
# Chemical Hygiene Plan

## Laboratory Safety Manual

03/21/2018
KECK Graduate Institute
Prepared by: Chemical and Biological Safety Committee (CABS)

# CHEMICAL HYGIENE PLAN
# (Laboratory Safety Manual)

# KGI Safety Committees

## CAMPUS SAFETY COMMITTEE (ILLINESS AND INJURY)

| | | |
|---|---|---|
| Natalie Barnard | Campus Safety Support | 70339 |
| Cheryl Merritt | Director Human Resources<br>Committee Chair | 77853 |

## CHEMICAL AND BIOLOGICAL LABORATORY SAFETY

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| Larry Grill | Dean of Research | 70175 | |
| Jasmine Yu | Committee Chair | 78698 | (new change) |
| Natalie Barnard | Committee Member | 70339 | (new change) |
| Anastasia Levitin | Committee Member | 70154 | |
| Ryan Davis | Committee Member | 79375 | |
| Jamie Liu | Committee Member | 79542 | |
| John Krstenansky | Committee Member | 70158 | |

## FACILITIES SAFETY

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| Natalie Barnard | Facilities Supervisor | 70339 |

Established Pursuant to:
California Code of Regulations, Title 8, Section 5191 http://www.dir.ca.gov/Title8/5191.html
Exposure to Hazardous Chemicals in Laboratories

# Chemical Hygiene Plan

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# I. Purpose & Scope

## A. Purpose

The California Occupational Safety and Health Administration (CAL-OSHA) has promulgated a regulation covering the occupational exposure to hazardous chemicals in laboratories. Included in this regulation is a requirement for KECK Graduate Institute (KGI) to develop and carry out a Chemical Hygiene Plan.

The Chemical Hygiene Plan must include:

- procedures to assure safety and health in laboratories,
- criteria for implementation of control measures,
- provisions for training and information dissemination,
- provisions for medical consultation,
- designation of responsible personnel (to maintain safe conditions), and criteria for identification of particularly hazardous substances (i.e., labeling).

This document is KGI's Chemical Hygiene Plan. All laboratory personnel must understand and follow the guidelines outlined in this plan. In addition, each employee is expected to develop safe, personal chemical hygiene habits aimed at minimizing chemical exposures to themselves and coworkers. This Chemical Hygiene Plan will be reviewed, evaluated and updated annually and must be made readily available to employees, their representatives and any representative of CAL-OSHA.

It is important to follow this plan. CAL-OSHA may monitor our laboratory operations. If we are not following the Chemical Hygiene Plan procedures, the University could be fined substantially. More importantly, following these procedures will assure that all KGI employees and students work in a safe and healthy environment.

## B. Scope

This plan applies to all KGI employees engaged in the laboratory use of hazardous Chemicals. "Laboratory use of hazardous chemicals" means the handling or use of such chemicals in which all of the following conditions are met:

1. Chemical manipulations are carried out in containers 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, nor in any way simulate a production process; and
4. Personnel Protective equipment is available and in common use to minimize the potential for employee exposure to hazardous chemicals.

"Laboratory" means a room or group of rooms under the control of a lab supervisor or principal investigator (PI) where relatively small quantities of hazardous chemicals are used on a non-production basis. Rooms such as computer labs, offices, electronic labs, reading labs are not considered "laboratories" under this Chemical Hygiene Plan.

# II. Chemical Hygiene Responsibilities

## A. KGI President/Dean

1. The President/Dean of Research has the ultimate responsibility for chemical hygiene throughout University laboratories, and, with assistance of other program administrators, provides ongoing support for safe use of chemicals at KGI.

## B. KGI Chemical Safety Officer

1. Barbara Erwin serves as KGI's Chemical Safety Officer.
2. This individual, and members of the Chemical and Biological Safety committee shall have the responsibility and authority to:
    a. Work with administrators and other employees to develop and implement appropriate chemical and biological hygiene policies and practices.
    b. Inspect any KGI facility and investigate any accident involving KGI employees, students or equipment.
    c. Temporarily suspend the operations in any KGI laboratory in which the practices represent an imminent health hazard.
    d. Monitor procurement of chemicals.
    e. Oversee the performance of regular, formal chemical hygiene inspections and inspections of emergency equipment in all KGI laboratories.
    f. Assist Lab Supervisors/PI and Laboratory Managers to develop safety precautions and adequate facilities.
    g. Maintain current knowledge concerning the legal requirements of regulated substances in the laboratory.
    h. Review the KGI Chemical Hygiene Plan annually.
    i. Monitor safety training for compliance with code-mandated items.
    j. In conjunction with Claremont University Consortium (CUC) EH&S officers coordinate the chemical waste disposal program.

## C. Lab Supervisor/Manager/PI

1. The laboratory supervisor, manager or Principal Investigator is the individual who has the primary responsibility for safety in the laboratories under their control.
2. This individual, or delegated members of their staff, shall have the responsibility to:
    a. Develop a Laboratory Chemical Safety Plan for chemicals specific to their lab use.
    b. Provide a periodic Risk Assessment to inspect their laboratories for unsafe conditions and practices and take appropriate corrective action.
    c. Provide the required safety training to the employees and students that work in their laboratories. Document the training provided.
    d. Investigate injuries to lab employees or over-exposure events.
    e. Evaluate the need for protective equipment or chemical exposure monitoring.
    f. Request appropriate monitoring from KGI Chemical Safety Officer if necessary.

