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1.0 Regulatory Authority

Title 8, California Code of Regulations (CCR), subsection 5191

2.0 Administering Agency

California Division of Occupational Safety and Health, Department of Industrial Relations (CAL/OSHA)

3.0 Policy

It is the policy of the California State University, Sacramento (Sacramento State), to provide its employees with a safe and healthful workplace. In order to achieve this goal, it is essential that all faculty and staff who use chemicals in a laboratory setting become familiar with this Chemical Hygiene Plan.

4.0 Purpose

This document has been designed to:

- Protect all Faculty, Staff, Students, Volunteers, and Visitors involved in the laboratory use of hazardous chemicals from exposure to chemicals.
- Comply with California Occupational Health and Safety Administration, Title 8, Section 5191, Occupational Exposure to Hazardous Chemicals in Laboratories.

5.0 Scope

This document applies to the laboratory use of hazardous chemicals by all personnel under the direct supervision of a CSU employee (i.e., Temporary Employees, Temporary Agency Employees, Voluntary Employees, Part-Time Employees, Full-Time Employees, Student Assistants, Federal Work Study Assistants, Graduate Assistants, etc.). All personnel shall comply with the provisions outlined in this document.

For the purpose of this document, the laboratory use of hazardous chemicals is defined as the use of hazardous chemicals in a facility in a manner in which all of the following conditions are met:

- (1) Chemical manipulations are carried out on a scale in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person;
- (2) Multiple chemical procedures or chemicals are used;
- (3) The procedures involved are not part of a production process, or in any way simulate a production process; and
- (4) "Protective laboratory practices and equipment" are available and in common use industry-wide to minimize the potential for employee exposure to hazardous chemicals.

The use of hazardous chemicals on campus which does not meet these conditions shall be managed in accordance with Title 8, Section 5194, the Hazard Communication Standard.

6.0 Responsibilities, Title 8 CCR § 5191 (e)(3)(G)

While the overall responsibility for University health and safety rests with the President, the immediate responsibility for laboratory health and safety belongs to each employee working with chemicals. All



employees are responsible for knowing how to handle the chemicals that they work with in a safe manner. If one is unsure of the hazard, or proper procedure, they should seek assistance prior to proceeding.

6.1 Executive Safety Committee

The Executive Safety Committee serves as the campus chemical hygiene committee. This committee should:

- Meets three times per academic semester.
- Develop and recommend policy to the President relating to the use of hazardous chemicals and other University Chemical Hygiene Plan requirements.
- Review the annual report of the Chemical Hygiene Officer relating to the effectiveness of the University Chemical Hygiene Plan.
- Review investigation reports of significant laboratory/chemical accidents reported to the ESC by College Level Safety Committees,
- causes of accidents, and steps taken to ensure that accidents/incidents do not recur.

6.2 Office of Environmental Health & Safety

- Provide pro-active support on issues of hazard identification and evaluation; procedures for correcting unsafe conditions, control measure determination and implementation; employee information; and training programs.
- Maintain centralized environmental monitoring records, allowing employee access as required by law.
- Maintain the EH&S Learning Management System and provide employee training status reports.
- Serve as the principal point of contact with regulatory agencies on matters of chemical hygiene at the University.
- Arrange for general safety inspections and safety equipment testing as required under the University Chemical Hygiene Plan to include, but not be limited to: eye washes, showers, ventilation, and fume hoods.

6.3 Chemical Hygiene Officer (CHO)

- Advises and assists administrators and other employees in implementation of chemical hygiene policies and practices.
- Facilitates the University Employee Medical Monitoring Program.
- Maintains currency on legal requirements concerning hazardous materials and advises the Campus Executive Safety Committee and organizational units of changes in regulatory requirements.
- Conducts audits of all laboratories to ensure compliance with the Chemical Hygiene Plan. Audits will be conducted with the Laboratory Supervisor present in an effort to interact directly with the responsible party.
- Provides safety training when requested.
- Investigates laboratory/chemical handling area accidents, incidents, spills/releases, or upset conditions; determines causes of accidents, and recommends corrective actions.



- Reviews and evaluates the effectiveness of the University Chemical Hygiene Plan, at least annually, and provide report and recommendations to the Executive Safety Committee.
- Works closely with designated Laboratory Supervisor (see 6.5) to facilitate the approval procedures as described in Section 12.

6.4 Deans, Directors, and Department Chairs

Deans, Directors, and Department Chairs are to work with their organizational units to ensure that affected employees are trained on the provisions of the University Chemical Hygiene Plan and are taking action to comply with its requirements. These individuals should:

- Identify all laboratories and chemical handling areas in their organizational unit.
- Assign Lab Supervisor (see 6.5) for each laboratory/chemical handling area.
- Assure that laboratory safety training matrices/tracks appropriately reflect employee training needs.

6.5 Laboratory Supervisor

Laboratory Supervisors are administrators/faculty/staff who supervise others in chemical use or handling. A principal investigator of a research project is considered to be the Laboratory Supervisor for that project. Laboratory Supervisors are to take measures that protect the health and safety of the workers under their supervision. They should:

- Ensure that action is taken to correct work practices and conditions that may result in the release of hazardous materials.
- Ensure that protective equipment is available, working and used as appropriate.
- Work with the Office of Environmental Health & Safety to identify employees who need to be included in the Medical Monitoring program.
- Provide and document that employees have been trained and understand the content of the Chemical Hygiene Plan at initial assignments and whenever a new hazard is introduced.
- Identify materials considered particularly hazardous and communicate warnings to workers as appropriate.
- In coordination with the Chemical Hygiene Officer, Laboratory Supervisors should conduct inspections, at least once per semester, of the laboratory/chemical handling areas which they supervise using the RSS Assessment tool.
- Maintain accurate chemical inventories using the RSS Inventory tool and ensure SDSs are available for all chemicals used or stored in the laboratory space under their purview. SDSs for many chemicals are available on-line through the SDSonline system, SDSs not available online must be acquired from the manufacturer and maintained in an accessible location.
- Review SDSs as needed to assure an understanding of the chemical hazards and protective measures of the chemicals in the laboratory.

6.6 Laboratory Workers

Laboratory workers are personnel, including but not limited to faculty, staff, and student researchers, engaged in the laboratory use of hazardous chemicals. These workers are required to:



- Understand and act in accordance with the Chemical Hygiene Plan and any laboratory-specific standard operating procedures.
- Participate in training programs.
- Practice good personal chemical hygiene.
- Report all accidents and incidents to the supervisor on a timely basis.
- Review SDSs as needed to ensure an understanding of the chemical hazards in the laboratory.

6.7 All Faculty, Staff, Students, Volunteers, and Visitors involved in laboratory use of hazardous chemicals

- All Faculty, Staff, Students, Volunteers, and Visitors involved in laboratory use of hazardous chemicals have the authority to temporarily stop their work, at any time, if the individual has a reasonable belief that there is a safety concern to the extent that performing the work may lead to injury or illness to themselves, a colleague, or any person on campus.
- Under no circumstances shall SWA be used without reasonable belief that there is a safety concern and without making a report to their management and EHS.
- Under no circumstances will any employee, supervisor or manager retaliate in any way, or initiate any disciplinary action against any employee for invoking SWA and making a safety report in good faith.

7.0 Standard Operating Procedures, Title 8 CCR § 5191 (e)(3)(A)

7.1 General Rules

- Laboratory specific procedures are to be stored in the Laboratory Safety Manual for each laboratory space.
- Know how to access SDSs for all hazardous chemicals in the laboratory.
- Be aware of the chemical hazards as determined from the SDS and other appropriate references.
- Wear appropriate personal protective equipment whenever working with chemicals.
- Understand appropriate procedures for emergencies, including evacuation routes, spill cleanup procedures and proper waste disposal.
- Know the location and proper use of emergency equipment (e.g., fire extinguishers, emergency eyewash and shower).
- Use proper personal hygiene practices including washing hands after handling chemicals and before leaving the laboratory. The use of gloves does not preclude the need to wash hands.
- If chemicals have been spilled in the eyes or on the body, flush in the eyewash/safety shower for at least fifteen minutes. Seek medical attention.
- When working with flammable chemicals, be certain there are no sources of ignition near enough to cause a fire or explosion in the event of a vapor release or liquid spill.
- Be alert to unsafe conditions and correct them or report them as soon as they are detected.
- Know how and where to properly store chemicals when not in use.
- Always consider using a less-hazardous chemical in the process.
- Do not bring food, beverages, tobacco, or apply cosmetics in chemical use or storage areas.
- Do not use glassware which is damaged and unsafe.



- Service animals and minors are permitted into laboratories. Prior to entry, safety precautions need to be addressed with the NSM Safety Manager and/or the Chemical Hygiene Officer, as well as the laboratory responsible party, prior to any service animals or minors entering the laboratory space.

