

SAFETY RULES FOR RESEARCH LABORATORIES

Important Phone Numbers:

Duncan Hall Service Center:	Steven Cappelloni	4-4921
Science Service Center:	Jamie Lunkley	4-4990
College of Science Safety:	John Hawk	4-4875
	Randy Kirchner	4-5004
	University Police	4-2222

1a. Emergency Procedures

Emergency phone numbers are posted by the phone and at the top of this document.

Anyone who comes upon an emergency situation should call the University Police (911 from campus phones or 408-924-2222 from cell phones) if time is critical. Blue light and elevator phones call directly to the police. In any situation involving fire, chemical spill or personal injury, and a faculty or staff member is not available, call 4-4921 or 4-5000 in Duncan Hall or 4-4990 in Science for assistance. After 5:00 pm or on weekends call 911.

1. Building Evacuation

If you hear the emergency alarm, or are told to evacuate by Emergency Coordinators or Monitors, walk quickly to the nearest stairway and exit the building. Take your personal belongings with you as you may not be allowed to return immediately. Do not use the elevators. Handicapped persons should be safely positioned on the stairwell landings outside the hall fire doors, from where assigned emergency people will move them to safety. Evacutrac evacuation devices are located on the 4th and 6th floor of every stairwell in Duncan Hall and on the 3rd floor of every stairwell in science.

Follow the instructions of the Emergency Coordinators. Be quiet so you can hear them. Once outside, move immediately towards the grassy area on the San Carlos Street Mall or- to the other side of San Salvador Street if you exited from Duncan Hall. If you evacuated from the Science Building, move to the grassy area near Tower Hall or across Fourth Street. Do not return to the building unless the Police or Emergency Coordinators announce that it is permissible.

2. Earthquake

Find cover even in a light earthquake. If doorways, desks, or lab benches are unavailable, face up against the inner hall walls and protect your head. Remain inside the building pending instructions from University Police or Emergency Coordinators.

3. Fire

Call a faculty or staff member immediately if nearby and/or call 911. Trained personnel may attempt to control the fire using a fire extinguisher. If the fire cannot be controlled, close all doors and confine the fire.

Stay calm. Do not open doors hot to the touch. Avoid breathing heated air. Use a towel or clothing to protect your lungs. Remember the air is clearer near the floor.

If you become trapped, place clothing or other marker outside window, stay near the floor, and shout at regular intervals. Stairwells are the most fire resistant areas.

4. Chemical Spills

Non-hazardous spills can be cleaned up with paper towels and water but see your advisor for clarification. For spills of hazardous materials notify a faculty or staff member immediately if nearby. He/she will assess the seriousness of the situation and act accordingly. Do NOT attempt to clean up the spill on your own, unless you have been trained to do so. First aid should be started at

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once on anyone who has been contaminated by the spill, taking care that the first aid treatments given are appropriate to the material spilled and that spreading of the contamination does not occur.

5. Injuries

In the event of a serious injury or life threatening situation, call 911 immediately. Then try to obtain help and to provide first aid. All injuries must be reported to your advisor. You must complete an accident report. For the treatment of injuries go to the Student Health Center.

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1b. Personal Protective Equipment (PPE)

Hazards in a research laboratory are many and diverse. It is the responsibility of any person working in a research laboratory to be aware of all of the significant hazards in the laboratory and to protect him/herself accordingly. Minimum Personal Protective Equipment required in research laboratories typically consists of eye protection and suitable clothing and footwear. Additional protective equipment may be necessary depending upon laboratory activities.