### D. KGI Chemical and Biological Safety Committee

1. KGI's Chemical and Biological Safety Committee members are volunteers. The Committee is responsible for reviewing and approving any changes to the KGI Chemical Hygiene Plan.
2. The Safety Committee may also investigate and discuss reported unsafe practices conducted in any KGI laboratory. Their recommendations for correction, including disciplinary action, are to be sent to the President/Dean of Research/and Principal Investigator (PI).

## III. Laboratory Hazardous Chemicals: Standard Operating Procedure (SOP)

A. The KGI Chemical Hygiene Plan (this document) provides guidelines and a number of specific procedures relevant for all laboratories. However, each laboratory MUST identify specific requirements for their labs. To do so, a laboratory must prepare a Laboratory Chemical Standard Operating Procedure (SOP) For a copy of this document see Barb Erwin CSO

B. The Laboratory Chemical Standard Operating Procedure is designed to address and document unique lab needs and procedures; The SOP is required and must be sent to the Chemical Safety Officer for approval prior to using the chemical. Upon approval the SOP in it's written from must be kept on file in the laboratory and with the KGI Chemical Hygiene Plan.

C. A Laboratory Chemical Standard Operating Procedure FOR KNOWN CARCINOGENS is (*required* by OSHA and Prop 65 California Code) in labs where hazardous procedures are identified. This would involve the use of particularly hazardous substances, select carcinogens, reproductive toxins, or substances that cause a high degree of acute toxicity.

D. For a detailed list of hazardous chemicals at KGI see Barb Erwin CSO. Safety Instructions and OSHA standards can be obtained from OSHA web site. *http://www.osha.gov/*

## IV. Laboratory Chemicals

### A. Chemical Procurement

The decision to purchase a chemical shall be a commitment to handle and use the chemical properly from receipt to disposal. If one chooses to purchase any reagent form Prop 65 list they must seek prior approval from the Chemical Safety Officer. **Depending on exposure levels OSHA Regulated Carcinogens in Hazard Communication Areas may require: Regulated Area, Clean Room, Changing Facilities, Exposure Monitoring, Training, Medical / Biological Monitoring. **In Lab Standard Work Areas OSHA Select Carcinogens require "Designated Areas" where they are stored and handled. Carcinogens should only be handled in Laboratory Hoods or in Glove Boxes unless an initial Hazard Assessment has been done by the PI ***

*Use the Hazardous Chemical Procurement form available from the Chemical Safety Officer*.

## B. Chemical Storage and Transport

1. Chemical storage areas must have a standard KGI "CAUTION" sign that identifies emergency contact personnel and the specific chemical hazard.
2. Please limit the number of flammable liquids stored in your lab to 10 gallons per safety cabinet.
3. Segregate chemicals by hazard classification and compatibility.
    a. Separate oxidizers from flammable, combustible, or any organic material.
    b. Separate acids from acid-sensitive materials such as cyanides and sulfides.
4. Place acid-resistant trays under bottles of mineral acids.
5. Minimize storage of chemicals at the lab bench, in hoods, and at other work areas.
6. Stored chemicals shall be inspected periodically by individual lab managers and annually by the Chemical Safety Officer. The inspection should detect corrosion, deterioration, or damage to the storage container as well as facility as a result of leaking chemicals.
7. Take advantage of the quarterly hazardous waste pickup to purge your labs of old or unwanted chemicals. Properly label and remove barcode and discard through KGI waste pick-up services.
8. No chemicals shall be transported to or from KGI as most chemicals require special transport documentation and are regulated by the Department of Transportation. Please check for details at http://www.dot.gov/, and the Environmental Protection Agency at http://www.epa.gov/.

## C. Chemical Handling

Exposure to all chemicals should be minimized as all chemicals inherently present hazards in certain conditions and concentrations. General precautions for the handling and use of all chemicals are:

1. Use a container size of the minimum convenient volume for the task at hand. Quantities of chemicals at the lab bench should be as small as practical.
2. Avoid skin contact with all chemicals.
3. Wash all skin, which came in contact with chemicals before leaving the laboratory.
4. When leaving the lab, stop all operations, or, for operations that do not require monitoring, make precautions for the interruption of utility service (e.g., loss of water pressure or electricity).
5. Food or beverages shall not be stored in laboratories or in chemical or specimen refrigerators and lab utensils or glassware will not be used for non-laboratory operations such as food or liquid consumption.
6. Treat substances of unknown toxicity as toxic. Any chemical mixture must be assumed to be as toxic as its most toxic component.
7. Laboratory employees must be familiar with the symptoms of exposure for the chemicals with which they work and the precautions necessary to prevent exposure.
8. In all cases of chemical exposure, the OSHA Permissible Exposure Limit (PEL) is not to be exceeded.PEL information on all chemicals can be found in the MSDS.
9. No students shall be allowed to work alone in the lab when working with chemicals. They must use a buddy system and someone must be close by to check on them periodically if not directly in the lab with them.
10. Students are not allowed to order any chemicals at KGI. A lab manager or PI must approve and place the order.