7.2 Working Alone

- Working alone in certain circumstances, situations, or environments is unsafe and requires special arrangements to minimize potential hazards.
- Work of a clearly hazardous nature (e.g., tasks involving high energy, toxic, flammable, cryogenic, or high pressure materials) must not be conducted alone.
- Hazardous activities must be scheduled during hours when another worker capable of helping in an emergency is present (within earshot).

7.3 Unattended Operations

- When possible, do not leave hazardous chemical processes unattended.
- Post a notification including chemical process and emergency contact information on the door or near the process.
- Provide for proper ventilation. Conduct operations with hazardous or odiferous chemicals in fume hoods.

7.4 Personal Hygiene

- Wash promptly whenever a chemical has contacted the skin.
- Avoid the inhalation of chemical vapors.
- Do not use mouth suction to pipette anything; use mechanical pipettes.
- Wash well with soap and water prior to leaving the lab.

7.5 Protective Clothing (as required by ANSI and Cal/OSHA standards)

- The minimum safety attire while in a laboratory is closed toe and closed heel footwear, and long pants or other garment covering the entirety of the lower body with no skin exposed between the footwear and the garment.
- Eye protection is required to be worn in all areas when there is a risk of receiving eye injuries such as punctures, abrasions, contusions, or burns as a result of contact with flying particles, hazardous substances, projections or injurious light rays. Safety glasses must have side shields and meet the ANSI Z87.1 (1989) standard for impact resistance.
- Safety glasses shall be supplemented with goggles and/or face shields when there is a likelihood of splashed chemicals or flying particles (e.g., when pouring or mixing chemicals and handling cryogens).
- Lab coats or aprons should be worn when performing a chemical process or procedure which may result in contamination of the clothing with hazardous chemicals.
- Gloves must be available and resistant to the type of chemical being used. Nitrile gloves (6 – 8 mils) are acceptable for most laboratory work where the intended use is to prevent incidental contact with hazardous materials. Processes where there is direct chemical contact require the user to consult the SDS or compatibility guides provided by the glove manufacturer.



- Inspect gloves prior to use to ensure they are in good condition.
- Long hair and loose clothing must be confined.
- Carefully inspect all protective equipment before using. Do not use defective protective equipment.

7.6 Housekeeping

- Access to emergency equipment, showers, eyewashes, aisles and exits shall never be blocked by anything.
- Keep all work areas, especially laboratory benches, clean and free of clutter.
- Chemical containers must be labeled with the identity of the contents and the hazards of the material.
- All hazardous chemicals shall be closed and stored properly when not in use.
- Wastes shall be properly labeled and containers should be closed and kept in the appropriate storage location.
- Clean up spilled chemicals promptly and thoroughly. Contact with dried residue of some chemicals can cause irritation or burns to the skin.

7.7 Chemical Storage

- Properly segregate incompatible chemicals (Appendix D).
- Compatible chemicals may be stored together, in secondary containment.
- Corrosive, flammable and toxic liquids should be stored below eye level.
- Properly dispose of unneeded or outdated chemicals.
- Do not exceed the capacity of refrigerators or storage cabinets recommended by the manufacturer.
- Chemicals are not to be left out of their designated chemical storage area (i.e. chemical cabinets, flammable storage refrigerators/cabinets, behind locked doors in the room designated for the storage of chemicals) when not in active use.

7.8 Chemicals of Moderate, Chronic or Acute Toxicity

A chemical is considered toxic if it exerts harmful effects on a biological mechanism. The SDS will provide information on the toxicity of chemicals.

- When working with volatile liquids, gases, or dispersible powders the process may result in the chemical's becoming airborne. A chemical fume hood or other local exhaust ventilation must be used.
- Wear appropriate gloves and a lab coat.
- Always practice good personal hygiene.
- Ensure that two people are present when the work involves materials that are highly toxic or of unknown toxicity.

7.9 Flammable Liquids

- Flammable liquid cabinets must be used if greater than 10 gallons of flammable liquids are stored in the laboratory.
- Ensure flammable liquid storage cabinets are labeled.



- Chemicals with a flash point less than 140 °F should be stored in a flammable liquid storage cabinet or designated flammable storage location.
- Place flammable liquid storage cabinets away from sources of ignition.
- Store only compatible material inside the cabinet. Do not store paper or other combustible material in a flammable liquid storage cabinet.

7.10 Corrosive Liquids

- Personnel using corrosive liquids shall prevent contact with the eyes and skin by wearing safety glasses or goggles, chemical resistant gloves and a lab coat or apron.
- Fuming and concentrated acids shall be handled in a chemical fume hood.
- Do not pour water into acid. Slowly add the acid to the water and stir.
- Know the location of the nearest eyewash and safety shower before beginning a procedure.

7.11 Compressed Gas Cylinders

- Compressed gas cylinders must be securely fastened at all times using chains or straps to prevent them from creating a hazard by tipping, falling or rolling.
- No more than one cylinder may be secured per restraint.
- Cylinder valve protection must be replaced prior to moving the cylinder and when it is not connected to a regulator.
- Full and empty cylinders should be stored separately.
- Empty cylinders must be labeled as such.
- The movement of cylinders must be done using designated carts with straps or chains.
- Cylinders must not be stored on carts.

7.12 Reactive Chemicals

- Laboratory Supervisors must identify and evaluate the use of all reactive chemicals in the work area to determine the extent of the hazard and to evaluate the controls necessary to safeguard employee health.
- Laboratory Supervisors must ensure that laboratory workers understand the hazards of reactive chemicals and are aware of proper handling and storage procedures. This information is available on the SDS for the chemical.
- The labels of peroxide-forming chemicals shall be marked with the date of receipt.
- Peroxide-forming chemicals shall be disposed of, or tested, prior to the end of their shelf life (Appendix E).

7.13 Cryogenic Materials

- Cryogenic fluids shall be stored or handled only in containers designed for such use.
- When personal contact with a cryogenic fluid is possible, (as when preparing cold baths or dispensing liquid nitrogen), a full-face shield should be worn in addition to goggles.
- Wearing of watches, rings, or other items that may trap the cryogenic material should be avoided.
- When gloves are worn while handling cryogenic materials, they should be dry, impervious and loose enough to be easily tossed off the hands.



- Cryogenic materials shall be dispensed and used in areas with good ventilation.

8.0 Control Measures and Equipment, Title 8 CCR § 5191 (e)(3)(B)

Chemical safety is achieved by being continually aware of chemical hazards and by keeping chemicals under control using safe work practices, engineering safeguards (such as hoods), and other protective measures. All laboratory personnel should be alert to recognize the malfunction of engineering, and other safeguards, and shall report through their supervisor to the HEERA manager any unsafe conditions and/or accidents.

The organizational unit shall always design safety procedures into a potentially hazardous process. Only when engineering controls, such as fume hoods and glove boxes, are determined to be insufficient will personal protective equipment, administrative controls, and other corrective measures be considered to achieve permissible levels of exposure.

8.1 Exposure Control

- Control measures shall be established to ensure that no worker is exposed to airborne concentrations of hazardous materials equal to, or greater than, the permissible exposure limits (PEL), action limits, or ceiling limits established by Cal/OSHA.
- The Chemical Hygiene Officer shall perform qualitative or quantitative personal exposure monitoring, as necessary, to verify that employee exposures are less than published limits.
- Organizational units shall take the steps necessary to eliminate, or reduce to the lowest practical level, worker exposure to contaminants by inhalation, ingestion, absorption, etc.
- Workers, Laboratory Supervisors, or heads of organizational units, may request industrial hygiene monitoring of work areas from the Office of Environmental Health & Safety or the Chemical Hygiene Officer.
- Each laboratory is equipped with a hazardous materials spill kit to assist in containment and cleanup of simple hazardous material spills. Contact the Chemical Hygiene Officer in the event that a hazardous materials spill kit is utilized in a laboratory space.

8.2 Ventilation

Each laboratory or chemical storage area must be provided with ventilation of sufficient quality and quantity to provide comfort to the occupants and control ordinary odors generated by human activity. The general laboratory ventilation system is not designed to protect the worker from airborne chemical hazards. Any chemical process which generates hazardous or odiferous vapors, gasses, aerosols or particulates must be performed in a fume hood.

- Fume hood sashes should be closed except when necessary to adjust the apparatus inside the hood or to conduct a chemical procedure.
- Fume hoods must provide an average linear face velocity of 100 feet per minute with a minimum of 70 feet per minute at any one location. If the hood is unable to attain the required face velocity, the sash will be lowered until a satisfactory velocity is achieved. The hood shall be marked indicating the maximum sash height.
- The hood fan shall be kept in operation whenever a chemical is inside the hood, whether or not any work is being performed in the hood.



