BIOLOGICAL SCIENCES DEPARTMENT SAFETY RULES FOR RESEARCH LABORATORIES

IMPORTANT PHONE NUMBERS

Microbiology Service Center:	**Veronica Zavala**	**4-4926**
Biology Department		**4-4900**
College of Science Safety:	**Randy Kirchner**	**4-5004**
	Huong Nguyen	**4-4875**
	Mikey Walsh	**4-4875**
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. Persons requiring assistance to evacuate using the stairs 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 a small, incipient fire using a fire extinguisher. If the fire cannot be controlled or is large, 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 (College of Science Safety office 924-5004 or 924-4875) immediately. They 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 Randy Kirchner (4-5004) for assistance and 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 minor injuries, go to the Student Health Center. For major or life-threatening injuries, go to the nearest hospital. 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 protective eye equipment. If an irritant should get in your eye, wash the eye for 15-20 minutes at the eye wash fountain; then see a physician. Remove contacts while flushing, if worn. 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. Long pants or equivalent, shoes that cover the entire foot, and shirts that overlap with pants are required. Laboratory aprons or lab coats protect clothing and provide an additional barrier to hazardous materials. Confine long hair.

3. Gloves

Gloves provide a layer of protection for the hands. Gloves are not completely impermeable to chemicals and the permeability of a particular glove type varies based on the chemical. Make sure the gloves used 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 face shields, chemical aprons 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.). Peroxide-forming chemicals (e.g. diethyl ether, tetrahydrofuran, decalin) must be dated with the received and opened dates and used or disposed of within one year.

2. Storage

Chemicals should be stored in their original containers, whenever possible. 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 hazard type, as described in the Chemical Hygiene Plan. Briefly, segregate corrosive chemicals into the five corrosive chemical classes (organic acids, inorganic acids, oxidizing acids, inorganic bases, and organic bases), placing each class into separate secondary containment. Segregate flammables into flammable materials storage cabinets (if applicable) and away from oxidizers as well as other general storage chemicals. Do not store corrosives or poisons above eye level (roughly 5 ft). This classification system 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/Freezers

Laboratory refrigerators/freezers should be clearly labeled as not safe for food or drink storage to be used for human consumption. Refrigerators/freezers designed to be intrinsically safe for storage of flammables (i.e. suitable for storage of flammable materials, sometimes called “explosion-proof”) should be marked as such. Do not store flammable materials in standard, not intrinsically-safe refrigerators or freezers. 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.

4. Inventory

The College of Science Chemical Inventory Coordinator maintains a master chemical inventory of the hazardous materials in the College of Science. On an annual basis, the Chemical Inventory Coordinator will provide a Chemical Inventory List containing the hazardous chemicals for each specific laboratory room. The faculty or staff member for each specific laboratory room is responsible for checking this list to ensure accuracy.

5. Safety Data Sheets

Each laboratory space must have safety data sheets available for substances in the laboratory. Paper or electronic copies of safety data sheets must be accessible in the laboratory. Electronic copies of safety data sheets are available free from MSDS Online.

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. Remove or deface the label. Once empty dispose the bottle; plastic to general waste bin, glass into the glass discard. Empty containers of extremely toxic chemicals (i.e. EPA P-listed wastes, see pages 59-76; examples include cyanide salts, solid sodium azide, some pharmaceutical drugs such as warfarin and nicotine) must be disposed of as hazardous waste.

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 segregating the hazardous waste in the same way as for non-waste chemicals.

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.

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) or College of Science Safety personnel (924-4875).

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), or College of Science Safety Personnel (924-4875) 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 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).

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 contaminated with biohazardous materials.

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 (including but not limited to pipette tips and serological pipettes) 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.

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 on all four sides of the container and the lid. 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.

When biohazardous waste bags are full, they must be delivered to DH 637. When faculty, staff or students transport biohazardous waste from research labs to the Micro Service Center (DH 637), it must be in a secondary containment bin that is properly labeled with a tight-fitting lid. The Micro Service Center has large red biohazard garbage bins on rollers labeled “For Biohazard Transport”. One of these bins should be secured from the Micro Service Center, taken to the research space, filled with full bags of biohazard waste, and returned to the Micro Service Center where the full biohazard bags must be transferred to one of the red “Biohazardous Waste Bins” located inside DH 637 near the dishwasher.

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.

2. Fume hoods.

Fume hoods should not be used for storage. When in use, the sash should be kept below 18 inches and as low as possible while still allowing for safe work. Fume hoods should never be opened beyond 18 inches, except for the introduction or removal of large objects. When not in use, fume hood sashes should be kept closed to conserve energy.

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

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 (College of Science Safety office 924-5004 or 924-4875) immediately. They 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 Randy Kirchner (4-5004) for assistance and record keeping.

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 (i.e. plugged into a series of extension cords or power strips) and should be secured to prevent tripping hazards. Power cords should not be run though inaccessible spaces (under carpets, through ceilings, or walls). Extension

cords are only for temporary use and must be unplugged at the end of each day and when equipment is not in use.

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. Laboratory Access

Access to any of the research or teaching laboratories in the biology department requires permission from the person responsible for the laboratory. Various labs may require different personal protective equipment including lab coat, gloves, and eye protection. Always follow PI directions.

2. 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. Pyrophoric materials and hydrofluoric acid shall never be used while working alone.

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 the 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.
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 emergency eyewash 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, transport them to the next closest shower/eyewash.
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; never in laminar flow hoods or biosafety cabinets.
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. 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 or cut-proof gloves 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. Do not pick up broken glass with bare or gloved hands. Use tongs or a broom and dustpan.
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. Remember: cryogen gloves are designed to protect from incidental splash only! Never immerse cryogen gloves into a cryogenic liquid, as burns will occur from glove leaks.

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. This training will be documented.
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. Health and physical hazard pictograms on the reagent bottles can provide some of this information. For additional

information you can request 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 PI 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 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. Construct and clamp reaction apparatus thoughtfully in order to permit manipulation without the need to move the apparatus until the entire reaction is completed.
10. 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/Semester Audit

Laboratories must be inspected semesterly by the College of Science Safety office and a record of inspections kept for 3 years. Ensuring inspection occurs semesterly is the responsibility of the person in charge of the laboratory (PI), 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 Randy Kirchner (924-5004) 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.

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 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.