## D. Disposal of Chemicals

1. KGI provides a chemical waste disposal program for the campus. This service is provided at no cost to labs within the generating department. The possible exceptions to this are handling some unknowns.
2. Chemical waste must be disposed of through the KGI waste disposal program. Some non-hazardous chemical waste can be disposed of by pouring down the sewer. Consult KGI Chemical Safety Officer prior to any sewer disposal.
3. All chemical waste containers must be labeled with the word "waste" plus a plain-language description of contents. Please use the waste labels provided to you by the Chemical Safety Officer. Containers must also have a tight fitting lid.

## E. Chemical Spill Response

When a chemical spill occurs, personnel at the spill scene must act quickly to reduce the consequences of the spill. The actions taken depend on the magnitude, complexity, and degree of risk associated with the spill. The following steps outline the actions which should be taken in response to a chemical spill. See also **Appendix A: Chemical Spill Response Guidelines Keck Graduate Institute**

### 1. *Stay clear and warn others.*

Proceed with caution and advise others that are in the immediate area of the spill of the potential danger, if you are unsure of the chemical identity please contact the CSO.

### *2. Assist injured or contaminated persons.*

If persons are injured, provide first-aid if you or another available individual is trained to do so. If persons have been contaminated by the spilled chemical, lead them to the nearest eyewash or emergency shower (depending on the extent / location of the contamination) and assist in washing off the material. However, do not put yourself at risk and become a casualty. Injuries resulting from chemical spills are often medical emergencies, and the **CSO Barb Erwin (7-0160) or Workplace Safety William Roberts (7-7894)** should be immediately notified when this occurs.

### *3. Assess the situation. Is this an emergency?*

An emergency situation exists when there is a high risk to:

- Persons.
- Property.
- Environment.

See the Spill Response Guides **(*Appendix A*)** which provides information on the quantity of spilled material that is considered an emergency for different classes of hazardous chemicals. **These amounts are for guidance only.** Spills of amounts less than that listed may also constitute an emergency depending on the circumstances. Always consider the whole situation when determining if an emergency situation exists or not. All spills in areas accessible to the general KGI community (e.g.: corridors, lobbies) are considered emergencies. Whenever a spill occurs in a public area, contact the **CSO Barb Erwin (7-0160) or Workplace Safety William Roberts (7-7894).**

If an emergency arises, isolate the area and contact the **CSO Barb Erwin (7-0160) or Workplace Safety William Roberts (7-7894)** when informed of an emergency situation, the **CSO Barb Erwin (7-0160) or Workplace Safety William Roberts (7-7894)** will contact the appropriate emergency response persons or team. For this purpose, specific information is needed from the person reporting the incident. This information must include:

- Identity of the person making the report.
- Nature of the incident (fire, explosion, chemical spill, gas leak).
- Location of the incident (building and room number).
- Presence of any injuries.
- When and how the incident occurred.

### *4. Get help for all but minor spills.*

If an emergency does not exist, assistance from outside the immediate work area may still be required. Consider the following;

- Number and training of persons required.
- Personal protective equipment required.
- Spill abatement material required.
- Nature of the spill (e.g. amount spilled, hazards of the spilled chemical).

Minor spills or spills of chemicals of low toxicity and/or volatility can be handled by personnel at the worksite. More serious spills up to the amounts listed in the Spill Response Guides **(*Appendix A)*** may be handled by local personnel with assistance from the KGI Chemical Spill Team. If the nature, quantity or location of the spill exceeds the capacity of spill team personnel to deal with it safely and effectively, then outside help must be requested by contacting the **CSO Barb Erwin (7-0160) or Workplace Safety William Roberts (7-7894).** If there is any doubt regarding the ability of local or spill team personnel to handle a chemical spill, always contact the **CSO Barb Erwin (7-0160) or Workplace Safety, William Roberts (7-7894).**

### *5. Control and clean-up the spill*.

Spill Response Guides **(*Appendix A)*** provides information on the hazards of spills and how they should be handled in terms of containment and clean-up. In all cases, consult the Material safety Data Sheet to obtain more specific information on the chemical spilled to ensure it is cleaned up safely and effectively.

### *6. Report the spill.*

If not already done, report the spill to the CSO and Workplace Safety. All spills, even those which do not require outside assistance, must be reported. See Section **XV** for details on the reporting requirements and procedures.

## F. Glassware and Containers

1. All labs using glassware must have a clearly labeled broken glass container. Broken glassware will be immediately disposed of in this container.
2. All containers of chemicals shall be labeled.
    a. Labels shall be informative and durable

b. Labels will identify contents and general hazards
c. Labels will include the plain-language chemical name
d. The chemical source, receipt date, storage location and initials/identifier of person who prepared the container should also be placed on the label.