- Fume hoods should not be used as storage areas for chemicals, apparatus, or other materials. Excessive storage reduces the ability of the hood to contain airborne contaminants.
- The performance of all fume hoods shall be evaluated at least annually. Ensure the fume hood has an inspection tag indicating the maximum sash height. If the tag is not present, contact EH&S.

8.3 Emergency Eyewashes and Safety Showers

- Emergency eyewashes and safety showers are required in areas where splash hazards to corrosives, eye irritants or chemicals that are toxic via skin and/or eye contact exist. They must be in accessible locations that require no more than ten (10) seconds for the injured person to reach.
- Access to eyewash fountains and safety showers must not be restricted or blocked in any way.
- Eyewash fountains must be activated monthly by EH&S and the activity documented on the inspection tag.
- Safety showers must be activated monthly by EH&S, or a designated party by EH&S, and the activity documented on the inspection tag.

8.4 Hazard Identification

- Labels: Whenever possible, chemicals shall be stored in their original container with label integrity maintained. Re-containing chemicals is discouraged. If chemicals are to be re-contained, the label on the new container must include the complete chemical name and an indication of the hazards (see Appendix I).
- Small containers and vials with chemically compatible contents may be stored in a secondary container which is labeled with a description of the contents and the hazards.
- If the chemical is produced exclusively for the laboratory of origin, the Laboratory Supervisor will determine if it is a hazardous chemical in accordance with the Cal/OSHA Hazard Communication Standard, Title 8, §5194. If it is a hazardous chemical and its characteristics are not covered under the University General Operating Procedures, the Laboratory Supervisor will provide and document training on its proper handling and storage.
- If the chemical produced is transferred to a user outside this University, the Laboratory Supervisor will comply with the University Hazard Communication Program, including labeling and preparation of the SDS.
- Solutions of known hazardous chemicals produced in a laboratory/chemical handling area must be labeled with the name(s) and formula(s) of the chemical(s), in English, and dated. If the identity of the contents of a solution is unknown, then words describing the properties of the solution should be used.

8.5 Hazardous Materials Signage

- In each location that hazardous materials are stored or used, the laboratory supervisor will post emergency response information signage at laboratory entry.
- A template for the Hazardous Materials Signage can be obtained through EH&S.



9.0 Medical Consultation and Monitoring, Title 8 CCR § 5191 (e)(3)(F)

Certain employees are required to participate in the Medical Monitoring Program due to known exposures to chemical or physical agents. In addition, an opportunity to receive medical consultation at the employer's expense shall be provided to workers, at no cost to them, under the following circumstances:

- An employee develops any signs or symptoms thought to arise from chemical exposure.
- After a major chemical release, accident, or incident which may have resulted in an employee being exposed to a chemical.
- The supervisor, Laboratory Supervisor, or Chemical Hygiene Officer has determined that a chemical has exceeded the permissible exposure limit and the worker has been exposed.

Requests for medical consultation and/or monitoring should be made to the Office of Environmental Health & Safety. Medical monitoring records shall be maintained in accordance with the University Employee Medical Monitoring Program, allowing employee access as required by law.

10.0 Particularly Hazardous Substances, Title 8 § 5191 (e)(3)(H)

Cal/OSHA established a category of chemicals known as particularly hazardous substances for which additional precautions may be required. Particularly hazardous substances include select carcinogens, reproductive toxins, and substances with a high degree of acute toxicity. The carcinogenicity, or other toxicity, information is documented on the SDS.

Any work activity involving a particularly hazardous substance should be evaluated by an experienced Laboratory Supervisor in consultation with the Chemical Hygiene Officer to ensure that proper controls are in place and that appropriate, area-specific training may be given. Additionally, any work activity involving the use of a particularly hazardous substance should have a Standard Operating Procedure document created for use with that material. The following points will be addressed through use of the RSS Assessment software platform and in coordination with the EH&S Department to identify necessary control measures prior to working with any of these agents:

10.1 Laboratory Evaluation

- Establish the "Designated Area".
- Establish the need for employee exposure monitoring.
- Establish the need for medical surveillance.
- Establish the need for specialized training.
- Identify the controls and personal protective equipment needed.

10.2 Establishment of Designated Areas

- Designated areas shall be posted as such.
- Access to the designated area shall be restricted to trained personnel aware of the potential hazards associated with the materials and all necessary safety precautions.

10.3 Use of Containment Devices and Protective Equipment

- Wear appropriate PPE such as gloves, safety glasses, and lab coat.
- Read the SDS for the chemicals used: know special precautions to be taken.



- All work which may result in an airborne hazard shall be conducted in hoods or glove boxes which have been tested and approved by the office of EH&S.
- All PPE, including lab coats, shall be removed before leaving the designated area.

10.4 Decontamination Procedures

- Decontaminate the area when work is complete.
- Clean up spills promptly in a manner which does not create an airborne hazard.
- All materials shall be decontaminated before being moved from the designated area.
- Wash thoroughly prior to leaving the area, and after any procedure using chemicals in this classification.

11.0 Training, Title 8 § 5191 (e)(3)(D)

The goal of the training program is to ensure that all laboratory personnel are adequately informed about the work in the laboratory/chemical handling area, its risks, and what to do if an accident occurs. All laboratory personnel and laboratory supervisors should know the location and proper use of personal protective equipment and basic emergency response procedures. All Laboratory Workers and Supervisors must be trained in laboratory safety and the content of the Chemical Hygiene Plan prior to assignment, whenever a new hazard is introduced, and at least every three years.

11.1 Training Responsibilities

11.1.1 Environmental Health & Safety

EH&S shall provide and document training, including but not limited to, the following subject areas: (Training will be offered in classroom sessions or on-line Computer Based Training.)

- The content and requirements of the Cal/OSHA Laboratory Standard, TITLE 8 § 5191 (Appendix C).
- The content of the University Chemical Hygiene Plan.
- Occupational exposure limits established by Cal/OSHA (PELs, STELs, Ceiling Limits).
- Selection and limitations of Personal Protective Equipment.
- The use of Safety Data Sheets.
- Use of engineering controls.
- Disposal of hazardous waste.

11.1.2 Laboratory Supervisor

The Laboratory Supervisor for the laboratory shall provide and document training including, but not limited to, the following subject areas:

- The location of SDSs for chemicals used or stored in the lab.
- The hazards associated with the chemicals.
- The appropriate PPE for the hazards present in the laboratory.
- The location of emergency equipment including eyewash, safety showers, telephone, etc.
- Procedures for the operation of laboratory equipment which may be hazardous to operate or uses hazardous materials.



- Laboratory waste disposal procedures.
- Chemical storage locations.

12.0 Approval Procedures, Title 8 § 5191 (e)(3)(E)

A particular laboratory operation, or use of a particular chemical, requires prior approval from the Office of Environmental Health & Safety, as well as generation of a Standard Operating Procedure, whenever:

- A chemical listed in Appendix A or B is used in a manner which may result in a risk of employee exposure.
- Use of chemicals that are air or water reactive, or gasses that are highly flammable or asphyxiating.

The request for performing work of this nature shall be initiated by contacting the Chemical Hygiene Officer. The Office of Environmental Health & Safety shall review and renew approvals annually. A simple statement from the Laboratory Supervisor requesting such renewal and assuring that no changes affecting safety have been made in the procedure is sufficient. A copy of the renewal approval shall be forwarded to the Chemical Hygiene Officer for inclusion in the files.

12.1 Incidents Requiring Stoppage of Process

The process/procedure must be stopped and reviewed with the Chemical Hygiene Officer whenever any of the following occur:

- A worker requests medical attention as a result of injury or illness resulting from exposure to chemicals.
- A Laboratory Supervisor believes that there is a failure of any safeguard which may result in endangerment to persons in the area. Approval for restarting a chemical process is not required when safeguards are repaired or replaced and the Laboratory Supervisor judges that the safety of individuals is not compromised.
- The Laboratory Supervisor becomes aware of a new chemical or toxicological hazard for a chemical being used in the work area and this increased hazard may endanger workers if there are insufficient or inappropriate safeguards present in the work area.
- There is a major chemical spill (see Section 14).

13.0 Procurement and Gifts

The Laboratory Supervisor shall ensure that appropriate storage and/or controls are in place, in accordance with Section 12 of the Chemical Hygiene Plan, prior to the purchase, loan, or receipt of a gift of a chemical listed in Appendix A.

Transfer of chemicals listed in Appendix A between organizational units shall also require prior consideration of storage and controls.

13.1 Special Cases

- **Radioactive Chemicals and Radionuclides**
All radioactive chemicals and radionuclides subject to licensing requirements shall be procured, handled, stored, and disposed of in accordance with the University Radiation Safety Manual.



Copies of the University Radiation Safety Manual are available from the Office of Environmental Health & Safety upon request.

