions, or can increase an individual's existing allergies.

Hazardous Substances with Toxic Effects on Specific Organs

- Hepatotoxins – i.e., substances that produce liver damage, such as nitrosamines and carbon tetrachloride
- Nephrotoxins – i.e., agents causing damage to the kidneys, such as certain halogenated hydrocarbons
- Neurotoxins – i.e., substances which produce their primary toxic effects on the nervous system, such as mercury, acrylamide and carbon disulfide
- Biotoxins – biologically-derived toxins, such as botulinum toxin, tetrodotoxin. Some of these are regulated under the U.S. Patriot Act as "select agents"
- Agents which act on the hematopoietic system – e.g., CO and cyanides which decrease hemoglobin function and deprive the body tissues of oxygen
- Agents which damage lung tissue – e.g., asbestos and silica.

Symptoms of exposure to these materials vary. Staff working with these materials should review the SDS for the specific material being used and should take special note of the associated symptoms of exposure.

Particularly Hazardous Substances

OSHA recognizes that some classes of chemical substances pose a greater health and safety risk than others. To differentiate this different risk characteristic, OSHA identifies two categories of hazardous chemicals:

1. **hazardous chemicals**
2. **particularly hazardous substances**.

Substances that pose such significant threats to human health are classified as "particularly hazardous substances" (PHSs). The OSHA Laboratory Standards requires that special provisions be established to prevent the harmful exposure of researchers to PHSs, including the establishment of designated areas for their use. In most cases the entire lab where the material is used would be the designated area per Standard Operating Procedure for that material(s). See Section I.

Particularly hazardous substances are divided into three primary types:

1. **Acute Toxins**;
2. **Reproductive Toxins**; and
3. **Carcinogens**.

Acute Toxins

Substances that have a high degree of acute toxicity are interpreted by OSHA as being substances that "may be fatal or cause damage to target organs as the result of a single exposure or exposures of short duration." These chemicals, associated chemical waste, and storage containers must be handled with care to prevent cross contamination of work areas and unexpected contact. These chemicals must be labeled as "Toxic." Empty containers of these substances must be packaged and disposed of as hazardous waste without rinsing trace amounts into the sanitary sewer system.

Reproductive Toxins

Reproductive toxins include any chemical that may affect the reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogenesis).
http://www.ehs.ucsb.edu/units/labsfty/labrsc/chemistry/2011_particularly_hazardous_list.pdf
Reproductive toxins can affect the reproductive health of both men and women. For women, exposure to reproductive toxins during pregnancy can cause adverse effects on the fetus; these effects include embryolethality (death of the fertilized egg, embryo or fetus), malformations (teratogenic effects), and postnatal functional defects. For men, exposure can lead to sterility.

Examples of embryotoxins include thalidomide and certain antibiotics such as tetracycline. Women of childbearing potential should note that embryotoxins have the greatest impact during the first trimester of pregnancy. Because a woman often does not know that she is pregnant during this period of high susceptibility, special caution is advised when working with all chemicals, especially those rapidly absorbed through the skin (e.g., formamide). Pregnant women and women intending to become pregnant should consult with their laboratory supervisor and EH&S before working with substances that are suspected to be reproductive toxins.

Carcinogens (see next section)

Carcinogen Safety Program

Carcinogens are chemical or physical agents that cause cancer. Generally they are chronically toxic substances; that is, they cause damage after repeated or long-duration exposure, and their effects may only become evident after a long latency period. Chronic toxins are particularly insidious because they may have no immediately apparent harmful effects. These materials are separated into two classes: **Select Carcinogens** and **Regulated Carcinogens**.

Select carcinogens are materials which have met certain criteria established by the National Toxicology Program (NTP) or the International Agency for Research on Cancer (IARC) regarding the risk of cancer. There are hundreds of materials in this category. It is important to recognize that some substances involved in research are new compounds and have not been subjected to testing for carcinogenicity. The following references (links provided) are used to determine which substances are select carcinogens by Cal/OSHA's classification:

- OSHA Carcinogen List (*see next page*)
- Annual Report on Carcinogens published by the NTP, including all of the substances listed as "known to be carcinogens" and some substances listed as "reasonably anticipated to be carcinogens" http://www.ehs.ucsb.edu/units/labsfty/labrsc/chemistry/2011_particularly_hazardous_list.pdf
- IARC list including all of Group 1 "carcinogen to humans" materials; and some in Group 2A or 2B. See above link.

Regulated Carcinogens (next page) fall into a higher hazard class and have extensive additional OSHA requirements associated with them. The most common ones found in the lab are **formaldehyde, methylene chloride and benzene**. The use of these agents may require personal exposure sampling. When working with Regulated Carcinogens, it is particularly important to review and effectively apply engineering and administrative safety controls as the regulatory requirements for laboratories that may exceed threshold values for these chemicals are very extensive.

Managing Carcinogens

The safe use of all carcinogens should be addressed in the lab-specific *Chemical Hygiene Plan* (SOPs) of each lab using these materials – See Sec. I. EH&S does periodic reviews of labs using regulated carcinogens to determine if there is reason to believe that exposure levels exceed the Cal-OSHA limits. The review process is described in Sec. III.C.3. Typically, if these materials are used in a certified fume hood and proper PPE is utilized, there is little reason to believe exposure levels are a concern. In some circumstances, EH&S will do periodic exposure monitoring to verify this. In the unlikely event exposure limits are exceeded, additional steps must be taken under to eliminate the exposure, or protect the individual.

Regulated Carcinogens

The term “regulated carcinogen” means a recognized cancer causing substance, compound, mixture, or product regulated by Cal/OSHA sections 1529, 1532, 1532.2, 1535, 8358, 8359 or Article 110, sections 5200-5220.