## G. Personal Protective Equipment

1. At a minimum, ANSI approved safety glasses are required when there is a need for eye protection because of handling highly toxic or corrosive chemicals.
2. Chemical goggles and/or a full-face shield should be worn during chemical transfer of large quantities of corrosive chemicals.
3. Lab coats are required by OSHA for anyone working directly with or near chemical and biological hazards. OSHA also requires laboratory employers to provide at no cost to the worker a lab coat service. Lab coats are considered protective gear and must ***not be worn outside*** the laboratory (unless in transit between labs). Never cross the parking lot wearing your lab coat. The only exception to the lab coat rule is the Gail Baura Lab Building 517 which conducts sleep studies. (no longer relevant)
4. All labs coats except in the areas designated “pick up and drop off service” must be stored **WITHIN** the lab. Do not store used coats in hallways, offices, or corridors.
5. Wear appropriate chemical-resistant gloves at all times when hands may come in contact with chemicals. Discard damaged or deteriorated gloves immediately.
6. Wear thermal-resistant (non-asbestos) gloves when handling heated materials and exothermic reaction vessels. Discard damaged or deteriorated gloves immediately.
7. Respirators may be required for certain procedures, as determined by the lab's supervisor/PI in consultation with the Chemical Safety Officer.
8. Closed toed shoes must be worn in the laboratories at all times. Absolutely no sandals or open shoes will be allowed.
9. Avoid wearing skirts and shorts while working with hazardous reagents as this will expose the legs to potential injury.

## H. Personal Work Practices

1. Each KGI employee working in a laboratory must develop work habits consistent with this Chemical Hygiene Plan to minimize exposure to the chemicals. Laboratory Safety Rules should be understood and followed.
2. Plan operations, equipment and protective measures based on knowledge of the chemicals in use.
3. Use engineering controls (e.g., hoods, centrifuge rotor hoods) appropriately to minimize chemical exposure.
4. Wear appropriate protective equipment as procedures dictate and when necessary to avoid exposure.
5. Report unsafe laboratory practices or conditions to the Lab Supervisor/PI. The Lab Supervisor/PI should correct unsafe practices or conditions promptly.

## I. Safe Housekeeping Practices

The Occupational Safety and Health Act (OSH Act) requires employers to comply with hazard-specific safety and health standards. In addition, pursuant to Section5(a)(1) of the OSH Act, often referred to as the General Duty Clause, employers must provide their employees with a workplace free from recognized hazards likely to cause death or serious physical harm. OSHA has previously used the General Duty Clause to cite employers for

exposing employees to potential physical harm OSHA's General Requirements for Housekeeping related to Walking-Working Surfaces, CFR 1910.22 , applies to all permanent places of employment. Good housekeeping reduces injuries and accidents, improves morale, reduces fire potential, and can even make operations more efficient. The following example is taken from OSHA's Standard on Employee Emergency Plans and Fire Prevention Plans: 29 CFR 1910.38 (b)(3) Housekeeping: “The employer shall control accumulations of flammable and combustible waste materials and residues so that they do not contribute to a fire emergency. Proper housekeeping as a method of fire control is also covered in 1910.37 (a)(3), requiring that exit routes must be free and unobstructed. No materials or equipment may be placed, either permanently or temporarily, within the exit route.

### Specific laboratory housekeeping concerns include:

a. Keep the laboratory neat and free of clutter. Surfaces should be clean and free of infrequently used chemicals, glassware and equipment.
b. Access to sinks, eyewashes, emergency showers and fire extinguishers must not be blocked.
c. Properly dispose of chemicals and wastes. Old and unused chemicals should be disposed of promptly and properly, by removing barcode tag from inventory.
d. Provide a workplace that is free of physical hazards. Aisles and corridors should be free of tripping hazards. Attention should be paid to electrical safety, especially as it relates to the use of extension cords, proper grounding of equipment, and avoidance of overloaded electrical circuits and avoidance of the creation of electrical hazards in wet areas.
e. Remove unnecessary items on floors, under benches or in corners.
f. Properly secure all compressed gas cylinders.
g. Never use fume hoods for storage of chemicals or other materials.
h. Promptly remove all autoclaved items from the autoclave room when sterilization is complete.
i. All autoclave bags must be red biohazard bag for sterilization, labeled with Name and Date written across autoclave tape. After sterilization please place the red bag into a black trash bag for outside disposal. See Appendix B for complete autoclaving details.

# V. Safety Signs, Emergency/Safety Equipment, Engineering Controls, Special Rooms, General Precautions

## A. Safety Signs

1. Each main hallway entrance to a laboratory room/area, all chemical storage rooms and all cold rooms and warm rooms will have a standard "Right to Know" sign listing the individuals to contact in the event of an emergency.
2. Labs working with Carcinogens must post a “Carcinogen Sign” to inform all entrants to the lab.
3. The location of safety and emergency equipment within the laboratory, including spill kits, should be identified by signs.
4. Warning signs are required in the event of engineering controls or special room failures or certain spills.

## B. Emergency/Safety Equipment

1. Emergency showers shall be inspected annually by Facilities Services. And records of inspections will be maintained.
2. All laboratory personnel will have the opportunity to be trained in the proper use of fire extinguishers.
3. Eyewash stations shall be inspected weekly by laboratory employees to determine that they operate. Records of inspections shall be maintained in the laboratory.
4. All laboratory safety equipment (e.g., safety glasses, gloves, noise earmuffs) shall be inspected at appropriate intervals by the lab workers for operational sufficiency. Records are not required.
5. Keep access to fire extinguishing equipment, eye washes, showers, electrical disconnects and other emergency equipment unobstructed.