- **FDA Controlled Substances and Controlled Precursors**
All FDA controlled substances will be procured, handled, stored and disposed of in accordance with all federal, state, and local laws. Contact the Director of Public Safety for guidance on compliance with the applicable laws.
- **Explosives**
In the planning phase before starting any work involving explosives, the Chemical Hygiene Officer and the Executive Safety Committee will be informed. Work shall not proceed until written approval has been obtained from the Dean, Department Chair, Chemical Hygiene Officer, and the campus Chief of Police. It should be noted that the Federal Alcohol, Tobacco, and Firearms Agency; Department of Transportation; and state and local fire codes may regulate the use of some explosive materials. The Chemical Hygiene Officer will review the chemical inventory for potentially explosive materials and explicitly address the safe storage, handling, and use of these materials.

13.2 Procurement of Chemicals

- The purchase of all hazardous chemicals requires approval by Environmental Health and Safety and/or a trained department approver. Prior to approval, the chemical requester must demonstrate that the chemical can be used safely by completing a laboratory assessment in RSS.
- Chemical approval procedure is available on the EHS website, <https://www.csus.edu/campus-safety/environmental-health-safety/>, or by contacting EHS.

14.0 Prevention of Spills, Accidents, and Chemical Releases

14.1 Overview and Responsibilities

The majority of spills or releases can be prevented through careful planning, using good laboratory techniques, maintenance of good housekeeping and careful, deliberate action.

Potential Cause of Spill	Prevention Technique
Container, such as a flask or beaker, tips over	Secure containers and equipment to minimize the possible of tipping. Keep laboratory benches clear of non-essential items. Do not rush through procedures.
Container dropping	Keep containers and experimental equipment as low as possible. Use bottle carriers or carts to move chemicals.
Breaking a container or a piece of experimental apparatus	Assure apparatus is effectively secured. Provide pressure relief where necessary and vent into fume hood or other safe location. Use caution when removing or replacing chemical containers from shelving and cabinets.



A runaway reaction	Plan experimental reactions to anticipate and to provide controls for undesired outcomes such as overheating and excessive pressures.
Releases during transfer of materials from one container to another	Pay attention to what you are doing. Provide secondary containment or absorbent pads under work area.
Holes and other leaks in transfer equipment such as pipes, hose, or valves	Inspect for holes, cracking or other evidence of deterioration.
Placing material in an incompatible container or apparatus	Check for chemical compatibility with all vessels used to store or transport chemicals prior to use.
Breakage of thermometers or similar experimental equipment	Select equipment that has reduced potential for breakage, e.g., replace mercury thermometers and electronic temperature devices.

This section provides the information needed to respond to these events in laboratories and classrooms where chemicals are used or stored. **This section provides the information needed to respond to accidents and spills in University locations, including laboratories and classrooms where chemicals are used or stored.**

Faculty, and any other University employee, graduate student or designee who supervises students have the responsibility to respond to a situation involving students; employees who do not supervise students in a classroom or laboratory do not have responsibility to respond to injury or spill incidents involving students.

Faculty, and any other University employee, graduate student or designee, who supervises students where chemicals are used or stored, or is conducting research in a University laboratory have the following responsibilities:

1. Learn and understand the information in this section, 14.0
2. Using the chemical inventory, know exactly which chemicals are being used as teaching and research materials and stored where you work, where you do research, and for the classes you teach, and how to safely use those chemicals, use personal protective equipment (PPE) as necessary, know what to do in the event of a spill or accident, and know how to properly dispose of any chemical or hazardous waste generated by the instructional or research activity.
3. Be aware that to the best of your ability, you may need to distinguish between a basic first aid situation and one that requires medical attention beyond first aid.
4. Be aware that to the best of your ability, you may need to distinguish between a simple chemical spill and a complex chemical spill using the information in this section (14.3).
5. Know how to respond to a simple spill or a complex spill using the information in this section (14.3).



6. Know whom to call, what numbers to use, and where the campus emergency phones are.
7. Know the procedures and locations of exits in the event the area needs to be evacuated.
8. Know the locations for closest eye wash fountains and emergency showers and know the procedures for when and how to use them.
9. Know when and how to contact the University's Environment Health and Safety (EHS) Department in advance of any incident to answer any questions about these responsibilities, or other questions related to chemical inventory, chemical use, chemical hazards, personal protective equipment (PPE), emergency response procedures or hazardous waste.
10. Provide detailed information and training to all students for whom you have teaching responsibility about how to properly identify chemicals being used as teaching or research materials in each and every laboratory or classroom you teach, know and understand the hazards of those chemicals, the exact personal protective equipment (PPE) that must be used when these chemicals are present, how to respond in the event of an injury, or either simple or complex accident spill, and how to properly dispose of used and unwanted hazardous chemicals as hazardous waste.
11. Before beginning any laboratory task where you teach students as faculty or instructor, or conduct research as investigator, know what to do in the event of an emergency situation, including the location of first aid kits, eye washes, emergency showers, fire extinguishers, fire alarm pull stations, and spill kits.
12. Follow instructions in Section 14.2 or 14.3 to ensure that in the event of a student injury or chemical exposure, appropriate medical attention is received.
13. Know how to report to the EHS Department injuries requiring medical treatment or complex chemical spills or chemical exposures to any employee or student as soon as possible.

University employees who work with chemicals that are stored, used, or disposed have the following responsibilities:

- Learn and understand the information in this section, 14.0
- Using the chemical inventory, know exactly which chemicals are present and being used and stored where you work, and how to safely use hazardous chemicals, use personal protective equipment as necessary, know what to do in the event of a spill or accident, and know how to properly dispose of any chemical or hazardous waste generated by your work activity.
- Be aware that to the best of your ability, you may need to distinguish between a basic first aid situation and one that requires medical attention beyond first aid for all incidents that occur in your workplace, except for those that involve students who are already under direct supervision of faculty.
- Be aware that to the best of your ability, you may need to distinguish between a simple chemical spill and a complex chemical spill using the information in this section (14.3) for all incidents that occur in your workplace, except for those that involve students who are already under direct supervision of faculty.
- Know how to respond to a simple spill or a complex spill using the information in this section (14.3).
- Know who to call, what numbers to use, and where the campus emergency phones are.
- Know the procedures and locations of exits in the event the area needs to be evacuated.



- Know the locations for closest eye wash fountains and emergency showers and know the procedures for when and how to use them.
- Know when and how to contact the University's Environment Health and Safety (EHS) Department in advance of any incident to answer any questions about these responsibilities, or other questions related to chemical inventory, use, personal protective equipment, emergency response procedures or hazardous waste.
- Before beginning any work task involving chemicals, know what to do in the event of an emergency situation, including the location of first aid kits, eye washes, emergency showers, fire extinguishers, fire alarm pull stations, and spill kits.
- Follow instructions in Section 14.2 or 14.3 to ensure that in the event of any injury or chemical exposure appropriate medical attention is received for incidents that involve persons who are not under the direct supervision of faculty.
- Know how to report to the EHS Department and Workers Compensation Department any injuries requiring medical treatment or complex chemical spills or hazardous chemical exposures to any employee as soon as possible.

Students who are in classrooms, laboratories, or other campus facilities where chemicals are used have the following responsibilities:

- Learn and understand the information in this section
- Using the chemical inventory and information provided by your faculty instructor, graduate assistant, or room supervisor, know exactly which chemicals you are using, know how to safely handle those chemicals, how to use personal protective equipment as necessary, and know what to do in the event of a spill or accident.
- Know and understand the specific chemical safety and emergency response information and training provided by your faculty or other university instructor or supervisor.
- Know how to report any incident that requires first aid or medical treatment to your faculty or other university instructor or supervisor.
- Know how to report any chemical spill using the information in this section to your faculty or other university instructor or supervisor.