- Acrylonitrile
- Arsenic metal and inorganic arsenic compounds
- Asbestos
- Benzene
- 1,3-butadiene
- Cadmium metal and cadmium compounds
- Chromium(VI) compounds
- Coke Oven Emissions
- 1,2-Dibromo-3-chloropropane (DBCP)
- Ethylene Dibromide (EDB)
- Ethylene Oxide (EtO)
- Formaldehyde gas and formaldehyde solutions
- Lead metal and inorganic lead compounds
- Methylene Chloride
- 4,4'-Methylene bis(2-chloroaniline) (MBOCA)
- Methylenedianiline (MDA)
- Vinyl Chloride
- **2-Acetylaminofluorene**
- **4-Aminodiphenyl**
- **Benzidine (and its salts)**
- **3,3'-Dichlorobenzidine(and its salts)**
- **4-Dimethylaminoazobenzene**
- **alpha-Naphthylamine**
- **beta-Naphthylamine**
- **4-Nitrobiphenyl**
- **N-Nitrosodimethylamine**
- **beta-Propiolactone**
- **bis-Chloromethyl ether**
- **Methyl chloromethyl ether**
- **Ethyleneimine**

Those materials marked in **bold** have the additional requirement of needing to be reported to Cal-OSHA as being in use at a workplace (CCR, Title 8, 5209). If you possess, or are going to order, any of these materials, please contact EH&S. These materials are rarely used in research labs.

GENERAL PROCEDURES FOR WORKING WITH HAZARDOUS CHEMICALS

(adapted from Prudent Practices in the Laboratory, National Academies Press, 2011)

Personal Behavior

Demonstrating prudent behavior within the laboratory is a critical part of a culture of safety. This includes following basic safety rules and policies, being cognizant of the hazards within the laboratory, and exhibiting professionalism with co-workers. Maintaining an awareness of the work being performed in nearby hoods and on neighboring benches and any risks posed by that work is also important.

Minimizing Exposure to Hazardous Chemicals

Take precautions to avoid exposure by the principal routes, that is, contact with skin and eyes, inhalation, and ingestion. The preferred methods for reducing chemical exposure are, in order of preference,

1. substitution of less hazardous materials or processes
2. engineering controls,
3. administrative controls, and
4. personal protective equipment (PPE)

See also the Occupational Safety and Health Administration's (OSHA) Safety and Health Management eTool, Hazard Prevention and Control module available at www.osha.gov. Before beginning work, review all proposed laboratory procedures thoroughly to determine potential health and safety hazards. Refer to the Safety Data Sheets (SDS) for guidance on exposure limits, health hazards and routes of entry into the body, and chemical storage, handling, and disposal. Avoid underestimating risk when handling hazardous materials.

Engineering Controls

Engineering controls are measures that eliminate, isolate, or reduce exposure to chemical or physical hazards through the use of various devices. Examples include laboratory chemical hoods and other ventilation systems, shields, barricades, and interlocks. Engineering controls must always be considered as the first and primary line of defense to protect personnel and property. When possible, PPE is not to be used as a first line of protection. For instance, a personal respirator should not be used to prevent inhalation of vapors when a laboratory chemical hood (formerly called fume hoods) is available.

Avoiding Ingestion of Hazardous Chemicals

Eating, drinking, smoking, gum chewing, applying cosmetics, and taking medicine in laboratories where hazardous chemicals are used or stored should be strictly prohibited. Food, beverages, cups, and other drinking and eating utensils should not be stored in areas where hazardous chemicals are handled or stored. Glassware used for laboratory operations should never be used to prepare or consume food or beverages. Laboratory refrigerators, ice chests, cold rooms, and ovens should not be used for food storage or preparation. Laboratory water sources and deionized laboratory water should not be used as drinking water. Never wear gloves or laboratory coats outside the laboratory or into areas where food is stored and consumed, and always wash laboratory apparel separately from personal clothing.

Avoiding Inhalation of Hazardous Chemicals
Conduct all procedures involving volatile toxic substances and operations involving solid or liquid toxic substances that may result in the generation of aerosols in a laboratory chemical hood. Air-purifying respirators are required for use with some chemicals if engineering controls cannot control exposure. Significant training, along with a medical evaluation and respirator fit, are necessary for the use of respirators. Contact the campus Industrial Hygienist for more information about respirator fitting and use.

Laboratory chemical hoods should not be used for disposal of hazardous volatile materials by evaporation. Such materials should be treated as chemical waste and disposed of in appropriate containers according to institutional procedures and government regulations.

Avoiding Injection of Hazardous Chemicals
Solutions of chemicals are often transferred in syringes, which for many uses are fitted with sharp needles. The risk of inadvertent injection is significant, and vigilance is required to avoid an injury. Use special care when handling solutions of chemicals in syringes with needles. When accompanied by a cap, syringe needles should be placed onto syringes with the cap in place and remain capped until use. Do not recap needles, especially when they have been in contact with chemicals. Remove the needle and discard it immediately after use in the appropriate sharps containers. Blunt-tip needles, including low-cost disposable types, are available from a number of commercial sources and should be used unless a sharp needle is specifically required to puncture rubber septa or for subcutaneous injection.

Avoiding Skin Contact with Hazardous Chemicals
All laboratory operations must be conducted in accordance with the campus Personal Protective Equipment (PPE) policy. In general, a lab coat and safety glasses are the minimum required PPE when working in the laboratory. **Ordinary prescription glasses do not provide adequate protection against injury because they lack side shields and are not resistant to impact, but prescription safety glasses and chemical splash goggles are available.** Please see the section on PPE in this document for further information.

Housekeeping
A definite correlation exists between orderliness and the level of safety in the laboratory. In addition, a disorderly laboratory can hinder or endanger emergency response personnel. The following housekeeping rules should be adhered to:

- Never obstruct access to exits and emergency equipment such as fire extinguishers and safety showers. Comply with local fire codes for emergency exits, electrical panels, and minimum aisle width.

- Store coats, bags, and other personal items in the proper area, not on the benchtops or in the aisles.

- Do not use floors, stairways, and hallways as storage areas. Items stored in these areas can become hazards in the event of an emergency.

- Keep drawers and cabinets closed when not in use, to avoid accidents.

- Properly label in permanent marker and store all chemicals appropriately by compatibility.

- Label transfer vessels with the full chemical name, manufacturer's name, hazard class, and any other special warnings.

- Store chemical containers in order and neatly. Face labels outward for easy viewing. Containers themselves should be clean and free of dust. Containers and labels that have begun to degrade should be replaced, repackaged, or disposed of in the proper location. Do not store materials or chemicals on the floor because these may present trip and spill hazards.