## C. Engineering Controls

Engineering controls installed in the laboratory are intended to minimize employee exposure to chemical and physical hazards. Examples are laboratory fume hoods, exhaust ducts, and centrifuge rotor lid.

1. Inspection and Maintenance
    a. Improper function of building engineering controls (hoods, exhaust ducts) must be immediately reported to the CSO and the system must be taken out of service until proper repairs have been completed. A sign should be posted indicating that it is out of service. The CSO will send an email to all employees to alert them of the out of service and will also alter them when the instrument is back in operation.
    b. Engineering controls must be inspected periodically for operational sufficiency (e.g., air is moving in hoods, rotor lids are not cracked) by the Lab Supervisor/Manager/PI.
    c. Engineering controls will not be modified unless approved by the Chemical Safety Officer.

2. Fume Hoods
    a. Hoods shall be utilized for chemical procedures that might result in release of hazardous chemical vapors or dust.
    b. Be certain that the hood is operating before using it. All hoods shall have a flow indicator on the sash.
    c. After using hoods, continue to operate the fan until residual contaminants clear the duct work.
    d. Inform the Chemical Safety Officer of the use of unfamiliar chemicals or procedures to determine if the ventilation system is adequate to protect employees.
    e. Always keep the sash of the hood closed or below the height specified by the inspection sticker. When using the hood workspace, maintain the sash height as low as possible.
    f. Place sources of air contaminants as close to the back of the hood as possible, and always at least 6" back from the sash.
    g. Minimize storage of chemicals and equipment inside the hood.

h. Minimize interference with the inward flow of air into the hood.
i. Leave the hood operating when it is not in active use if chemical hazards are contained inside the hood or if it is uncertain whether there is adequate general laboratory ventilation.
j. Hoods shall be inspected upon installation and annually or by request, by The CSO. The hood face velocity shall be tested at each inspection to ensure that it is maintained between 100 to 125 feet per minute. A record of the most recent inspection shall be placed on the hood, and historical records will be retained by CSO.

### D. General Precautions

1. Preparation of food is not permitted in laboratory spaces where chemicals are used.
2. Eating and drinking are not permitted in laboratories where chemicals are used.

# VI. Employee Training, Hazard Information, and Personal Protection

### A. General Training

1. Each employee shall receive training at the time of initial assignment to the laboratory, before assignments involving new exposure situations, and at a regular frequency as determined by the Chemical Safety Officer. Training is mandatory and CAL-OSHA inspections are likely to include a survey of random individuals about the knowledge required to be presented in this training. Training will include:
    a. Location and details of the KGI Chemical Hygiene Plan (this document) and, if applicable, the Laboratory Chemicals: Standard Operating Procedure (SOP)
    b. A review of the Laboratory Safety Rules
    c. How to use MSDS's and their utility in the laboratory
    d. Location of the Permissible Exposure Limits (PELs) for OSHA-regulated substances.
    e. Chemical hazards in the laboratory, including medical signs and symptoms associated with acute and chronic exposure to those chemicals present in the laboratory that are potentially hazardous to the employee's health given quantities in use. Quantities may include very small amounts for carcinogens such as benzidine or large quantities for solvents with PELs over 500 ppm such as acetone;
    f. Location and availability of reference material on chemical safety;
    g. Location and proper use of emergency showers and eye washes for employees who might be exposed to chemical splashes and discussion of chemicals in the lab requiring urgent medical action. Exceptions to 15-minute flushing with water (e.g., hydrofluoric acid) must be discussed;
    h. Location and *use* of fire extinguishers and other lab safety equipment and personal protective equipment relevant to the employee's work;
    i. Building escape routes for use in the event of a fire or serious release of agents that are hazardous.
2. Supervisors are required to document all training.

### B. Hazard Information

1. The CUC Hazard Communication booklet should be available in each laboratory
2. Material Safety Data Sheets (MSDS's) describe relevant safety and health information for a chemical. MSDS's for chemicals used in the laboratory should be in each laboratory or access to the main University MSDS data base should be immediately available.
3. MSDS's can be obtained from NIOSH. http://www.cdc.gov/NIOSH/

### C. Personal Protection

1. All standard laboratory safety practices, such as the wearing of eye protection, shall be observed.
2. Prohibited Activities in Laboratories Where Chemicals are used. There shall be no eating, drinking, smoking, chewing of gum or tobacco, application of cosmetics, use of cell phones, or storage of food in areas where chemicas are used.
3. Pipetting. Pipetting of chemicals by mouth is absolutely prohibited. Mechanical pipettes shall be used for pipetting.
4. Supplementary Training. The Safety Committee will be responsible for providing periodic workshops and training sessions which cover current information, procedures and equipment available for the use of chemicals in laboratories.

## VII. Special Precautions

### A. Hazardous Work

1. Procedures in each laboratory will be evaluated by the Lab Supervisor/Manager/PI and the Chemical Safety Officer, and those that are deemed hazardous (e.g., use of significant quantities [10 x LD (lethal dose) 50] as defined on MSDS's or SARA Title III chemicals, and must be identified in the Laboratory Chemical Hygiene Plan.
2. All hazardous operations are to be performed while at least two people are present at the laboratory (or lab area if documented in the Laboratory Chemical Hygiene Plan).