Additional information is available including:

- Crisis Planning / Emergency Preparedness
<https://www.csus.edu/campus-safety/police-department/safety-training/index.html>
- Building Emergency Preparedness Program
<https://www.csus.edu/administration-business-affairs/risk-management-services/building-emergency-preparedness.html>
- Recognizing First Aid: <https://www.osha.gov/SLTC/medicalfirstaid/recognition.html>

14.2 Accidents – No Chemicals Involved

In the event you sustain an injury or illness in a university facility where chemicals are present or being used, but the incident does not involve a chemical spill or any chemical exposure:



1. Notify the person supervising the location immediately, if possible. If the injured person is the location supervisor, the Department leadership must be notified. In the event the injured person cannot initiate this notification, another person close to the situation must make that immediate notification.
2. To the best of the ability of the injured person and the location's faculty or supervisor, determine if the situation requires basic first aid or will require medical treatment. If a determination cannot be immediately made, the immediate response is to assume the situation requires medical treatment.
3. For all cases that require medical treatment, the faculty or supervisor or other witness must immediately **call 911 on the campus phone** and indicate an event has occurred that requires immediate medical attention.
4. **If a cell phone is used, call Campus Police Dispatch (916) 278-6000** - the caller must provide exact location information (Building-Floor-Room) and indicate that there is a need for immediate emergency medical response.
5. Faculty or supervisors are to assist the injured as possible and remain with the injured person until campus police and professional emergency medical technicians (EMTs) arrive.
6. Additional persons who are available can assist arriving EMTs in speedily locating the building, floor and room.
7. For simple first aid cases, the faculty or location supervisor may choose to assist the injured person with first aid, using materials found in the first aid kit.
8. In the event a student believes additional medical observation and advice is needed after the simple first aid is rendered, he or she may choose to visit the WELL. It is advised to call the WELL at 916-278-6461 to make sure they are open if the incident occurs after 4pm.
9. If the student decides to visit the Well, the faculty or supervisor may choose to accompany the student to the Well depending on circumstances.
10. Immediately after calling for medical assistance or providing first aid, the Department Chair is to be notified.
11. If any person receives medical attention beyond basic first aid, whether or not it involves chemical exposure, the **EH&S Department must be notified as soon as possible** but not more than 8 hours after the incident **at (916) 278-2020**. EH&S will report the event to Cal-OSHA if necessary, investigate the accident, and conduct exposure monitoring as needed.
12. For medical treatment cases involving Faculty, university employees or students employed by the university, the 24/7 **Workers Compensation line (844) 253-6460 must be contacted as soon as possible** and a Workers Compensation case initiated.

14.3 Accidents – Chemical Spill

In the event there is a chemical spill, or you sustain an injury or illness or chemical exposure in a university facility where chemicals are present or being used:

1. Notify the person supervising the location immediately, if possible
2. If the injured or chemically exposed person is the location supervisor, the Department leadership must be notified.
3. In the event the injured or chemically exposed person cannot initiate this notification, another person close to the situation must make that immediate notification.



4. To the best of the ability of the location's faculty or supervisor, use the information in this section (14.3) to **determine if the situation is a simple chemical spill or a complex chemical spill**. If a determination cannot be immediately made, the immediate response is to assume the situation is a complex chemical spill. How to respond both types of spills is below.
5. For cases where a hazardous chemical exposure has occurred that requires medical treatment, the faculty or supervisor or other witness must immediately must **call 911 on the campus emergency phone** and indicate a chemical exposure event has occurred that requires immediate medical attention.
6. **If a cell phone is used, call Campus Police Dispatch (916) 278-6000** - the caller must provide exact location information (Building-Floor-Room) and indicate that there is a need for immediate emergency medical response.
7. Faculty or supervisors are to assist the injured as possible and remain with the injured person until campus police and professional emergency medical technicians (EMTs) arrive.
8. Faculty, instructors, or other University personnel with supervisory responsibility for the location where the incident has occurred make the determination whether to use the showers or eye washes.
9. For hazardous chemical exposures, this assistance may involve immediately using the eyewash fountain, or the emergency shower.
10. Eyewash fountain and showers are to be used for 15 minutes. Contaminated clothing and lab coats must be removed to the extent possible.
11. Washing off a minor exposure to a non-hazardous chemical or using only the eyewash fountain is first aid, not medical treatment, and may not require calling 911.
12. Assisting personnel are advised to limit contamination of the building with a hazardous chemical by NOT taking the exposed person outside the lab and into hallways and bathrooms, unless immediate evacuation from the location is warranted, based on significant hazards of the spilled or released chemical.
13. Faculty, staff and supervisors, and any other assisting personnel must use appropriate Personal Protective Equipment to limit their own exposure while assisting the person exposed to a hazardous chemical, so that only those with proper PPE may assist.
14. For first aid cases and simple spills only, the faculty or location supervisor may assist the injured person by providing first aid, or for minor or non- hazardous chemical exposure, in ensuring that the person can appropriately remove contaminated clothing or PPE and ensuring the chemically exposed body parts are washed.
15. For students who have a minor or non-hazardous exposure, after washing or first aid as appropriate, the student may choose to have additional medical observation and advice. In these cases, he or she may choose to visit the WELL. It is advised to call the WELL at 916-278-6461 to make sure they are open if the incident occurs after 4pm.
16. If the student decides to visit the Well, the faculty or supervisor may choose to accompany the student to the Well depending on circumstances.
17. Immediately after medical assistance has been called or first aid rendered, the Department Chair is to be notified.
18. **If any person receives medical attention beyond basic first aid, whether or not it involves chemical exposure, the EH&S Department must be notified as soon as possible but not more than 8 hours**



after the incident at (916) 278-2020. EH&S will report the event to Cal-OSHA if necessary, investigate the accident, and complete exposure monitoring as needed.

19. For medical treatment cases involving Faculty, university employees or students employed by the university, the **24/7 Workers Compensation line (844) 253-6460 must be contacted as soon as possible** and a Workers Compensation case initiated.

DETERMINING A SIMPLE CHEMICAL SPILL:

All of the following criteria must be met to define a simple chemical spill.

- The material released must be known to the faculty, employee, graduate student or supervisory designee in charge of the location where the release occurs.
- This particular knowledge of the chemical teaching/research material enables the faculty, employee, graduate student or supervisory designee to immediately determine if the volume, toxicity, flammability or environmental effects of the material can be safely managed and cleaned up using the standard personal protective equipment (PPE) already being worn in the location.
- Standard PPE (fresh gloves, lab coat, goggles) are used to safely work with the chemical
- A fume hood is NOT needed to work with material (see fume hood spill below)
- The spill has NOT occurred in a public space (ex. hallway, elevator, etc.)

ADDITIONAL SIMPLE SPILL DEFINITIONS

- Low volume incidental release, splash, or drip of chemical teaching/research materials which are known to the faculty, staff, and graduate students responsible for the specific classroom, laboratories, countertops, measuring/weighing locations and fume hoods is not a spill, if it can be managed safely with standard PPE.
- Safe housekeeping of these incidental releases while wearing standard PPE is not a spill clean-up.
- Spills in a functioning fume hood that are in secondary containment may be defined as a simple spill by the faculty or supervisor in that location, based on exact knowledge of the spilled chemical and the certainty that it presents no hazard to the location in which the fume hood is located.
- Solid chemical spills are generally a simple spill. Unless the faculty, employee, graduate student or supervisory designee in charge of the location has determined that the substance cannot be managed with standard PPE in use, use damp paper towels to transfer it into plastic bags to prevent causing an airborne hazard by dry sweeping.

SIMPLE Chemical Spill Response

1. Determine that all criteria are met for a Simple Spill.
2. Immediately notify the Faculty or supervisor where the spill occurred.



3. Because it is a simple spill, the people cleaning the spill are knowledgeable about the spilled material, are current on all required EH&S training, and are approved to do so by the faculty, employee, graduate student or supervisory designee.
4. Ensure all personnel or students who are non-essential for the clean-up process are not in the immediate area of the spill.
5. Limit contamination of other areas by avoiding walking through the spill.
6. Use appropriate clean up techniques and the local spill response kit if needed. Call EH&S at (916) 278-2020 for guidance if necessary.
7. If a person is involved in a simple spill incident where the chemical has contacted skin, eye or mouth despite wearing PPE, that person must wash off the material as soon as possible.
8. Faculty or supervisor may assist those who need to have the chemical washed off by directing them to the appropriate location to do so. Simple spills are low volume, low hazard chemicals and a sink, rest room, or eye wash fountain may be all that is needed to provide the individual with the ability to wash the chemical off. The full body emergency shower is likely not necessary for a simple spill.
9. Work with another person to clean-up the spill. Do not clean-up a simple spill alone.
10. Use an appropriate chemical spill kit to neutralize and absorb inorganic acids and bases.
11. For other chemicals, use the appropriate spill kit or absorb the chemical with sorbent pads, paper towels, vermiculite, dry sand, or diatomaceous earth.
12. Collect the clean-up materials and residue and place it in a clear plastic bag. Double bag the waste and label the bag with a properly completed Hazardous Waste label.

COMPLEX CHEMICAL SPILLS:

Any spill that is NOT a simple spill is a complex chemical spill.

These are spills of larger quantities than 500 mL, known toxic substances for which standard PPE may not be sufficient, or a spill of an unknown chemical, or a spill of a toxic substance in a public area where people are not wearing PPE, or spills into or adjacent to drains.

Uncontrolled leaks from compressed gas cylinders can be considered a complex spill requiring an emergency response depending on the hazard of the gas.