- Keep chemical containers closed when not in use.

- Secure all compressed gas cylinders to walls or benches in accordance with regulation and the local requirements for seismic safety.

- Secure all water, gas, air, and electrical connections in a safe manner.

- Return all equipment and laboratory chemicals to their designated storage location at the end of the day.

- To reduce the chance of accidentally knocking containers to the floor, keep bottles, beakers, flasks, and the like at least 2 in. from the edge of benchtops.

- Keep work areas clean (including floors) and uncluttered.

- To avoid flooding, do not block the sink drains. Place rubber matting in the bottom of the sinks to prevent breakage of glassware and to avoid injuries.

- Do not pile up dirty glassware in the laboratory. Wash glassware carefully. Remember that dirty water can mask glassware fragments. Handle and store laboratory glassware with care. Discard cracked or chipped glassware promptly.

- Dispose of all waste chemicals properly and in accordance with organizational policies.

- Dispose of broken glass and in a specially labeled container for broken glass. Treat broken glassware contaminated with a hazardous substance as a hazardous substance.

- Dispose of sharps (e.g., needles and razor blades) in a specially labeled container for sharps. Treat sharps contaminated with a hazardous substance as hazardous substances.

Transport of Chemicals

When transporting chemicals outside the laboratory or between stockrooms and laboratories, use only break-resistant secondary containment. Commercially available secondary containment is made of rubber, metal, or plastic, with carrying handle(s), and is large enough to hold the contents of the chemical containers in the event of breakage. Resealable plastic bags serve as adequate secondary containment for small samples. When transporting cylinders of compressed gases, the cylinder must always be strapped in a cylinder cart and the valve protected with a cover cap. When cylinders must be transported between floors, passengers should not be in the elevator.

Working with Scaled-Up Reactions

Special care and planning is necessary to ensure safe scaled-up work. Scale-up of reactions from those producing a few milligrams or grams to those producing more than 100 g of a product may magnify risks by several orders. Although the procedures and controls for large-scale laboratory reactions may be the same as those for smaller-scale procedures, significant differences may exist in heat transfer, stirring effects, times for dissolution, and the effects of concentration—all of which need to be considered. When planning large-scale work, practice requires consulting with experienced workers and considering all possible risks. Although one cannot always predict whether a scaled-up reaction has increased risk, hazards should be evaluated if the following conditions exist:

- The starting material and intermediates contain functional groups that have a history of being explosive (e.g., N—N, N—O, N—halogen, O—O, and O—halogen bonds) or that could explode to give a large increase in pressure.

- A reactant or product is unstable near the reaction or workup temperature. A preliminary test to determine the temperature and mode of decomposition consists of heating a small sample in a melting-point tube.

- A reactant is capable of self-polymerization.

- A reaction is delayed; that is, an induction period is required.

- Gaseous byproducts are formed.

- A reaction is exothermic. What can be done to provide, or regain, control of the reaction if it begins to run away?

- A reaction requires a long reflux period. What will happen if solvent is lost owing to poor condenser cooling?

- A reaction requires temperatures less than 0 °C. What will happen if the reaction warms to room temperature?

- A reaction involves stirring a mixture of solid and liquid reagents. Will magnetic stirring be sufficient at large scale or will overhead mechanical stirring be required? What will happen if stirring efficiency is not maintained at large scale?

In addition, thermal phenomena that produce significant effects on a larger scale may not have been detected in smaller-scale reactions and therefore could be less obvious than toxic or environmental hazards. Thermal analytical techniques should be used to determine whether any process modifications are necessary. Consider scaling up the process in multiple small steps, evaluating the above issues at each step. Be sure to review the literature and other sources to fully understand the reactive properties of the reactants and solvents, which may not have been evident at a smaller scale.

Fume Hood Usage Guide: Standard Hoods

(Standard hoods do not have the "VAV control box" shown on the next page)

Per Cal-OSHA regulations, users of hoods must be trained on use of their fume hood. Attendance at one of the live or on-line lab safety orientations described below on the "Campus Policy on Laboratory Safety Training" page satisfies that requirement. The information on this page should also be read by all hood users and is posted on campus hoods for easy reference.

1. **Always work with the sash at the level of the red arrow sticker (picture on next pg.) and close it when not attended.** To adequately protect you, your hood should be producing a face velocity of about 100 ft/min. EH&S tests your hood and posts the red arrow stickers at the **proper sash level to:**
   - satisfy the required air flow and protect you (10 - 100 times more than full open sash) against airborne chemicals
   - protect you better from incidents within the hood
2. *All hoods on campus are equipped with an air flow monitor and/or alarm to warn you if the air velocity is too low – see examples pictured below. **If the alarm engages, lower the sash slightly until the alarm stops.** Do **NOT** disengage or over-ride the alarm. If your alarm sounds consistently this could indicate a real problem – call EH&S.
3. Always work at least 6 inches inside the hood to maximize capture efficiency.
4. Store only a minimum of equipment and chemicals in your hood because:
   - Excess materials will block the air flow into the intake slots at the back of the hood. Permanent equipment should be raised on a jack to allow the air to flow smoothly.
   - Most fires and explosions occur in the hood. Minimizing chemical volumes will reduce the chances of a small accident escalating into a large one.
5. Keep the lab windows closed. Drafts from open windows and doors can significantly affect your hood's performance (100 ft/min is only a few miles/hr of air).

"Magnihelic gauge" – note normal gauge position. Significant deviation may indicate condition of low air flow.

*Visible/audible alarm
Sounds during low-flow*

Fume Hood Usage Guide: Variable Air Volume Hoods ("Phoenix" system)

Per Cal-OSHA regulations, users of hoods must be trained on use of their fume hood. Attendance at one of the live or on-line lab safety orientations described below on the "Campus Policy on Laboratory Safety Training" page satisfies that requirement. The information on this page should also be read by all hood users and is posted on campus hoods for easy reference.

Variable Air Volume (VAV) hoods — unlike a standard hood above — automatically adjust the face velocity to stay within recommended safe work levels (~ 100 ft./min). A VAV hood is easily distinguished by the gray control box on the hood – pictured below.