1. Eye Protection

OSHA approved eye equipment (at a minimum meeting standard ANSI Z87.1) suitable for the hazards present must be used. Hazards might include explosion hazards requiring impact resistant safety glasses, and/or splash hazards requiring splash resistant safety goggles, and/or ultraviolet radiation hazards requiring UV-blocking safety glasses. It is often the case that multiple hazards exist, in which case safety glasses that protect from all of the hazards present must be used. It is also possible that severe hazards are present requiring that full face shields be used in addition to safety glasses. The standards for eye protection by hazard category are available in document ANSI Z87.1-2010. Regular glasses cannot be substituted for approved eye equipment. It is very strongly advised that you do not wear contact lenses in the lab. Contact lenses can react with or absorb laboratory chemicals resulting in significantly greater eye damage. If an irritant should get in your eye, wash the eye for 15-20 minutes at the eye wash fountain; then see a physician. Permanent eye damage can occur in less than 15 seconds from a chemical in the eye.

2. Clothing

Clothing should be appropriate to the laboratory. There should be minimum skin exposure. Shorts, sandals, swim suits, tank tops, etc. leave large amounts of skin unprotected and thus are inappropriate in a laboratory. Shoes should cover the full foot. Loose, long clothing and long hair should be confined. Do not wear rings or bracelets to the laboratory (These are a potential hazard that could result in a destroyed ring or damaged finger). Laboratory aprons or lab coats protect clothing and provide an additional barrier to hazardous materials.

3. Gloves

Gloves provide an additional layer of protection for the hands; however gloves are not completely impermeable and can significantly reduce manual dexterity. If you use gloves make sure they are appropriate to the task at hand. Remove contaminated gloves promptly. Remove gloves before touching surfaces that other people might contact with bare hands (keyboards, doorknobs etc.).

4. Additional PPE

Additional PPE may include gloves, facemasks, blast shields etc. You must be familiar with the hazards associated with specific laboratory activities and any safety precautions or equipment required before you begin the activity.

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1c. Chemical Storage, Labeling and Inventory

1. Labeling

Chemicals should be, at a minimum, labeled with the chemical name, date, and hazard classification if known (flammable, toxic, reactive, corrosive etc.).

2. Storage

Chemicals should be stored where possible in their original containers. Cabinets should be suitably ventilated, and provided with seismic restraints for both the cabinet itself (i.e. it is anchored to the building), and for the contents (i.e. a lip on the shelf).

Secondary Containment

Liquids must be provided with secondary containment. Containment should be sufficient to hold 110% of the container volume for a single container. For multiple containers secondary containment must hold 150% of the volume of the largest container or 10% of the aggregate volume, whichever is greater.

Segregation

Chemicals should be separated by compatibility using DOT classifications. The nine DOT categories are listed below. More details are provided in the appendix.

1. Explosives
2. Compressed Gases
3. Flammables
4. Flammable Solids (includes pyrophoric materials)
5. Oxidizers
6. Toxic and infectious substances
7. Radioactive materials
8. Corrosives
9. Other hazardous materials

This classification should be taken as a guide only and specific information about the chemicals involved should be taken into account.

Flammables should be stored in a suitable cabinet. At a minimum, other incompatible materials cannot share secondary containment. Ideally, incompatible materials will be stored in separate locations.

Chemical Refrigerators

Laboratory refrigerators should be clearly labelled as to suitability for storage of flammables, etc. Substances stored in refrigerators should be segregated as above and provided with secondary containment.

4. Compressed Gases

1. Secure all compressed gas tanks in upright position with restraints at 1/3 and 2/3 the height of the tank.
2. Use only the appropriate regulators. Never substitute.
3. When using compressed gas tanks, never open the main valve more than one-half turn.
4. Shut off tanks when not in use.
5. Transport and store tanks properly. Use hand trucks for transportation. Mark empty tanks with "MT."

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3. Inventory

Each laboratory space must maintain a chemical inventory that is updated at least once a year. Updated inventory must be submitted to John Hawk. An NFPA fire diamond consistent with the inventory must be posted at the entrance to the laboratory.

4. Material Safety Data Sheets

Each laboratory space must keep on hand material safety data sheets for substances in the laboratory. Alternately, electronic copies of material safety data sheets must be accessible.