COMPLEX Chemical Spill Response

Complex spills require an emergency response from the Sacramento Fire Department Hazmat Team

1. Faculty, Staff, and students do not respond directly to a complex chemical spill.
2. Unless you have been contaminated by the spilled material, when the faculty or location supervisor has declared a spill emergency, evacuate from the immediate area and leave the room where it occurred.
3. Call 911 on the campus phone and indicate the room location where a chemical spill has occurred that requires Sacramento Fire Hazmat response.
4. If a cell phone is used, call Campus Police Dispatch (916) 278-6000 - the caller must provide exact location information (Building-Floor-Room) and indicate that there is a need for immediate Sacramento Fire Hazmat response.



5. If the spill presents a situation that is immediately dangerous to life, activate the fire alarm and clear the entire building.
6. Anyone who has been directly exposed to a significantly hazardous chemical should not evacuate the building unless the situation is immediately dangerous to life and health, and prioritize immediately washing the contamination off.
7. Faculty, instructors, or other University personnel with supervisory responsibility for students at the location where the incident has occurred make the determination whether to use the showers, eye washes, or restrooms, not the students or supervised staff.
8. Faculty or supervisors are to assist those who have been exposed to a significantly hazardous chemical by directing them to the nearest location outside the immediate spill area that has appropriate means to wash off the chemical, such as eye wash fountains, emergency showers, or rest rooms if appropriate.
9. For significantly hazardous chemicals, washing off the chemical must be immediate and continue for 15 minutes, unless trained EMTs and Hazmat responders arrive on the scene and require other procedures. Contaminated clothing and lab coats must be removed to the extent possible before washing and appropriately bagged and labeled as hazardous waste.
10. Faculty, staff and supervisors, and any other assisting personnel must use appropriate Personal Protective Equipment to limit their own exposure to a hazardous chemical while assisting the person exposed, so that only those with proper PPE may assist.
11. Assisting personnel are advised to limit contamination of the building with a significantly hazardous chemical by NOT taking the exposed person into hallways, stairways, and elevators, unless immediate evacuation from the location is warranted, based on significant hazards of the spilled or released chemical.
12. Be sure to notify EH&S at (916) 278-2020 as soon as possible after calling the police/dispatch of any complex chemical spills. EHS will handle further notifications to regulatory authorities as needed. EH&S will report the event to Cal-OSHA if necessary, investigate the accident, and conduct exposure monitoring as needed.
13. For medical treatment cases involving Faculty, university employees or students employed by the university, the 24/7 Workers Compensation line (844) 253-6460 must be contacted as soon as possible and a Workers Compensation case initiated.
14. No re-entry of any evacuated space where a complex emergency chemical spill has occurred is permitted until approval is provided by the Environmental Health & Safety Department.

14.4 Accidents – Fire

1. If a fire or smoke is detected in a laboratory or other University facility, the faculty or supervisor of that location must be alerted immediately.
2. Faculty, staff or supervisors in a location are not required to extinguish fires that occur in their work areas and should not attempt to do so unless:
 - It is a small fire (i.e., small trash can sized fire);
 - Appropriate fire extinguisher training has been received;
 - The person wishes to do so and is capable.
3. The immediate location must be evacuated, and a fire alarm pulled.



4. If the clothing of an individual catches on fire, the most immediate location where drenching water can be applied must be used.
5. Any time a fire occurs or a fire extinguisher is used, no matter for how brief a period, the incident must be reported to Police dispatch - **(916) 278-6000** (anytime) and then afterwards to EH&S **(916) 278-2020** (during normal business hours). All fires on state property must be reported to the State Fire Marshal by campus police.

14.5 Regulatory Requirements

The necessary work practices, procedures, and policies outlined in this chapter are required by the following:

- CCR §3320, "Emergency Action Plan" <https://www.dir.ca.gov/title8/3220.html>, and
- CCR §5162, "Emergency Eyewash and Shower Equipment" <http://www.dir.ca.gov/title8/5162.html>.
- CCR §5191. Occupational Exposure to Hazardous Chemicals in Laboratories, Appendix B
- CCR §5194. Hazard Communication

15.0 Hazardous Waste Management

General Requirements:

- Handle hazardous waste in accordance with the University's Guidelines for Hazardous Waste Management.
- Do not mix incompatible chemicals.
- All waste must be stored in leak-proof containers and labeled with the generator's name, chemical contents and date the accumulation began or the date that the chemical was determined to be waste.
- It is the responsibility of the waste generator to schedule a waste pickup with the Hazardous Materials Coordinator or EH&S.
- NO HAZARDOUS LABORATORY/CHEMICAL WASTE SHALL BE DISPOSED IN THE SINKS, DRAINS OR TRASH CANS. NO HAZARDOUS LABORATORY/CHEMICAL WASTE SHALL BE PLACED IN STORM DRAINS.
- Check with the Laboratory Supervisor for identification and appropriate disposal of hazardous waste.
- Before disposing of unwanted chemicals, check with others in the organizational unit who may be able to use them.
- Make sure all samples and products scheduled for disposal are properly identified, contained, and labeled. Do not leave them for others to clean up.

16.0 Records and Recordkeeping

General Requirements:

- Worker medical monitoring records shall be maintained in accordance with the California State University Employee Medical Monitoring Program Manual.
- Accident/incident records shall be maintained in the organizational unit, as well as by the Office of Environmental Health & Safety.



- Employee training records required by this document shall be maintained in the Learning Management System.

17.0 Changes to the University Chemical Hygiene Plan

- Faculty, administrators, or staff can propose changes to the University Chemical Hygiene Plan. The proposed changes are submitted to the Chemical Hygiene Officer.
- The Chemical Hygiene Officer will communicate the proposed changes, along with his/her recommendations, to the Executive Safety Committee and to all organizational units which might be affected by the proposed changes.
- The Executive Safety Committee will consider the proposed changes. The Committee may approve/disapprove the changes by a majority vote of all eligible voters, or it may refer the proposed changes to a subcommittee for further review.

18.0 Definitions

acute exposure	A single, brief exposure to a large dose of a toxic substance. Adverse health effects are evident soon after exposure.
acute toxicity	Adverse biological effects of a single dose of a toxic agent.
administrative controls	Methods of controlling exposures to contaminants by job rotation, work assignment or time away from the contaminant.
Cal/OSHA	California Occupational Safety and Health Administration. This agency develops and enforces occupational safety and health standards for most industry and business in the state of California.
ceiling limit	The maximum allowable exposure limit for an airborne chemical, which is not to be exceeded even momentarily. See also PEL and TLV.
Chemical Hygiene Officer	A person designated by the employer, who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene & Safety Plan.
Chemical Hygiene and Safety Plan	A written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in the particular workplace.



chronic exposure	Repeated exposure or contact with a toxic substance over a long period. Adverse biological effects from chronic exposure develop slowly, last a long time, and frequently recur.
chronic effect	Symptom of exposure to a hazardous material that develops slowly after many exposures, or that recurs often.
chronic toxicity	Adverse biological effect of repeated doses or long-term exposure to a toxic agent.
combustible	Able to catch on fire and burn. According to the DOT and NFPA, combustible liquids are "those having a flash point at or above 1000 F (37.80C), or liquids that will bum. They do not ignite as easily as flammable liquids. However, combustible liquids can be ignited under certain circumstances, and must be handled with caution. . ." Non-liquid substances that will burn, such as wood and paper, are called "ordinary combustibles." (See flammable.)
combustible gas	i. A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70°F (21.1°C); or ii. A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F (54.4° C) regardless of the pressure at 70°F (21.1°C); or iii. A liquid having a vapor pressure exceeding 40 psi at 100°F (37.8° C) as determined by ASTM D-323- 72.
combustible liquid	Any liquid having a flashpoint at or above 100°F but below 200°F.
compressed gas	A gas or mixture of gases in a container having an absolute pressure of 40 or more psi at room temperature.
corrosive	A chemical that causes visible destruction of, or irreversible changes in, living tissue by chemical action at the site of contact, or that has a severe corrosion rate on structural materials.
designated area	An area that may be used for work with "select carcinogens," reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of it, or a device such as a hood.



explosive	A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.
flammable	A flammable substance is one that will catch on fire and burn rapidly under ordinary conditions; for example, liquids with a flash point below 100°F and solids that ignite readily. Note the Uniform Fire Code uses a cut-off of 140°F, which qualifies more liquids as "flammable."
flashpoint	The minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite.
fume hood	A ventilation device enclosed on five sides with a moveable sash, constructed and maintained to allow chemical manipulations to be conducted inside enclosure while preventing or minimizing the escape of air contaminants into the worker's breathing zone.
general ventilation	Also known as general exhaust ventilation, this is a system of ventilation consisting of either natural- or mechanically- induced fresh air movements to mix with and dilute contaminants in the workroom air. This is not the recommended type of ventilation to control contaminants that are highly toxic, when there may be corrosion problems from the contaminant, when the worker is close to where the contaminant is being generated, and where fire or explosion hazards are generated close to sources of ignition (See LOCAL EXHAUST VENTILATION).
hazard warning	The words, pictures, and symbols, or a combination thereof, that appear on a label and indicate the hazards of the substance in the container.
hazardous chemical	A chemical, or mixture of chemicals, that can produce adverse physical effects (e.g., fire, explosion) or health effects (e.g., dermatitis, cancer).