1. **If the low-flow alarm engages, lower the sash until the alarm stops.** DO NOT over-ride the safety alarm by permanently engaging the "Mute" or "Emergency" button (e.g., with tape). If your hood is consistently alarming call EH&S (x-4899).

2. Always work with the sash at or below the level of the **red arrow sticker** (below), because:

    - If most bldg. sashes are raised, this will generate a hood alarm, and at your neighbor's hood, due to the limited capacity of your building's ventilation

    - A lowered sash protects you against airborne chemicals and incidents up to 100 times more than at sash full open.

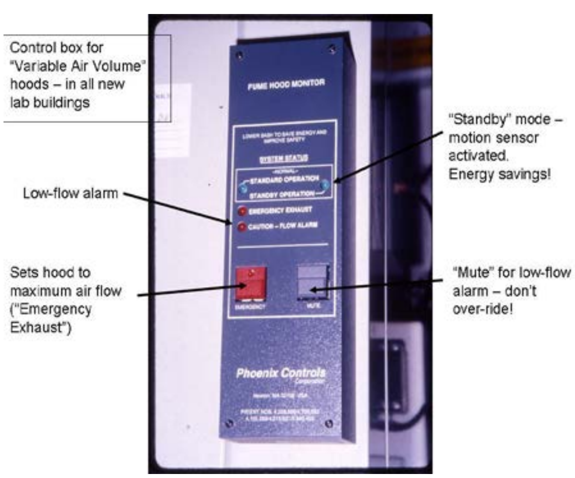
    - The lower the sash, the greater the **energy conservation** – lower sash when not in use

3. Store only the minimum of equipment and chemicals in your hood because:

    - Excess materials block air flow into the slots at back of the hood. Permanent equipment should be raised on a stand to allow the air flow into the lower slot.

    - Most lab fires/explosions occur in hoods. Minimizing chemical volumes will reduce the chances of a small accident escalating into a large one.

4. Always work at least 6 inches inside the hood to maximize hood capture efficiency.



Safe Storage of Chemicals

INTRODUCTION: If incompatible chemicals are mixed a fire, explosion, or toxic release can occur. In earthquake-prone areas like UCSB, it is vital that chemicals be stored safely. Note however, that chemicals can often fall into more than one hazard category and therefore the chemical label and/or Safety Data Sheet (MSDS) should be reviewed for storage requirements. Separate chemicals by adequate distance, or preferably by using physical barriers (e.g. storage cabinets). Avoid using the fume hood for chemical storage - this practice may interfere with the proper air flow of the hood. For especially dangerous materials, use a secondary container (e.g. plastic tub) large enough to contain a spill of the largest container. This chart indicates the most obvious chemical incompatibilities, and provides a basic segregation plan.

ACIDS: Examples: Acetic Acid; Chromic Acid*; Hydrochloric Acid; Hydrofluoric Acid; Nitric Acid*; Perchloric Acid*; Phosphoric Acid; Sulfuric Acid (* Indicates strong oxidizing acids, store per oxidizers section)

Storage Precautions:

- Store bottles on low shelf areas, or in acid cabinets.
- Segregate oxidizing acids from organic acids, **and** flammable materials.
- Segregate acids from bases, **and** from active metals such as sodium, potassium, etc.
- Segregate from chemicals which could generate toxic gases such as NaCN, iron sulfide, etc.

BASES: Examples: Ammonium Hydroxide; Potassium Hydroxide; Sodium Hydroxide

Storage Precautions:

- Separate bases from acids.
- Store bottles on low shelf areas, or in acid cabinets.

FLAMMABLES-fuels are reducing agents, examples:

Acetone	Ethyl Ether	Propanol
Benzene	Gasoline	Tetrahydrofuran
Cyclohexane	Hexane	Toluene
Ethanol	Isopropyl Alcohol	Xylene
Ethyl Acetate	Methanol	

Storage Precautions:

- Store in approved flammable storage cabinet(s) (required if there is > 10 gallons in the lab).
- Separate from oxidizing acids and oxidizers.
- Keep away from any source of ignition (flames, localized heat or sparks).
- Use only "flammable storage" (desparked) refrigerator

OXIDIZERS-react violently with organics (solvents,paper, wood, etc.

Example Solids	*Liquids*
Iodine	Bromine
Nitrates, Salts of	Hydrogen Peroxide
Peroxides, Salts of	Nitric Acid
Potassium Ferricyanide	Perchloric Acid
Sodium Nitrite	Chromic Acid

Storage Precautions:

- Keep away from organic solvents, and other combustible materials (i.e. paper).
- Keep away from reducing agents.

PEROXIDE-FORMING CHEMICALS-peroxides can be explosive and shock-sensitive. Examples: Ethers and acetals with alpha-hydrogen (e.g. ethyl ether, THF); Alkenes with allylic hydrogen (e.g. cyclohexene). Store tightly sealed to exclude oxygen. Label with date of receiving/opening. Dispose within recommended guidelines – usually 6 months for ethers.

PYROPHORIC SUBSTANCES-spontaneously ignite in air.
Examples: Some finely divided metals; Some organoaluminum compounds ($LiAlH_4$, $Al(CH_3)_3$); Silane; phosphorus, yellow (should be stored and cut under water)
Storage Precautions:

- rigorously exclude air and water from container.
- store away from flammables.

WATER REACTIVES -react violently with water to yield flammable or toxic gases.
Solids: Calcium carbide, magnesium, lithium, potassium, sodium
Liquids: phosphorous trichloride, thionyl chloride
Storage Precautions:

- Rigorously avoid exposure to water and air
- Store away from flammables
- Lithium, Potassium and sodium should be stored under kerosene or mineral oil

HIGHLY TOXICS, CARCINOGENS, REPRODUCTIVE TOXIN These chemicals can be very hazardous by themselves, or in combination with other chemicals. If they are easily inhaled, (gases and volatile liquids) then they are particularly hazardous.
Liquids - Seal tightly and store in a ventilated cabinet apart from incompatibles. Use secondary containment (e.g. plastic tub) to contain any spills.
Examples: Formaldehyde; Carbon disulfide; Mercury; Nickel carbonyl; Cyanide solutions
Gases - Store in a gas cabinet or other ventilated cabinet
Examples: Chlorine; Fluorine; Hydrogen chloride; Nitric Oxide; Hydrogen Cyanide
Solids -Store away from incompatibles (usually acids) that would release toxic gas upon contact.
Examples: Cyanides, Salts of; Sulfides, Salts of

Refrigerators and Freezers in Labs

Certain refrigerator/freezer units are designed specfically for the storage of flammable materials, and to prevent potentially injurious explosions in your lab. These units have special protections to prevent ignition of flammable vapors. For example, the light switch, defrost feature, and thermostat inside the storage compartment have been removed or relocated. This is critical, since flammable vapors coupled with an ignition source could result in a explosion. In other words, a normal kitchen refrigerator is not safe for the storage of chemicals.