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1d. Hazardous Waste

1. Segregation

Utmost care must be taken to avoid combining incompatible waste materials in the same container. This is especially true when more than one person is using the same hazardous waste containers. Incompatibility will depend on the substances involved and may vary from laboratory to laboratory, but a starting point is separation into the following six categories:

	Aqueous waste
Acid compatible	Organic Waste
	Acutely Hazardous waste
Base compatible	Aqueous waste
	Organic Waste
	Acutely Hazardous waste

Note that Biohazardous waste is a category subject to separate regulation discussed below. Material Safety Data Sheets should be carefully consulted to ensure correct disposal of any particular chemical.

2. Secondary Containment

Secondary containment is required for the storage of all regulated hazardous materials. Secondary containment for a single container will be 110 percent of the primary container. Secondary containment for multiple containers will be 150 percent of the largest container's volume or 10 percent of the aggregate volumes of all containers, whichever is greater.

3. Labeling

Hazardous waste must be accumulated in labelled containers segregated by compatibility. Hazardous waste labels must indicate the date accumulation started, the contents of the container and the responsible party. Standard hazardous waste labels are available on the chemistry department website.

4. Accumulation

Containers must be closed to the atmosphere, unless hazardous material is currently being added to the container.

5. DO NOT OVERFILL WASTE CONTAINERS

6. Pickup

When waste containers are full, call Randy Kirchner (924-5004) to schedule pickup.

7. Required Pickup

Waste containers must be scheduled for pickup at a maximum of 270 days after the start of

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accumulation.

8. Broken Glass

Place broken glass in the appropriate container.

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1e. Biohazardous Waste

Note that biohazardous waste is subject to separate regulation. The following items relating to biohazardous waste are taken from the Santa Clara County Website (www.sccwaste.org).

1. Biohazardous Waste Segregation:

SHARPS include devices that have acute rigid corners, edges, or protuberances capable of cutting or piercing, including, but not limited to hypodermic needles, needles with syringes, lancets, blades, acupuncture needles, blood vial contaminated with biohazardous waste, root canal files, and broken glass items.

BIOHAZARDOUS include laboratory waste, human or animal specimen cultures; stocks of infectious agents, wastes from production of bacteria, viruses, spores, discarded animal vaccines, and devices used to transfer, inoculate, and mix cultures; human or animal surgical specimens or tissue, and fluids suspected to be infected with agents known to be contagious to humans; waste containing recognizable fluid blood, fluid blood products.

PATHOLOGY is Biohazardous waste including surgical specimens or tissue that have been fixed in formaldehyde or other fixatives; recognizable human body parts.

CHEMOTHERAPY includes vials, IV tubing, gowns and gloves contaminated with chemotherapy agents.

PHARMACEUTICAL -Outdated or loose, unused pharmaceuticals classified by Chapter 11, Title 22, California Code of Regulations (22 CCR).

2. Biohazardous Waste Containment

Approved containers w/ labels shall be rigid, leak resistant with tight fitting lids and separated from all other waste. Biohazardous waste shall be placed in red biohazard bags labeled "Biohazardous Waste" and placed in containers with appropriate labels. Warning signs shall be posted in areas designated to store medical waste containers and shall display the following warning:

"CAUTION—BIOHAZARDOUS WASTE STORAGE AREA— UNAUTHORIZED PERSONS KEEP OUT," and in Spanish, "CUIDADO— ZONA DE RESIDUOS—BIOLOGICOS PELIGROSOS—PROHIBIDA LA ENTRADA A PERSONAS NO AUTORIZADAS."

Storage area & containers shall be secured against unauthorized entry and be clean of debris.

The area must also be easily accessible for waste removal.

Storage time for biohazardous waste is 90 days at 0°C or 30 days if less than 20/ lbs per month is generated or 7 days if 20 lbs/month or more is generated.

Sharps waste may be stored for 90 days at 0°C or for 30 days when 3/4 full and sealed.

