

# BIOLOGICAL SCIENCES DEPARTMENT SAFETY RULES FOR RESEARCH LABORATORIES

## IMPORTANT PHONE NUMBERS

Microbiology Service Center:	Veronica Zavala	4-4926
College of Science Safety:	John Hawk	4-4875
	Randy Kirchner	4-5004
College of Science Facilities Manager:	Stan Vaughn	4-4808
University Police:		4-2222

## I. 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 situations involving fire, chemical spill or personal injury, when a faculty or staff member is not available, call 911 for assistance. Afterwards please call 4-4900 in Duncan Hall to report the incident. 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. Evacuation devices are located on the 4th and 6th floor of every stairwell in Duncan Hall.

Follow Emergency Coordinator instructions. 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 exit from the south side of Duncan Hall. 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, line 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. Please use the back of your hand to test whether doors or door handles are radiating heat. Do not open doors hot to the touch. Avoid breathing heated air, smoke and gases. Use a moistened towel or piece of clothing to breathe through 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 in the building.

#### 4. Chemical Spills

Non-hazardous spills can be cleaned up with paper towels and water but see your research 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. First aid should be started at 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. Report spills to John Hawk for record keeping.

#### 5. Injuries

In the event of a serious injury or life threatening situation, call 911 immediately, and 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. Report any injuries to the Department Chair.

## II. Personal Protective Equipment (PPE)

**Minimum Personal Protective Equipment should be available in all research laboratories and consists of eye protection, lab coats, and gloves. When working in the lab, suitable clothing and footwear should be worn at all times. 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) shall be worn when working with significant volumes of hazardous chemicals such as acids and bases. Though no eye protection can prevent all injuries you should note that goggles that seal against the face generally provide better protection against chemical splashes than safety glasses. 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 for some reason you need to wear contact lenses please let the instructor know. In case of an emergency the instructor might need to remove these from your eyes. 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 when working with hazardous materials. 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. Laboratory aprons or lab coats protect clothing and provide an additional barrier to hazardous materials. Confine long hair.

### 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 and dispose of in proper waste container, not in the trash can. Remove gloves before touching surfaces that other people might contact with bare hands (keyboards, doorknobs etc.).

#### 4. Additional PPE

Additional PPE may include facemasks, face 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.

### III. Chemical Storage, Labeling, Inventory and Disposal

#### 1. Labeling

Chemicals should be, at a minimum, labeled with the full chemical name (no acronyms, formulas or structures by themselves are acceptable), 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**

Hazardous liquids must be provided with secondary containment adequate to the type of liquid. Containment should be sufficient to hold 110% of the largest container in secondary containment.

##### **Segregation**

Chemicals should be separated by organics and inorganics; also by solids and liquids. Chemicals should also be separated by compatibility using DOT classifications. The nine DOT categories are listed below.

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 labeled as to suitability for storage of flammables (i.e. explosion proof). Substances stored in refrigerators should be segregated as above and provided with secondary containment.

**3. 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."

**4. 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. [The NFPA diamond can only be allowed if it is kept up to date (probably yearly at the maximum, maybe every Semester) – otherwise the County Inspectors will have a fit about this]

**5. 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.

**6. Disposal of Empty Chemical Containers**

It is important to dispose of empty chemical containers properly, to avoid concerns by anyone encountering the container as to whether there are still any hazards present. Discard any residual chemical into the proper chemical waste container. Triple rinse the bottle and allow to air dry. Remove or deface the label. Once clean dispose the bottle (plastic to general waste bin, glass into the glass discard).

**IVa. 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:

Acid Compatible	Aqueous Waste 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.

Hazardous waste cannot be stored in the same secondary containment as pure chemicals.

Material Safety Data Sheets should be carefully consulted to ensure correct disposal

of any particular chemical. If there is any doubt as to how a particular waste should be disposed, call Randy Kirchner (924-5004).

**2. Secondary Containment**

Secondary containment is required for the storage of all regulated hazardous materials. Secondary containment will be 110 percent of the single largest container in secondary containment.

**3. Labeling**

Hazardous waste must be accumulated in fully labeled containers segregated by compatibility. Hazardous waste labels must indicate the date accumulation started, the contents and percentages of the container and the responsible party.

**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 accumulation. It is preferred that waste bottles (regardless of whether they are full or not) be picked up no later than 210 days (7 months) from the accumulation start date.

**8. Broken Glass**

Place broken glass in the appropriate container. If biohazardous, broken glass should be disposed of in a sharps container. Otherwise, a standard broken glass discard box (cardboard) will suffice.

**IVb. 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](http://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, blood vial contaminated with biohazardous waste, and broken glass items.

BIOHAZARDOUS includes 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.

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 with 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".

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.

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.

## V. 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 chemical waste containers 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.

Cleanup of hazardous spills must be done only by trained personnel.

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 labeled with the chemical name (not formula or structure) of the contents, your name and the date. 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.

# VI. Laboratory Activities

## 1. Emergency Contact Information

All students in research labs must fill out a student emergency contact form with information that includes next of kin contact and known allergies. These documents are kept on file in the Department of Biological Sciences and kept with the student's advisor.

## 2. Laboratory Access

Access to any of the research or teaching laboratories in the biology department requires permission from the person responsible for the laboratory. Minimum personal protective equipment must be worn in the laboratory.