Before purchasing a new refrigerator/freezer, or using an existing one, consider whether chemicals will be used for storage in this unit. Note that many lab refrigerators will be around for decades and therefore one can not guarantee that a normal unit will never be used for flammables storage. There are two types of refrigerator/freezer models that should be considered, depending on the type of hazardous material the unit will store.

I. FLAMMABLE MATERIAL STORAGE REFRIGERATORS/FREEZERS:

These have no internal electrical components which could trigger an explosion inside the unit. These must always be used for storage of volatile materials.

II. EXPLOSION-PROOF REFRIGERATORS/FREEZERS :

These units prevent triggering of interior or exterior explosions in a hazardous environment. Every motor and thermostat is designed to prevent arcing and possible ignition. Used for storage of volatile materials in areas with explosive atmospheres. These are rarely necessary in lab environments.

All refrigerator/freezer purchases and modifications on campus **must be pre-approved** by EH&S at X8243. In addition, all approved refrigerator/freezer units storing flammable materials must be labeled with signage reading, “Approved For Chemical Storage, No Food Storage”. All refrigerator/freezer units not approved for storage of flammable materials must be affixed with signage reading, “Explosion Hazard”. Please feel free to contact EH&S for your free labels.

This picture shows a UCI lab refrigerator which exploded when chemicals were inappropriately stored in a unit which was not designed for flammables storage.

Campus Policy on Laboratory Safety Training

Documentation of occupationally-related safety training is a legal requirement under Cal-OSHA. Accordingly, as of July 2010, UCSB instituted a policy regarding *baseline* safety training of all "laboratory workers". The training covers the core/universal issues common to most/all labs and addresses some (not all) specific regulatory requirements for documented training. In short, the policy requires that **all** lab workers complete one of the EH&S general lab safety orientations as outlined below before being issued access to their lab.

Note that the trainings below are generic and do not address the specific hazards, procedures and practices for a particular laboratory, or individual. Lab supervisors/PIs are still responsible under the law for ensuring this has been provided.

All members of the campus lab community have responsibilities under the policy - particularly the individual's home department which is responsible for ensuring new lab workers are identified and guided into the appropriate training session. The full policy can be found at:

http://www.policy.ucsb.edu/policies/policy-docs/lab-safety-training.pdf

Summary of Required General Laboratory Safety Orientations

1. **Required for Graduate Students:** A live 3-hour instructor-led general laboratory safety orientation (LS01) is offered regularly - generally twice per quarter. This training is more in-depth than those listed below and generally includes hands-on fire extinguisher training. This training is open to *any* laboratory worker and all are encouraged to take this course.

2. **Required for Other (Non-Graduate Student) Laboratory Workers, (**e.g., postdoctoral scholars, undergraduates working in research labs, visitors, etc.). Complete the appropriate one of the two online modules below. Alternatively, a PI/supervisor may, at their discretion, choose to send a worker to the more in-depth live training in #1.

    - Laboratory Safety Orientation for Chemical Users (LS40)
    - Laboratory Safety Orientation for Non-Chemical Users (LS41)

Non-UCSB Online Laboratory Safety Training

Documented safety training is a legal requirement of Cal-OSHA and ideally also helps prevent accidents. Within the UC system are a number of online safety training modules as listed below - the link below will lead to the trainings. However, as someone accessing these modules from outside that campus the training will not be documented. It is therefore recommended that the supervisor have the training documented at the time of completion.

Link to UC (Non-UCSB) Online Laboratory Safety Training:
http://ehs.ucsb.edu/training/lsvideo1.html

UC Online Training Catalog:

(campuses may have their own version/title for the same subject matter)

- Carcinogen Handling Safety
- Centrifugation Hazards
- Chemical Storage
- Compressed Gas & Cryogen Safety
- Day in the Life of the Lab (A PIs Perspective)
- Earthquake Safety
- Pressure Safety
- Cryogenics Safety
- Electrical Safety
- Ergonomics for the Laboratory
- Fire Safety in the Laboratory
- Fire Extinguishers Usage
- Formaldehyde Safety
- Fume Hoods
- Hazardous Materials Spill Response
- Hazardous Materials Shipping
- Material Safety Data Sheets
- Nanomaterials Handling
- Practicing Safe Science
- Pyrophoric Reagents Safety



Laboratory Self-Inspection Checklist

EH&S inspects all labs on campus at least annually. However, **lab supervisors should initiate regular self-inspections** (recommend minimum of twice-a-year) for the following reasons:

☐ By memos of understanding between UCSB, SB County Fire and the State Fire Marshal, EH&S is allowed to perform safety surveys on their behalves. Without these agreements, these agencies would conduct their own inspections. However, to continue these agreements, their expectations are that regular self-inspections and corrections are done by every lab.

☐ Under California law (OSHA), supervisors (PIs) are required to: *"… include procedures for identifying and evaluating work place hazards including scheduled periodic inspections to identify unsafe conditions and work practices."*

☐ Beyond any regulatory requirements, doing regular self-inspections will clearly increase the level of safety in your area.

To aid you in your surveys, a Self-Inspection Checklist follows, this is not a list of every possible safety issue, but are guidelines. Most items are based on applicable regulations or campus policy. Radiation and biohazard issues are not addressed here because they are highly specialized and these labs receive targeted EH&S visits. More information is also available at http://ehs.ucsb.edu. The links (underlined) noted below lead to further information.