health hazards	Substances for which there is evidence, from at least one scientific study, that acute or chronic health effects may occur in exposed persons. These chemicals include carcinogens, toxic agents, reproductive toxins (mutagens and teratogens), irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents that damage the lungs, skin, eyes, or mucous membranes.
hazardous material	Any substance or compound that has the capability of producing adverse effects on the health and safety of humans.
incompatible	The term applies when two substances cannot be mixed together without the possibility of a dangerous reaction.
ignition temperature	The lowest temperature at which a substance will ignite and continue to burn. The lower the ignition temperature, the more likely the substance is to be a fire hazard.
laboratory	A facility where the "use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.
local exhaust	A ventilation method for removing contaminated air at the point where the contaminants are generated (e.g., a fume hood).
mutagen	A substance capable of causing damage to genes and chromosomes, particularly those of sperm or egg cells, resulting in mutations.
oxidizer	A material that causes the ignition of combustible materials without an external source of ignition. When mixed with combustible materials, an oxidizer increases the rate of burning of these materials when the mixtures are ignited. Oxidizers usually contain their own oxygen, and can, therefore, burn in an oxygen-free atmosphere, are usually very unstable or reactive, and pose a serious fire hazard.
Permissible Exposure Limit (PEL)	An exposure limit that is published and enforced by OSHA as a legal standard. PEL may be either a time-weighted- average (TWA), exposure limit (8-hour), a 15-minute short term exposure limit (STEL), or a ceiling (C). The PELs are found in Tables Z- 1, Z-2, or Z-3 of OSHA regulations 1910.1000. (See also TLV).



personal protective equipment	Any devices or clothing worn by the worker to protect against hazards in the environment. Examples are respirators, gloves, and chemical splash goggles.
principal investigator	Person who is responsible for the design, conduct or reporting of research.
reactivity	A substance's susceptibility to undergoing a chemical reaction or change that may result in dangerous side effects, such as explosions, burning, and corrosive or toxic emissions. The conditions that cause the reaction, such as heat, other chemicals, and dropping, will usually be specified as "Conditions to Avoid" when a chemical's reactivity is discussed on an SDS.
reproductive toxins	Chemicals that affect the reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogenesis).
select carcinogen	Any substance that meets one of the following criteria: (i) It is regulated by OSHA as a carcinogen; or (ii) It is listed under the category, "known to be carcinogenic," in the "Annual Report on Carcinogens," published by the National Toxicology Program (NTP) (latest edition); or (iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or (iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogenic" by NTP, and causes statistically significant tumor incidence in experimental animals.
suspect carcinogen	A substance that might cause cancer in humans but has not yet been proven to do so.
teratogen	An agent or substance that may cause physical defects in the developing embryo or fetus when a pregnant female is exposed to that substance.



TWA	Time Weighted Average: The exposure limit averaged over a normal 8-hour workday or 40-hour workweek.
toxic substance	A substance that causes harmful biological effects after either short-term or long-term exposure.
toxicity	A relative measure of the adverse biological effects that can result from exposure to a harmful substance.
unstable	A chemical is unstable if it tends to decompose or undergo other undesirable chemical changes during normal handling or storage.
ventilation	Circulation and exchange of air and the method by which this is accomplished.
volatile	A term used for a liquid that evaporates at room temperature. Very volatile liquids, such as gasoline, form vapors (evaporate) quickly and are a breathing hazard.



Appendices

APPENDIX A: Select Carcinogens and Reproductive Toxins

APPENDIX B: Cal/OSHA Permissible Exposure Limits For Chemical Contaminants

APPENDIX C: Title 8 § 5191 Occupational Exposure to Hazardous Chemicals in Laboratories

APPENDIX D: Chemical Compatibility Chart APPENDIX E: Peroxide-Forming Chemicals

APPENDIX F: California State University, Sacramento General Lab Self-Inspection Checklist



Appendix A: SELECT CARCINOGENS and Reproductive Toxins

For the most current identified carcinogens and reproductive toxins, please visit the following sites:

CalOSHA: Occupational Safety & Health Administration:

1. Regulated Carcinogens: <http://www.dir.ca.gov/title8/5203.html>
2. Specified Carcinogens: <http://www.dir.ca.gov/title8/5209.html>

Cal-OEHHA: California Office of Environmental Health Hazard Assessment

- Website: http://www.oehha.org/prop65/prop65_list/Newlist.html
Chemicals identified in Prop 65 List of known to cause cancer or reproductive toxicity

IARC: International Agency for Research on Cancer:

- Website: <http://monographs.iarc.fr/ENG/Classification/>
Group 1: Carcinogenic to humans:
Group 2A: Probably carcinogenic to humans
Group 2B: Possibly carcinogenic to humans

NTP: National Toxicology Program (US Department of Public Health):

- Website: <http://ntp.niehs.nih.gov/pubhealth/roc/roc13/index.html>
Report on Carcinogens – RoC

Appendix B: Cal/OSHA PERMISSIBLE EXPOSURE LIMITS FOR CHEMICALS

CalOSHA: Occupational Safety & Health Administration:

https://www.dir.ca.gov/title8/5155table_ac1.html

Appendix C: Title 8 § 5191 Occupational Exposure to Hazardous Chemicals in Laboratories

CalOSHA: Occupational Safety & Health Administration: <http://www.dir.ca.gov/title8/5191.html>



Appendix D: Chemical Compatibility Chart

Below is a chart adapted from the CRC Laboratory Handbook which groups various chemicals into 23 groups with examples and incompatible chemical groups. This chart is by no means complete but it will aid in making decisions about storage. For more complete information please refer to the SDS for the specific chemical.

Group	Name	Example	Incompatible Groups
Group 1:	Inorganic Acids	Hydrochloric acid Hydrofluoric acid Nitric acid Sulfuric acid	2,3,4,5,6,7,8,10,13,14, 16,17,18,19,21,22,23
Group 2:	Organic acids	Acetic acid Butyric acid Formic acid Propionic acid	1,3,4,7,14,16,17,18,19 ,22
Group 3:	Caustics	Sodium hydroxide Ammonium hydroxide solution	1,2,6,7,8,13,14,15,16, 17,18,20,23
Group 4:	Amines and Alkanolamines	Aminoethylethanolamine Aniline Diethanolamine Diethylamine Ethylenediamine Monoethanolamine Triethanolamine Triethylamine Triethylenetetramine	1,2,5,7,8,13,14,15,16, 17,18,23
Group 5:	Halogenated Compounds	Carbon tetrachloride Chlorobenzene Chloroform Methylene chloride Carbon Tetrachloride 1,2,4-Trichlorobenzene 1,1,1-Trichloroethane Trichloroethylene Trichlorofluoromethane	1,3,4,11,14,17
Group 6:	Alcohols Glycols Glycol Ether	1,4-Butanediol Butanol (iso, n, sec, tert) Diethylene glycol Ethyl alcohol Ethyl butanol Ethylene glycol Furfuryl alcohol Isoamyl alcohol Methyl alcohol Propylene glycol	1,7,14,16,20,23
Group 7:	Aldehydes Acetaldehyde	Acrolein Butyraldehyde Formaldehyde Paraformaldehyde Propionaldehyde	1,2,3,4,6,8,15,16,17,19, 20,23
Group 8:	Ketones	Acetone Acetophenone Diisobutyl ketone Methyl ethyl ketone	1,3,4,7,19,20
Group 9:	Saturated Hydrocarbons	Cyclohexane Heptane Paraffins Pentane Petroleum ether	20
Group 10:	Aromatic Hydrocarbons	Benzene Ethyl benzene Naphtha Toluene Xylene	1,20