## 3. Hours

Permission is required for work outside regular work hours. Working alone is extremely dangerous. At an absolute minimum, make sure someone is aware of your presence in the laboratory. Very careful consideration of hazards is necessary before undertaking laboratory operations without another person in the laboratory.

## 4. Horseplay

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

## 5. 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. 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 or other pipetting device.
2. No eating, drinking, or use of cosmetics in the laboratory (except when allowed in designated areas).
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.

## **3. INHALATION HAZARDS**

1. Experiments which generate fumes, vapors or dusts shall be performed in fume hoods-not laminar flow 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.
4. When volatile flammable materials may be present, use only non-sparking electrical equipment.
5. Confine long hair and loose clothing.

## **5. GLASSWARE**

1. Use only boro-silicate (Pyrex, Kimax, etc.) containers for heating solutions.
2. Never heat a closed system such as a sealed test tube or closed bottle.
3. Do not force glass tubing or thermometers into rubber stoppers. Lubricate fire-polished tubing and protect hands with a towel when inserting tubing/thermometers.
4. A 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.
5. Hand protection should be used when picking up broken glass.
6. 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. USE OF DEPARTMENT INSTRUMENTATION AND TRAINING**

1. All individuals will be appropriately trained to use any instrument or device. This training can be done by either their lab's faculty advisor or an appropriate technical staff member.
2. Individuals intending to use department equipment will sign in on the sign-up sheet (when appropriate) in order to identify and contact the person should any problem arise during instrument use.

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

**9. OTHER HAZARDS**

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

**VII. Inspections****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. Semester Audit**

Each laboratory will be audited on a semester basis 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.

## VIII. Field Activities

### 1. Vehicle Safety

1. All drivers using University owned or rented vehicles for field trips must be SJSU employees or registered volunteers with a valid driver's license, must observe all traffic safety laws, and pass the CSU Defensive Driving Training Exam.
2. Students need to be aware of their surroundings at all times; especially when boarding or exiting vehicles and walking along any type of road exposed to traffic.
3. Students are encouraged to use University transportation when available; however, the University is not liable for accidents that occur when students provide their own transportation to meet at a pre-determined field trip site.

### 2. Precautions

1. Students should dress appropriately for field trips and anticipate inclement weather conditions. Students should be trained to recognize sunstroke and hypothermia symptoms as well as basic weather patterns to determine if weather would create hazardous conditions.
2. A basic first aid kit should be carried by a lead person when conducting field research in a group. Individuals working in the field should bring their own first aid kit. All individuals are responsible for personal items including sunscreen, insect repellent, and prescription medications.
3. All individuals are encouraged to bring water and food as appropriate for the length of the field trip.
4. All individuals should familiarize themselves to emergency services locations (clinics, hospitals, park ranger station, etc.) prior to trips.
5. Students should inform their advisers of any individual medical conditions prior to going into the field such as allergies to insect stings, diabetes, asthma, and/or physical disabilities.
6. Any student who is uncertain about the types of potential hazards or physical requirements that may exist should consult their advisor. Any student who feels that a particular activity exceeds his/her physical capabilities should alert their advisor prior to leaving for the field.

### 3. Field Safety

1. A "buddy system" should be used when in the field. This ensures that each individual has a partner who knows his or her whereabouts at all times. Do not wander off alone.
2. Potential environmental hazards may include, but are not limited to:
  - a. **Stings from venomous insects (bees/wasps).** Medication for immediate relief from stings may be carried in the first aid kit, but students who know they react severely to such stings are advised to carry appropriate medications.
  - b. **Bites from venomous snakes.** Students need to know how to identify and avoid poisonous snakes in the field. When in doubt if a snake is poisonous, avoid it. In case of snake bite, return to the vehicle and seek prompt medical attention.
  - c. **Poisonous plants.** Students need to know how to identify common poisonous plants and should be instructed how to avoid them. This precaution includes poison

oak that can cause contact dermatitis, and plants that might be poisonous upon ingestion (some mushrooms and berries). Students should not to eat field-collected plants or fruit.

- d. **Ectoparasites (ticks).** Tick-borne Lyme disease poses a threat to individuals working in grassy, wooded areas. Students need to familiarize themselves with tick safety measures including tucking and taping pant legs, using repellents, and frequent tick body checks. Any ticks found on the body should be carefully removed. Consult your doctor promptly if your experience symptoms (fever, joint aches, swollen glands, reddish flushing of skin) following a tick bite.
- e. **Endoparasites (*Giardia*).** Never drink untreated water. Water obtained from sources in the field should be boiled, filtered, or chemically treated before consumption. Wash hands after handling soil, especially before eating.
- f. **Lightning.** If a thunderstorm threatens, seek shelter in a building or vehicle. Seek protected areas such as ravines or valleys, and avoid open areas and exposed and or elevated landscape areas such as hilltops. Never stand near or under isolated tall objects, such as trees or power poles, and avoid cover under rock overhangs or in other situations where an individual could become part of the shortest path of lighting to ground.
- g. **Uneven terrain.** Students may be exposed to areas of uneven terrain, and at risk to injury to due falls. Students must to exercise caution when hiking in steep terrain, and slippery areas such as moss-covered rocks and waterfalls.

#### 4. Aquatic Field Exercises

Special precautions will be taken for any field research around or in water and will be provided by the Principal Investigator based on individual project requirements.