Hazardous Waste

1. Are personnel generating chemical waste trained with waste disposal procedures? Individuals who have not taken the UCSB Lab Safety course (live or on the EH&S website) must take this course before generating hazardous waste for disposal **Online Hazardous Waste Course*** (EH09)
   (*This course meets the waste management training requirements enforced by Santa Barbara County Fire Department)

2. Is the illegal disposal of hazardous substances down the drain prevented?

3. Are all hazardous waste containers labeled with the official UCSB Hazardous Waste label?
   - ☐ Is there a supply of UCSB waste labels handy (available in all campus storerooms)?
   - ☐ Are labels attached when the **first drop** of waste goes into the container?
   - ☐ Are all constituents in mixtures identified, as well as their concentrations?
     Do not use generic names like "*Waste or Organic waste*" instead use proper chemical name(s).
   - ☐ Are chemically incompatible wastes segregated?
   - ☐ Is there a designated area for storage of hazardous waste and labeled as such?

4. Are lab personnel instructed not to dispose of chemicals by fume hood evaporation? By law, waste containers must be capped when not in use.

5. Is chemical waste disposed of within **9 months** of their accumulation, *regardless how much material remains inside the container*? Contact EH&S for waste disposal.

6. Are all "sharps" (syringes, razor blades, etc.) disposed in puncture resistant, leak-resistant containers and sealed tightly to preclude loss of contents? Is there a designated glass disposal container in the lab? Lab personnel are designated to empty these into their bldg. dumpster – custodial staff will not do so.

Chemical Safety

1. Is your lab's legally-required (Cal-OSHA) Lab-specific *Chemical Hygiene Plan* (CHP) completed and shared with all workers? Does your CHP address your use of OSHA *Particularly Hazardous Substances* (human carcinogens, acute toxins, reproductive toxins, and pyrophorics)?

2. Are Cal-OSHA regulated carcinogens such as formaldehyde/formalin, dichloromethane, and benzene always used in a fume hood and with appropriate gloves/eyewear?

3. Are chemical containers properly labeled with chemical name and hazard type of the material? (e.g., repackaged materials and lab-synthesized materials)

4. Are stored chemicals segregated according to hazard classification/compatibility (acids, bases, flammables, oxidizers, water reactives, etc.)? Compatibility Chemical Storage Chart

5. Are all containers of peroxide-forming chemicals (e.g., ethers) dated upon receipt and disposed of within the prescribed time period (contact EH&S for prompt disposal)? Peroxides can be explosively unstable.

6. Are flammable liquids kept inside approved flammable storage cabinets whenever possible?

   ☐ Are flammable liquids always stored in approved flammable cabinets when in excess of 10 gallons?

   ☐ Do you have large volumes of flammable solvents (e.g., multiple cases or drums) in storage that are above what is reasonably needed? The quantities of flammables that can legally be stored are regulated by CA Fire Code. Please don't stockpile large quantities of these materials.

   ☐ Are flammable liquids stored away from sources of heat, ignition, electrical equipment or sources of static electricity?

   ☐ **Static Electricity** - Electrically ground and bond all containers/equipment involved in pumping flammable liquids to prevent buildup of static electricity as an ignition source.

7. Are acid volumes greater than 10 gallons stored in an approved storage cabinet?

8. Is there a catch pan beneath manometers, barometers, etc. which contain large quantities of mercury?

9. It is highly recommended chemical spill cleanup materials be available.
   Are all lab workers familiar with the location of spill cleanup kits?
   Note: Some lab buildings have a designated "spill closet" – generally keyed to graduate master key.

Laboratory Equipment

1. Are the eyewash and emergency shower stations free of any obstructions which would prevent ready access? These units are tested by FM regularly. It is recommended that labs run their eyewash units monthly to maintain clean water in the lines.

2. Have fume hoods been EH&S tested within the year (check label)?
   - ☐ Is **air flow indicator** present and operational?
   - ☐ Is lab **equipment or chemicals** within the hood minimized? **Keep only items in use.**
   - ☐ Are air entry slots at back of hood kept clear of obstructions? ***Cluttered hoods interfere with proper air flow***.
   - ☐ Is front **sash lowered** to the appropriate level "red arrow mark" when hood is in use? If the low flow alarm engages, lower the sash until the alarm stops. If the alarm continues when the sash is lowered to the "red arrow mark" please contact EH&S at x3743. **DO NOT** over-ride the safety alarm by permanently engaging the "Mute" or "Emergency" button (e.g., with tape, paper clips, etc.).
   - ☐ Has everyone using a fume hood been properly trained to use their fume hood? *General fume hood use is covered in the Lab Safety training course. The training however, does not cover lab specific hood use. Ensure lab members have documented their fume hood training.*

3. Are biological safety cabinets certified annually or when moved (check sticker) and are they the proper types for the work being conducted?

4. Do labs using non-ionizing radiation equipment, such as lasers, microwaves, and ultraviolet light sources, have properly posted warning signs and shielded work areas?

5. Compressed gas cylinders
   - Are cylinders dated upon arrival and contents clearly identified?
   - Inspect regularly for defects, i.e., excessive rust, dents, bulging, corrosion, etc.
   - Unidentified cylinders should be marked, "CONTENTS UNKNOWN" and returned to the manufacturer.
   - Non-lecture bottles $\geq$ 5 years old must be returned to the manufacturer to ensure they are safety/pressure tested as required by law ("hydostatic testing") Check stamped date on cylinder when it was last tested.
   - Corrosive gases (e.g. **HF, HBr, HCl, H_2S**) can degrade the cylinder over time and/or produce dangerously high pressures of hydrogen. Dispose of within 2 years.
   - Are cylinders secured upright with welded chains and brackets bolted to a wall, bench or other secure object (no type C-clamps)?
   - Are protective caps in place while cylinders are not in use?
   - Flammable gases (e.g. hydrogen, methane) tubing should be equipped with a **flash arrestor** to prevent flame flashback to cylinder. Available from gas vendors.
   - Use of large cylinders of highly toxic gases must be reviewed/approved (EH&S, x-4899)
   - Highly toxic gas cylinders should be equipped with a **reduced flow orifice** (RFO) connection to prevent rapid discharge of cylinder contents. Available from gas vendors.
   - Gas cabinets with toxic or flammable gas delivery manifolds often have an **excessive flow detection and auto-shutoff valve** built-in. Verify that this safety feature is functional.