Chemotherapy waste may be stored for 7 days or for 90 days if stored at 0°C.

Pathology waste may be stored for 7 days or 90 days if stored at 0°C.

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Pharmaceutical waste may be stored for 90 days when container is full, or one year if less than 10 lbs per year is generated.

Note especially that biohazardous waste must be collected more frequently than other types of hazardous waste.

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1f. Housekeeping

1. Benches and Work areas

Work areas should be kept clean and free from obstructions. Cleanup should follow the completion of any operation or at the end of each day. Unlabeled containers and chemical wastes should be disposed of promptly.

2. Fume hoods

Fume hoods should not be used for storage. When in use the sash should be kept below the marked level, except for the introduction or removal of large objects. When not in use, fume hood sashes should be kept closed.

3. Accessibility

Access to exits, emergency equipment, controls and such should never be blocked. Backpacks and personal items should not be left where they will interfere with movement through the lab.

4. Spills

Spilled chemicals should be cleaned up immediately and disposed of properly. Spill control chemicals should be used as appropriate for major spills.

Only small amounts of research materials should be stored in lockers and drawers. Such materials should be clearly labelled with the chemical name (not formula or structure) of the contents, your name and the date. Especially do not store concentrated acids, bases, flammable substances or oxidizers in locations other than approved storage cabinets.

5. Mechanical and Electrical

Moving parts (e.g. belt drives on vacuum pumps) should be guarded as appropriate.

The electric panel(s) to the lab must be readily accessible and not obstructed. Plugs cords and outlets should be in good condition. Power strips and extension cables should not be daisy chained and should be secured to prevent tripping hazards. Power cords should not be run through inaccessible spaces (under carpets or through ceilings).

6. Plumbing

Air gaps must be maintained between faucets and sinks or other vessels to prevent backflow in the case of a loss of water pressure. 'P'-traps must be kept free of debris.

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1g. Laboratory Activity

1. Laboratory Access

Access to any of the research or teaching laboratories in the chemistry department requires permission from the person responsible for the laboratory. Written permission is required if the responsible party is not present. A key request, signed by the person responsible for the lab and issued through the chemistry department, is considered written permission. Personal protective equipment appropriate to the hazards present must be worn in the laboratory.

2. Hours

Because of the many and diverse hazards that may be present in a research laboratory, working alone can be dangerous. **It is the responsibility of any person working in a research laboratory to be aware of all of the significant hazards in the laboratory.** When significant hazards are present, researchers must ensure they have a companion with appropriate training regarding laboratory hazards, safety procedures and emergency procedures available to provide assistance in the case of an emergency.

3. Horseplay

HORSEPLAY, PRANKS AND OTHER ACTS OF MISCHIEF ARE ESPECIALLY DANGEROUS AND ABSOLUTELY PROHIBITED!

4. Experiments

ALL EXPERIMENTS MUST BE APPROVED BY THE PRINCIPAL INVESTIGATOR. Prior to the beginning of an experiment or laboratory operation, care should be taken to consider the chemicals and operations involved, hazards resulting from these chemicals and operations and steps required to mitigate these hazards. These should be noted in a laboratory notebook or a written work plan. Under certain circumstances additional training may be required. If you have any questions regarding any aspect of an experiment do not hesitate to contact your research advisor before proceeding. Some specific hazards and means of mitigation are listed below. This list should not be taken as comprehensive.

Specific Hazards

1. INGESTION HAZARDS

1. No pipetting by mouth! Use a pipet bulb.
2. No eating, drinking, or use of cosmetics in the laboratory.
3. Never use chemical equipment as containers for food or drink.
4. Never use food or drink containers to store chemicals.
5. Smoking in the laboratory is prohibited.
6. Never taste, or deliberately inhale any chemicals.