### B. Allergens, Embryotoxins and Teratogens

1. Areas where such agents are used will be identified by a standard caution sign.
2. Wear suitable gloves to prevent hand contact and wear other protective gear (e.g., lab coats) when exposed to allergens.
3. Allergens and embryotoxins will be stored in adequately ventilated areas in unbreakable secondary containers.
4. Handle reproductive toxins only in a hood with a current (within 1 year) inspection label and use protective equipment to prevent skin contact as prescribed by the Lab Supervisor/PI and the KGI Chemical Safety Officer.
5. The Lab Supervisor/Manager/PI, HR, the KGI Spill Teams and Chemical Safety Officer will be notified of significant spills and other personal exposure incidents.

### C. Chemicals of High Acute Toxicity

1. Areas where these chemicals are stored and used will have restricted access and have [specific] warning signs naming the hazard types.
2. Vacuum pumps when used with these chemicals must have scrubbers or High Efficiency Particulate Absolute (HEPA) filters.
3 Approval of the Chemical Safety Officer and Lab Supervisor/Manager/PI will be obtained before initiating a new procedure using these chemicals.

4 The Lab Supervisor/Manager/PI will be knowledgeable of chemicals in use and will be required to fill out the: Chemical Procurement, and Hazardous Chemicals: Standard Operating Procedures forms for that particular chemical prior to purchase and or use.

### D. Chemicals of High Chronic Toxicity

1 Such chemicals will be maintained in labeled, unbreakable, chemically resistant containers and stored in a limited-access area appropriate for the chemical.
2 Areas where such agents are used shall be identified by a sign on the hood, glove box or lab area.
3 The Lab Supervisor/Manager/PI will be knowledgeable of chemicals in use and will approve new procedures prior to implementation.
4 Vacuum pumps when used with these chemicals must have scrubbers or High Efficiency Particulate Air (HEPA) filters.
5 Any contaminated equipment or glassware will be decontaminated as soon as possible and before further use.
6 For powders, a wet mop or vacuum with a HEPA filter will be used for cleanup, and the waste will be immediately disposed of.
7 The Lab Supervisor/Manager/PI will be knowledgeable of chemicals in use and will be required to fill out the: Chemical Procurement, and Hazardous Chemicals: Standard Operating Procedures forms for that particular chemical prior to purchase and or use.

## VIII. Medical Attention and Surveillance

### A. Medical Attention

1. An opportunity to receive medical attention from a licensed physician is available to all employees who work with hazardous chemicals in the laboratory.
2. The opportunity for medical attention will be made available to employees at no cost and without loss of pay under the following circumstances:
    a. Whenever an employee develops signs or symptoms associated with a hazardous agent to which the employee may have been exposed in the laboratory;
    b. Whenever there is a spill, leak, explosion or other occurrence resulting in the likelihood of an exposure hazardous to health or if a PEL is exceeded. A medical examination must be provided in the event a PEL is exceeded in a personal exposure.

### B. Medical Surveillance Programs

1. Medical surveillance will be established when exposure monitoring determines a need or if it is likely that an exposure to a hazardous chemical has occurred.

## IX. Laboratory Accidents

This section includes over-exposures to hazardous agents.

### A. Injuries or Over-exposures (Aid to Employees)

1. An exposure exceeding an OSHA PEL is an “over-exposure.”

2. If an employee is seriously injured or incapacitated, call 9-911 to obtain emergency medical treatment. Never enter an enclosed space where a person appears unconscious without assistance from KGI emergency personnel.
3. Chemical splashes require immediate flushing of the affected areas. 15 minutes of flushing for significant splashes or any splash in the eye is recommended. Eye wash stations and lab deluge showers are intended for this purpose.
4. For minor injuries, treat with the laboratory first aid kit or contact Cynthia Ferrini HR for approval in transporting the person to the KGI designated hospital. Treatment should prevent exposure to chemicals if the injured person will continue to work in the lab prior to healing (e.g., a cut on the finger will be covered by a bandage and the person will wear a plastic glove until the cut is fully healed).
5. Most injuries or over-exposure events require completion of a “Report of Accident” form **WHICH** can be obtained from the KGI Human Resource office.

### B. Accident or Over-exposure Investigations

1. Accident or over-exposure investigations will be conducted by the immediate supervisor with assistance from other personnel as deemed necessary.

# X. Laboratory Incidents near Misses: Introduction and Reporting

## A. Scope of Investigation and Analysis

A **near miss** is an unplanned event that did not result in injury, illness, or damage - but had the potential to do so. Only a fortunate break in the chain of events prevented an injury, fatality or damage. An **incident** is defined as “an occurrence or event that interrupts normal procedure or precipitates a crisis”. Although human error is commonly an initiating event, a facility process or system invariably permits or compounds the harm, and should be the focus of improvement. Other familiar terms for these events is a "close call", or in the case of moving objects, "near collision". The often misunderstood phrase is so-called to stress that not only had things gone remotely off course towards danger, but they had actually only "barely missed" catastrophe.