6. ☐ Are refrigerators for storing flammables clearly posted with signage indicating they are safe for such storage? (e.g. "desparked", "lab-safe", "explosion-proof", "flammable storage").

- ☐ Are refrigerators that are **NOT** designed for flammables storage clearly marked as such? (this is very important to prevent a potential explosion)
- ☐ Are all chemical storage refrigerators marked with "*No Food*" labels?
- ☐ Refrigerators in labs utilized for food or drinks should be marked "*Food Only/No Chemicals*?"
- ☐ Laboratory refrigerators/freezers and other sensitive equipment, preferably should be connected to emergency back-up power.

7. Is the location of manuals/instructions for each piece of equipment known?

8. Are the belt guards in place on all pumps, etc?

9. **Solvent stills with water-reactive drying agents**

- Are solvent stills clearly labeled with the solvent name and drying reagent?

- Ensure water-flow monitor are installed that would automatically shut off the heating mantles in the event of cooling water loss (pic with arrow). Periodically test monitors by shutting down the water flow to verify the system is functioning properly. They are available commercially. We strongly recommend this important safety device be adopted. Fires associated with stills are not uncommon, including the $3M fire at UCI in 2001.

- Ensure secondary containment pans are beneath the stills. In the event of a system leak this should capture any leakage and prevent the solvent from spreading out and finding an ignition source.

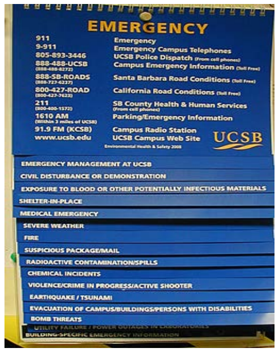
- **Quenching Solvent Stills -**The quenching of used still-pots is potentially dangerous but can be done safely if appropriate precautions are taken. "See EH&S Fact Sheet on still quenching"

Pressurized Systems - Inspect and test all high pressure vessels regularly per the owner's manual requirements. Each vessel should have a use-log of: experiment conditions, dates of runs, testing/maintenance history, etc. in order to track the vessel's life-expectancy. Pressure vessels must include a functional over-pressurization rupture disk to prevent a catastrophic vessel failure.

General Safety Concerns

1. Has EH&S posted outside the lab an emergency information contact sign, indicating the hazards within, responsible persons and phone numbers? Is the information correct? Call EH&S to update (x-8243).

2. Has the **UCSB Campus Emergency Flip Chart** been posted in the work area? Has the, *Building-Specific Emergency Information* section page has been completed?



3. Are rooms containing regulated hazardous substances, such as infectious and radioactive materials, posted with warning/caution signs and appropriate authorizations?

4. Are aisles free of obstructions? Minimum clearance for lab aisles is 2 ft.

5. Do work areas have adequate ventilation and illumination? To prevent suffocation, verify that fresh air is supplied to cold/hot rooms that are used as work areas. Check emergency door release and alarm mechanisms.

6. Are fire extinguishers functional (plastic seal and pin intact and show pressure)?
   Are the extinguishers located on their wall hooks?
   Is the area in front of the extinguishers accessible?

7. Are food and beverages kept out of chemical work areas and out of laboratory refrigerators?

8. Is the lab poster summarizing the UCSB Laboratory Personal Protective Equipment (PPE) Policy in place and are all affected individuals following its provisions? Do all individuals understand the different PPE requirements for Category 1, 2 and 3 hazardous materials?

For more PPE, including glove reference charts, click link.

9. Have all respirator users been certified through the ***Respiratory Protection Program*** as run by EH&S?

10. Is the level of housekeeping in the lab satisfactory?
    - No hazardous materials stored on floor
    - Aisles and corridors kept clear
    - Lack of clutter
    -Glassware that is scattered on benchtops and out in the open clutters working areas, is easily broken, will not stay clean, and, if dirty, may be confused for clean glassware and potentially negate any viable research.

11. Lab doors are fire-rated and therefore can not be propped open with a wedge or other device. Discontinue use of these, or SB County Fire may confiscate them and cite the University.

12. Secure your highly hazardous materials, e.g. highly toxic gas, radiation, select biological agents. Ensure the lab door(s), freezers, refrigerators, storage cabinets, etc. with these materials are locked whenever the lab is left unattended.

Electrical Safety

1. Check electrical equipment and inspect for frayed cords and damaged connections? Electrical tape is prohibited.

2. Multiple outlet strips plugged directly into a wall outlet? Does the power strip have a circuit breaker? Extension cords are not to be permanently used with power strips.

3. Are employees instructed **not** to use extension cords in place of permanent wiring (use allowed if only on a temporary, immediate, basis)? Have permanent receptacles installed for long-term electricity needs.

- Ensure extension cords are 14-gauge (heavy duty) at a minimum, and **temporarily** servicing only one appliance or fixture?
- Ensure extension cord is plugged directly into receptacle. Extension cords should never be used plugged end-to-end; use the proper length cord.
- If extension cords are used, ensure cords are not running through walls, ceiling or doors?

4. Are cord guards provided across an aisle or other passageway to prevent tripping?

5. Is all electrical equipment grounded (three-prong plugs) or double insulated?
   – Are 3-prong plugs only used for 3-prong receptacles, and never altered to fit into an outlet?

6.Are Ground Fault Circuit Interrupters in place where electrical outlets are in use within 6 feet of water? Ensure GFCI's are working properly by using the "test" button.

7. Are all electrical boxes, panels and receptacles covered to protect against electrocution?

8. Are control switches, circuit breakers and electrical panels free of obstructions? These items must be accessible at all times.

9. Are high voltage control panels and access doors posted?

Seismic Safety

1. Do shelves used for chemical storage have seismic restraining devices (e.g. lip, wire or bungee cord) installed to prevent chemicals from falling? Is all valuable or hazardous equipment seismically anchored?