Group 11:	Olefins	Butylene 1-Decene 1-Dodecene Ethylene Turpentine	1,5,20
Group 12:	Petroleum Oils	Asphalt Gasolines Mineral Oil	20
Group 13:	Esters	Amyl acetate Butyl acetates Ethyl acetate	1,3,4,19,20
Group 14:	Monomers Polymerizable Esters	Acrylic acid Acrylonitrile Butadiene Acrylates	1,2,3,4,5,6,15,16,19,20,21,23
Group 15:	Phenols	Cresote Cresols Phenol	3,4,7,14,16,19,20
Group 16:	Alkylene Oxides	Ethylene oxide Propylene oxide	1,2,3,4,6,7,14,15,17,18,19,23
Group 17:	Cyanohydrins	Acetone cyanohydrin Ethylene cyanohydrin	1,2,3,4,5,7,16,19,23
Group 18:	Nitriles	Acetonitrile Adiponitrile	1,2,3,4,16,23
Group 19:	Ammonia	Ammonia gas Ammonium Hydroxide	1,2,7,8,13,14,15,16,17,20,23
Group 20:	Halogens	Chlorine Fluorine	3,6,7,8,9,10,11,12,13,14,15,19,21,22
Group 21:	Ethers	Diethyl Ether THF	1,14,20
Group 22:	Phosphorus	Phosphorus, Elemental	1,2,3,20
Group 23:	Acid Anhydrides	Acetic anhydride Propionic anhydride	1,3,4,6,7,14,16,17,18,19



Appendix E: Peroxide-Forming Chemicals

TABLE 1. COMMON PEROXIDE-FORMING COMPOUNDS

Group A- Chemicals that form explosive levels of peroxides without concentration

(Safe storage time after opening - 3 months)

Chemical Name	CAS Number	Synonym(s)
1,1-Dichloroethylene	75-35-4	Vinylidene Chloride
2-Chloro-1,3-Butadiene ^{1,3}	126-99-8	Chloroprene
Butadiene ^{1,3}	106-99-0	
Divinyl Acetylene	821-08-9	
Isopropyl Ether	108-20-3	
Tetrafluoroethylene	116-14-3	
Vinyl Ether	109-93-3	Divinyl ether

Group B-Chemicals that form explosive levels of peroxides on concentration

(Safe storage time after opening - 12 months)

Chemical Name	CAS Number	Synonym(s)
2-Butanol	78-92-2	
2-Cyclohexan-1-ol	822-67-3	
2-Hexanol	626-93-7	
2-Pentanol	6032-29-7	
3-Methyl-1-Butanol	123-51-3	Isoamyl alcohol
4-Heptanol	589-55-9	
4-Methyl-2-Pentanol	108-11-2	
Acetal	105-57-7	
Acetaldehyde	75-07-0	
alpha-Methyl-Benzyl Alcohol	98-85-1	Phenyl Ethanol
Benzyl Alcohol	100-51-6	
Cyclohexanol	108-93-0	
Cyclohexene	110-83-8	
Cyclooctene	931-87-3	
Cyclopentene	42-29-0	
Decahydronaphthalene	91-17-8	
Diacetylene	460-12-8	
Dicyclopentadiene	77-73-6	
Dioxane	123-91-1	1,4 Dioxane
Ethylene Glycol Dimethyl Ether	110-71-4	Diethylene Glycol Dimethyl Ether and Glyme
Ethyl Ether	60-29-7	Diethyl Ether
Furan	110-71-4	
Isopropyl Benzene	98-82-8	Cumene



Methylcyclopentane	96-37-7	
Methyl Isobutyl Ketone	108-10-1	
Penten-1-ol	821-09-0	
Propyne	74-99-7	Methyl Acetylene
Tetrahydrofuran	109-99-9	
Tetrahydronaphthalene	119-64-2	

Group C- Chemicals which may autopolymerize as a result of peroxide accumulation

(Safe storage time after opening: inhibited chemicals- 12 months; uninhibited chemicals: - 24 hours)

Note: Do not store inhibited chemicals in this group under inert atmospheres

Chemical Name	CAS Number	Synonym(s)
1,1-Dichloroethylene	75-35-4	Vinylidene Chloride
2-Chloro-1,3-Butadiene ^{1,3}	126-99-8	Chloroprene
Acrylic Acid ²	79-10-7	
Acrylonitrile ²	107-13-1	
Butadiene ^{1,3}	106-99-0	
Buten-3-yne	689-97-4	Vinyl acetylene & Butenyne
Chlorotrifluoroethylene	79-38-9	
Methyl Methacrylate ²	80-62-6	
Phenethyl Alcohol	60-12-8	Phenyl Ethanol
Styrene	100-42-5	
Tetrafluoroethylene	116-14-3	
Vinyl Acetate	108-05-4	
Vinyl Chloride	75-01-4	Monochloroethylene

1. When stored as a liquid monomer
2. Although these form peroxides, no explosions involving these monomers have been reported
3. Also stored as a gas in gas cylinders.



Appendix F: California State University, Sacramento General Lab Self-Inspection Checklist

Laboratory Supervisors should conduct inspections, at least once per semester, of the laboratory and chemical handling areas which they are supervising. To aid supervisors to complete the inspection, the following checklist is provided. These are not a list of every possible safety issue, but are general guidelines. For questions about this checklist or for assistance with hazard identification, contact Sacramento State EHS office.

Building:		Room:	
Date:		Completed By:	

Place an "X" in box indicating status:

TRAINING				
Inspected	Acceptable	Deficient	NA	Corrective Action /Owner
Lab personnel instructed in potential hazards in lab and safety procedures and policies. Is instruction documented				
EH&S Training Matrix developed for the Department				
All lab personnel (including PI) completed all required EH&S training (per department EHS training Matrix)				
Personnel trained in applicable Standard Operating Procedures (SOP's)				
Copy of supervisor/PI led safety training records sent to Department Office				
Sacramento State Chemical Hygiene Plan accessible and reviewed by all lab personnel				

HAZARD COMMUNICATION				
Inspected	Acceptable	Deficient	NA	Corrective Action/Owner
All containers are legibly labeled with full chemical names and the hazard of the material. Containers of non-hazardous substances (e.g., water) are labeled explicitly to avoid confusion and stock solutions are properly identified (e.g. buffers labeled and marked with the words "buffer").				



Written chemical inventory is current, available in lab and provided to Lab Stockroom manager				
Hazard Evaluation completed and documented in last 6 months				
Standard Operating Procedures documented and available for hazardous operations				
Lab personnel wear all required PPE?				
Lab personnel know the location of the Safety Data Sheets (SDS)?				
Lab inspection been completed in last 6 months?				
Lab policies and procedures being followed?				

HAZARDOUS CHEMICAL STORAGE				
Inspected	Acceptable	Deficient	NA	Corrective Action/Owner
Hazardous substances are separated according to chemical compatibility.				
Containers of peroxide-forming chemicals are dated upon receipt and disposed of or tested within manufacturer's suggested expiration dates.				
All chemical containers are capped and sealed, except when actively adding or removing materials from them.				
Containers of hazardous chemicals stored in secondary containment				
Chemical storage areas are routinely inspected for leaks and evidence of container deterioration.				
Flammable liquids in quantities in excess of <u>10 gallons</u> are stored in an NFPA- approved flammable liquid storage cabinet.				
All flammable liquid cabinets are free of combustible materials (cardboard, paper, etc.).				



Flammables can only be stored in “flammable approved” refrigerators				
Fume Hoods not used for storage				
Shelves have “lips” to prevent chemicals from falling				

HAZARDOUS WASTE				
Inspected	Acceptable	Deficient	NA	Corrective Action/Owner
Chemical waste is contained and labeled according to the campus hazardous waste guidelines with the words “Hazardous Waste,” with the waste’s physical state, hazardous properties (e.g. flammable), full product names, and appropriate percentages.				
Containers are labeled with the initial date of accumulation				
Sharps are stored in rigid, red, biohazard containers.				
Biohazardous waste is contained in red bags that are labeled as Biohazardous.				
Animal carcasses and/or infectious tissues are properly contained and disposed of in a timely manner.				

EMERGENCY INFORMATION, EQUIPMENT & SPILLS				
Inspected	Acceptable	Deficient	NA	Corrective Action/Owner
Current Emergency Information posted in lab (procedures, contacts)				
Fire Extinguishers present/charged/accessible/signage visible				
Emergency Shower/Eyewash inspected monthly				
Fume Hoods Certified in last 12 months				
Biological Safety Cabinets certified in last 12 months				



First Aid Kit present, stocked and without expired products				
Chemical spill kits are present and procedures known by staff				
Incidental spills are cleaned up in a timely manner and benches and equipment are cleaned/decontaminated as often as necessary to prevent unnecessary exposure to chemical or biological agents.				
Compressed Gas cylinders are strapped to prevent toppling				

GENERAL HOUSEKEEPING				
Inspected	Acceptable	Deficient	NA	Corrective Action/Owner
No food or drink is allowed or present in lab				
Exits/aisles/corridors are not blocked				
Refrigerators and microwaves are labeled with food/drink specifications (i.e. No Food, or Food for Consumption Only)				
Sinks available for hand washing				
Materials not stored within 24" of ceiling (18" if sprinklered)				
Power-strips not connected in a series (daisy-chained)				
Power-cords not in use (in lieu of permanent wiring)				
Shelves/cabinets above 6" are secured to prevent toppling				
Electrical panel has unobstructed access				