- Near misses are smaller in scale, relatively simpler to analyze and easier to resolve. Thus capturing near misses not only provides an inexpensive means of learning it has some equally beneficial spin offs.

    1. Captures sufficient data for statistical analysis; trending studies.

    2. Provides immense opportunity for ‘employee participation’ a basic requirement for successful Chemical and Biological Laboratory Safety Program. This embodies principles of behavior shift, responsibility sharing, awareness, and incentives etc.

- Near Miss a Zero Cost Learning Tool: A near miss is a cheaper learning tool than learning from actual injury or property loss accident.

- An ideal near miss event reporting system includes both mandatory (for incidents with high loss potential) and voluntary, (non-punitive reporting by witnesses). A key to any near miss report is the "lesson learned". Near miss reporters are in a position to describe what they observed about genesis of the event, and the factors that prevented loss from occurring.

- The events that caused the near miss are subjected to root cause analysis to identify the defect in the system that resulted in the error and factors that may either amplify or ameliorate the result.

- To prevent the near miss from happening again, the organization must institute teamwork training, feedback on performance, and a commitment to continued data collection and analysis; a process called continuous improvement.

## B. General process of investigation and analysis for documenting a Corrective Action

After any workplace accident, even when no injury occurs, an incident report allows managers to determine how to prevent similar occurrences. An incident report is used to document significant events. Incident/ Near Miss forms are the most critical part of successful corrective action, because it directs the corrective action at the root of the problem. That is to say, it is effective solutions we seek, not root causes. Root causes are secondary to the goal of prevention, and are only revealed after we decide which solutions to implement.

1. Define the problem.
2. Gather data/evidence through reports, interviews and investigation of laboratory or facilities involved in the incident.
3. Ask why and identify the causal relationships associated with the defined problem.
4. Identify which causes if removed or changed will prevent recurrence.
5. Identify effective solutions that prevent recurrence, that are within your control, meet your goals and objectives and do not cause other problems.
6. Implement the recommendations.
7. Observe the recommended solutions to ensure effectiveness.
8. Apply Root Cause Analysis (RCA) to aid in investigation and final analysis.

## C. Analysis Tool for Investigation (root cause analysis RCA)

**Root cause analysis (RCA)** is a class of problem solving methods aimed at identifying the root causes of problems or events. The practice of RCA is predicated on the belief that problems are best solved by attempting to correct or eliminate root causes, as opposed to merely addressing the immediately obvious symptoms. By directing corrective measures at root causes, it is hoped that the likelihood of problem recurrence will be minimized. However, it is recognized that complete prevention of recurrence by a

single intervention is not always possible. Thus, RCA is often considered to be an iterative process, and is frequently viewed as a tool of continuous improvement.

RCA, initially is a reactive method of problem detection and solving. This means that the analysis is done after an event has occurred. By gaining expertise in RCA it becomes a pro-active method. This means that RCA is able to forecast the possibility of an event even before it could occur. Root cause analysis is not a single, sharply defined methodology; there are many different tools, processes, and philosophies of RCA in existence. However, most of these can be classed into five, very-broadly defined "schools" that are named here by their basic fields of origin: safety-based, production-based, process-based, failure-based, and systems-based.

- **Safety-based RCA** descends from the fields of accident analysis and occupational safety and health.
- **Production-based RCA** has its origins in the field of quality control for industrial manufacturing.
- **Process-based RCA** is basically follow-on to production-based RCA, but with a scope that has been expanded to include business processes.
- **Failure-based RCA** is rooted in the practice of failure analysis as employed in engineering and maintenance.
- **Systems-based RCA** has emerged as an amalgamation of the preceding schools, along with ideas taken from fields such as change management, risk management, and systems analysis**.**

## D. Incident Reporting and Procedures

A. An incident is defined as “an occurrence or event that interrupts normal procedure or precipitates a crisis”. Therefore it is important in the investigation process that all incidents no matter how minor they may seem must be reported to the lab manager, PI, and the Chemical Safety Officer (CSO). The CSO may escalate the incident to the President and Dean if deemed necessary and especially when, people, property and the environment are at risk.
B. The CSO must start an investigation beginning with an initial lab inspection.
C. Each person involved in the incident must fill out an Incident Report provided by the CSO. The reports must be completed within five (5) business days following the reporting.
D. If deemed necessary the CSO may require an interview from each lab member.
E. Once the interviews and Incident reports are complete the CSO may require additional information from any lab member if needed in order to collect sufficient data to provide efficient corrective actions.
F. The CSO will deliver a full report to the President, Dean and Human Resource Manager.
G. The CSO will provide the PI and lab members with a list of corrective actions, time lines for completion and follow up dates for a final inspection.