2. CONTACT HAZARDS

1. Use appropriate personal protective equipment (at a minimum, eye protection, closed shoes, minimum exposed skin).
2. Learn the location of the eyewash fountain and the safety shower. Learn how to use them. In case of serious accidents, where more than one student's eyes are exposed to chemicals, using a sink filled with water or running water to rinse eyes might be necessary.
3. If chemicals are spilled on the skin immediately wash with copious amounts of water for 15 minutes.

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4. Do not wear rings or bracelets to the laboratory (these are a potential hazard that could result in a destroyed ring or damaged finger).

3. INHALATION HAZARDS

1. Experiments which generate fumes, vapors or dusts shall be performed in the hoods.
2. Do not inhale fumes.
3. So that hoods draw properly, laboratory windows and doors should be kept closed.

4. FLAMMABLE HAZARDS

1. Learn the location of the fire extinguisher and fire blanket. Learn how to use them.
2. Learn what substances are flammable. Never use an open flame to heat a flammable liquid.
3. When volatile flammable materials may be present, use only non-sparking electrical equipment.
4. Confine long hair and loose clothing.

5. GLASSWARE

1. Use only boro-silicate (Pyrex, Kimax, etc.) containers for heating solutions.
2. Do not force glass tubing or thermometers into rubber stoppers. Lubricate fire-polished tubing and protect hands with a towel when inserting tubing/thermometers.
3. Vacuum-jacketed glass apparatus should be handled with extreme care to prevent implosions. If possible vacuum-jacketed glass apparatus should be taped or otherwise contained to minimize flying glass in case of implosion.
4. Hand protection should be used when picking up broken glass.
5. Broken glass should be disposed of in appropriate containers.

6. COLD TRAPS AND CRYOGENIC HAZARDS

1. Use appropriate gloves and eye protection with all cryogenic liquids; use gloves with dry ice.

7. GENERAL SAFETY

1. Work with materials only after you have learned about their flammability, reactivity, corrosiveness and toxicity. Colored diamond shaped labels on the reagent bottles can provide some of this information. For additional information you can request Material Safety Data Sheets which are available in the laboratory and online.
2. Although pregnancy is a personal issue, for your health and the health of your child, please inform your advisor if you are pregnant. Consult with your physician! We want to make sure you and your physician are aware of the chemicals that will be used in the lab so that you are able to make an informed decision about continuing with laboratory work.
3. Know the types of protective equipment available and proper type for each job.
4. Know the location of, and how to use, safety equipment such as fire blankets, eye washes, and safety showers.
5. Know the safety rules and procedures that apply to the work to be done.
6. Be alert to unsafe conditions and actions and call attention to these so the corrections can be made as soon as possible.
7. Be certain that all chemicals are correctly and clearly labeled. Post warning signs when unusual hazards exist.
8. Use equipment only for its designated purpose.
9. Heat solutions in test tubes so that there is no hazard to self or neighbors.
10. Construct and clamp reaction apparatus thoughtfully in order to permit manipulation without the need to move the apparatus until the entire reaction is completed.

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11. Use a plastic safety bucket when transporting liquid chemicals, reactive solids, and large amounts of glass equipment within or between buildings

8. OTHER HAZARDS

1. Additional Hazards may be present in your laboratory; ask your research advisor.

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2. Other Hazards

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3. Inspection

1. General Inspection

Laboratories must be inspected monthly and a record of inspections kept for 3 years. Inspection is the responsibility of the person in charge of the laboratory, but may be delegated as long as the inspection is completed.

2. Fire extinguishers

Fire Extinguishers must be easily accessible. They must be inspected monthly and serviced annually. Contact John Hawk (4-4875) to schedule fire extinguisher servicing.

3. Safety showers

Safety showers and eyewash stations should be inspected and operated monthly.

4. Fume hoods

Fume hoods should be inspected for proper air flow and operation annually.

5. Semesterly audit

Laboratory safety will be audited each semester by a member of the department safety committee, in conjunction with members from the college of science safety and the university Environmental Health and Safety.