Visit web links for securing lab instruments & appliances:

Seismic Protection Methods for Lab Instruments and Appliances

Earthquake Restraint System for Optical Tables

Securing Your Stuff

2. Are cabinets, chemical shelves and furniture over 42 inches in height braced against walls to prevent their falling over in the event of an earthquake?

3. Is overhead storage of heavy objects minimized and restrained?

Administrative

(Note: these training requirements must be met by supervisors to satisfy their personal regulatory obligations)

1. All lab workers are required to complete the UCSB Lab Safety Orientation to satisfy numerous regulatory training requirements. Verify everyone has attended either the live class for grad students & staff (LS01), or completed the appropriate online course for undergrads and postdocs (LS04). Visit our training history link, to view personnel that have completed the course.

2. Are safety training records generated from the class maintained (Lab Safety Training Checklist) and available for review by employees, EH&S and outside agencies?

3. Are all employees aware of the following:

- ☐ How to access Material Safety Data Sheets (now known as Safety Data Sheets)?
- ☐ UCSB Laboratory Personal Protective Equipment policy/poster?
- ☐ Know the location of the emergency eyewash/shower station?
- ☐ The Emergency Assembly Point for your building?
- ☐ The location of the nearest fire alarm pull station?
- ☐ The three basic types of fire extinguishers and their applicability?
- ☐ The location/availability of first aid kits within the building?
- ☐ The location of the Automated External Defibrillator (AED), available in some departments?
- ☐ The location of the circuit breaker box?
- ☐ The location/purpose of your building's Safety Corner bulletin board?
- ☐ The identity of your Department Safety Rep?
- ☐ The availability/purpose of the UCSB Hazard Reporting Form

Chemical Waste Disposal

REGULATIONS: Hazardous waste regulations are stringent and penalties for violations can be severe. Santa Barbara County inspects UCSB labs for compliance on a regular basis.

STORAGE

- Store chemical waste in a designated area. Label as, "**HAZARDOUS WASTE STORAGE AREA**"
- Store chemicals in containers compatible with, and durable enough for, the waste.
- Liquid waste must be in screw-top containers. Do not overfill - allow for expansion.

LABELING

- Identify waste by proper chemical name (no abbreviations or chemical structures). List chemical names of hazardous components in that mixture by percent weight.
- Deface existing labels when reusing containers.
- Label and date container(s) when the first drop of waste is added. Hazardous waste shall be given to EH&S for disposal within ***nine months*** of start date.
- Use ***UCSB HAZARDOUS WASTE*** label on all hazardous waste containers. All portions of the label must be completed. Labels are available for free in all science storerooms –see below.

SEGREGATION: group waste into the following categories:

- halogenated organics (*dichloromethane, chloroform*)
- acids with pH 2 or less (*HCL, sulfuric acid*)
- alkali metals and other water reactives (*sodium,lithium)*
- strong oxidizers (*nitric acid, chlorates, permanganates*)
- unstable chemicals

-non-halogenated organics (acetone, methanol, xylene)
-alkaline solutions of pH 12.5 or greater (sodium hydroxide)
-*heavy metal solutions and salts (mercury,silver, zinc)*
-cyanides (potassium cyanide)

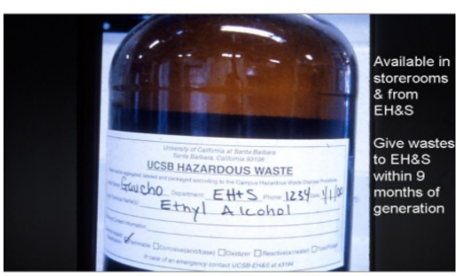
DISPOSAL

- Chemicals may not be disposed in regular trash, sink disposal, or allowed to evaporate.
- Complete a *UCSB Waste Pick-up Request Form*. Send by campus mail or fax(X8659). Also available on EH&S website for electronic submission:

http://www.ehs.ucsb.edu/units/hw/hw.html

- *EH&S cannot accept responsibility for improperly labeled, packaged, and/or segregated chemicals, and will not pick them up.*
- *Transferring waste into appropriate containers is the generators responsibility.*
- *Waste containers become the property of EH&S and will not be returned*

For more information see: http://www.ehs.ucsb.edu/units/hw/hw.html



UCSB Hazardous Waste Label

Disposal of Sharps

Sharps are defined as any object having acute corners, edges or protuberances capable of cutting or piercing, e.g. **needles, razor blades, glass, etc.** These items **can NOT be disposed of in the normal lab trash**. Every year custodians are injured by sharps in trash cans.

1. Lab Glassware Not Contaminated by Hazardous Materials (e.g. Pasteur pipettes)
Place glass into a labeled *"Sharps Only"* trash box or other sturdy container. Cardboard boxes specifically made and labeled for this purpose are available from scientific supply companies, or in campus storerooms. When full, dispose into the dumpster for your building - custodial staff will **not** empty.

Glass disposal box – available in lab storerooms

2. Needles, Syringes, Scalpels Not Contaminated by Hazardous Materials
These are particularly dangerous and require precautions beyond those of glassware:
•Label a **rigid puncture-proof container** with the words "*Sharps Waste*" (example pictured, note cardboard is not acceptable)
•Place all sharps into sharps container as they are generated
•When full, tape container closed or tightly lid containers prior to disposal
•Place sealed sharps containers directly into bldg. dumpster, or into the glass container noted above

Puncture-proof container for disposal of razor blades and syringes. Available in lab storerooms.

3. Sharps Contaminated by Hazardous Materials
If sharps are *un*contaminated use the procedures above. For contaminated sharps do this:
•**Sharps contaminated with chemicals** - A sharps container as described above should be labeled as *"Sharps contaminated with (chemical name)".* Give to EH&S for disposal with other chemical wastes.
•**Sharps contaminated with radioactive materials-** A sharps container as described above should be properly labeled as "*Sharps contaminated with (isotope name)".* Dispose via EH&S.
•**Sharps contaminated with biohazardous (infectious) materials-** must be placed in approved red plastic sharps container (picture above, available in storerooms). The sealed containers must be autoclaved before disposal and within 7 days of becoming filled. Place autoclaved container in an opaque bag and place into dumpster, or glass disposal container noted above.