# XI. Laboratory Inspections

A. The Chemical and Biological Safety Officer will inspect each laboratory annually.

B. The purpose of the inspection is to verify that this Plan and, if applicable, the Hazardous Chemicals: Standard Operating Procedures (SOP) are being followed and to identify needed changes in procedures. The form entitled “Laboratory Inspection Checklist and Report is used for this inspection and could be used for a self-inspection by laboratory staff. Please inquire with the CSO to receive a form.
C. A written inspection report (the checklist with correction actions) will be provided to the Lab Manager/Supervisor/PI and maintained on file in the by the Chemical Safety Officer.
D. The Lab Supervisor/Manger/PI is responsible for taking corrective action for deficiencies when indicated in the written inspection report. Deficiencies must be corrected within one week after receiving the final report.
E. At the end of one week following inspection the CSO will inspect the lab for compliance.
F. If deficiencies are ignored immediate action may be taken by the CSO officer to include but not limited to Lab closure and unfavorable implications of annual reviews. If necessary the non compliant behaviors may be escalated to the President and Dean for immediate corrective action.

# XII. List of Chemicals in Laboratory (Annual)

Once a year, each laboratory will do an inventory of all chemicals in their labs. They are required to compare a specific lab list against KGI’s Chemical Database accounting for all chemicals routed to that laboratory. Inventory list should be completed within one week from the day the list is received. Failure to comply with inventory will be followed up by KGI President/Dean for compliance. Each Lab Supervisor/Manger/PI is responsible for maintaining a proper inventory, by inspecting each chemical as they come into the lab for a barcode and to remove and report the barcode to the Chemical Safety Officer before disposal so that it can be removed from the database.

# XIII. Record keeping

a. Accident or over-exposure incident reports must be sent to KGI HR and must be retained for 5 years.
b. Records of exposure to personal or biological monitoring of hazardous chemicals and other harmful agents will be maintained in HR for the duration of employment of the exposed employee, plus 30 years.
c. Medical records for employees developed as a result of exposure to hazardous chemicals or harmful agents will be maintained for the duration of employment, plus 30 years, in HR.
d. Results of area air sampling will be maintained by HR for 5 years.
e. Records of employee training will be maintained for 5 years in the employee’s departmental personnel record.
f. Records of laboratory inspections will be maintained for 5 years by the Chemical Safety Officer.

# XIV. Select Carcinogens: KGI Use Policy

## I. References

A. California Code of Regulations, Title 8, General Industry Safety Orders
B. National Institute of Health, National Toxicology Program (NTP), Annual Report on Carcinogens
C. International Agency for Research on Cancer (IARC) Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans

## II. Policy

The use of chemical carcinogens shall be planned and performed in a manner that minimizes risk and ensures a safe and healthful environment. Acquisition, use, storage, and disposal of chemical carcinogens shall be done in compliance with State and Federal law and in accordance with KGI policy and procedures.

Chemical carcinogen users at KGI shall strive to reduce exposure to the lowest practicable level. For the purposes of this policy, chemical carcinogens include chemical carcinogens regulated by standards promulgated by the California Occupational Safety & Health Administration (Cal-OSHA) pursuant to Title 8, section 5191 Occupational Exposure to Hazardous Chemicals in Laboratories; and Title 8, Subchapter 7, General Industry Safety Orders, Group 16, Control of Hazardous Substances, Article 110, Regulated Carcinogens.

For a complete list of chemical carcinogens located in each lab please refer to the NFPA sign located on each lab door. A full list of known carcinogens is located directly behind the NFPA sign.

# XV. Enforcement of Chemical Hygiene Plan

## A. Administration Commitment

Sometimes it is necessary for employees, especially laboratory and facilities maintenance personnel, to work with or around potentially hazardous substances. In these instances, it is important that employees are aware of the identity of the substance, including its health-related and physical properties, and the work practices required to minimize potential hazards.

KGI has provided engineering controls, personal protective equipment, emergency equipment and this Chemical Hygiene Plan (CHP) as measures to ensure a safe work environment for employees working in laboratories and support areas. The President and Dean of the University are fully committed to enforcing policies that provide a safe and healthful work environment for all employees, students and visitors to the university. As a result all accidents, incidents, near misses and non-compliance to safety will be reported directly to them. The President and Dean of the University have given the Chemical Safety Officer complete authority to determine and enforce correction actions. Failure to comply will escalate to the immediate attention of the President and Dean.

## B. Enforcement Steps

If a supervisor or principal investigator shows disregard for the contents of this plan, the following steps will be taken to correct the situation:

1. The CSO will notify the individual of the problem. The individual will be given the opportunity to comply in a timely manner, except where, people, property and the environment might be in imminent danger, then immediate action will be necessary.

2. If there is still a problem following step 1, then the President and Dean will be notified. The President and Dean will consider and enforce further action.

# XVI. References

## A. Governmental Agency Websites

**DOT Department of Transportation**
http://www.dot.gov/

**EPA Environmental Protection Agency**
http://www.epa.gov/

**OSHA Occupational Safety and Health Administration**/ OSHA STANDARDS SUBPART Z - Toxic and Hazardous Substances Hazard Communication Standard CFR 1910.1200 http://www.osha.gov/

**NIOSH National Institute of Occupational Safety and Health**
http://www.cdc.gov/niosh/homepage.html

## B. Internet Sites: SDS and Chemical Information

Vermont SIRI
http://siri.uvm.edu/index.html
Fisher Scientific
https://www1.fishersci.com/support/hlth/chemicals.jsp
Sigma Aldrich
http://www.sigmaaldrich.com/Area_of_Interest/The_Americas/United_States/Safety_Information.html