KGI KECK GRADUATE INSTITUTE

Chemical Hygiene Plan

Laboratory Safety Manual

Version 10. Revised on 07/25/2024 by Laboratory Safety Manager, Jasmine Yu

Reviewed and approved by: Laboratory, Chemical and Biological Safety Committee (LCABS)

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Occupational Exposure to Hazardous Chemicals in Laboratories

Contents

I. Purpose and 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/Associate Vice Provost 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. Jasmine Yu 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:
   - Work with administrators and other employees to develop and implement appropriate chemical and biological hygiene policies and practices.
   - Inspect any KGI facility and investigate any accident involving KGI employees, students or equipment.
   - Temporarily suspend the operations in any KGI laboratory in which the practices represent an imminent health hazard.
   - Monitor procurement of chemicals.
   - Oversee the performance of regular, formal chemical hygiene inspections and inspections of emergency equipment in all KGI laboratories.
   - Assist Lab Supervisors/PI and Laboratory Managers to develop safety precautions and adequate facilities.
   - Maintain current knowledge concerning the legal requirements of regulated substances in the laboratory.
   - Review the KGI Chemical Hygiene Plan annually.
   - Monitor safety training for compliance with code-mandated items.
   - 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:
   - Develop a Laboratory Chemical Safety Plan for chemicals specific to their lab use.
   - Provide a periodic Risk Assessment to inspect their laboratories for unsafe conditions and practices and take appropriate corrective action.
   - Provide the required safety training to the employees and students that work in their laboratories. Document the training provided.
   - Investigate injuries to lab employees or over-exposure events.
   - Evaluate the need for protective equipment or chemical exposure monitoring.
   - Request appropriate monitoring from KGI Chemical Safety Officer if necessary.

D. Laboratory employee

1. Laboratory employee include research staff, graduate students, student volunteers and anyone else who work in KGI research labs for more than 5 days.
2. The laboratory employee is responsible for:
   - Completing safety training sessions as required.
   - Work in accordance with the Chemical Hygiene Plan and Laboratory Specific Operating Procedures (SOPs).
   - Utilizing appropriate engineering controls and personal protective equipment.
   - Developing good chemical hygiene habits, including keeping a neat work area.
   - Becoming knowledgeable about the hazard potential of each chemicals used in the laboratory
   - Reporting any injuries, accidents, and near misses to supervisor

E. 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)

1. 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)
2. 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 an approval prior to using the chemical. Upon approval the SOP in it's written form must be kept on file in the laboratory and with the KGI Chemical Hygiene Plan.
3. 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.
4. For a detailed list of hazardous chemicals at KGI see Jasmine Yu. Safety Instructions and OSHA standards can be obtained from OSHA web site: 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

Chemical storage areas must have a standard KGI "CAUTION" sign that identifies emergency contact personnel and the specific chemical hazard.

1. Please limit the number of flammable liquids stored in your lab to 10 gallons per safety cabinet.
2. Segregate chemicals by hazard classification and compatibility.
3. Separate oxidizers from flammable, combustible, or any organic material.
4. Separate acids from acid-sensitive materials such as cyanides and sulfides.
5. Place acid-resistant trays under bottles of mineral acids.
6. Minimize storage of chemicals at the lab bench, in hoods, and at other workareas.
7. 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.
8. 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.
9. 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 dot.gov, and the Environmental Protection Agency at 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 SDS.
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 Hazardous Chemical Waste

What is Hazardous Chemical waste?

A hazardous chemical waste is a solid, liquid or gaseous material that is ignitable, corrosive, reactive, or toxic.

The **ignitability** characteristic applies to wastes that are:

- Liquids with a flash point less than 140°F
- Solids capable of spontaneous combustion under normal temperature and pressure
- Oxidizing materials o Ignitable compressed gases
- Examples include ethanol, sodium nitrate, hydrogen gas, xylene and acetone

The **corrosivity** characteristic applies to wastes that are:

- Aqueous solutions with a pH less than or equal to 2 or greater than or equal to 12.5
- This does not apply to solid or non-aqueous materials
- Examples include hydrochloric acid, nitric acid, and sodium hydroxide

The **reactivity** characteristic applies to the following:

- Materials that react violently or generate toxic fumes when mixed with water
- Cyanide or sulfide bearing wastes which evolve toxic fumes when mixed with acids or bases
- Materials that are normally unstable or explosive
- Examples include sodium metal, reactive sulfides, potassium cyanide andpicric acid

The **toxicity characteristic** applies to wastes that have the potential to contaminate groundwater if improperly disposed of. These materials are regulated as hazardous waste due to their potential to leach out specific toxic substances in a landfill. There are currently 40 contaminants on the list that include certain heavy metals, pesticides and organic compounds. Examples include chloroform, mercury, pyridine.

Satellite Accumulation of Waste in the Lab

Each location in labs where hazardous waste is generated and stored is a satellite accumulation area. There are specific requirements for managing chemical waste within these areas

- All chemical waste containers must have a tight fitting lid and be free of drips.

- Waste containers must be appropriately 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.
- The initial date that hazardous waste is placed in the container must by clearly marked and visible.
- Hazardous waste must be stored in secondary containment. Separate incompatible waste containers in separate secondary containment.
- Laboratory Satellite Accumulation Areas may not accumulate more than fifty- five gallons of a hazardous waste or more than one quart of any single extremely or acutely hazardous waste.
- Extremely hazardous waste is defined by 22CCR 66260.10 as “wastes… that may likely result in death, disabling personal injury or serious illness caused by the hazardous waste or mixture of hazardous waste because of its quantity, concentration or chemical characteristics.” These include wastes that are water reactive, are of high acute or chronic toxicity based on LD50 values, carcinogenicity, or bioaccumulative persistence.
- College operational maximum accumulation time even if quantity limits are not reached is nine months. 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.
- North State Environment is the commercial hauler that KGI uses to collect chemical, sharps, glass and other hazardous waste. CSO schedules the pickup time with North State Environment quarterly and inform KGI community.
- Chemical waste must be disposed of through the KGI waste disposal program. Waste that is contaminated with chemical hazards must be disposed as chemical hazardous waste. Somenon-hazardous chemical waste can be disposed of by pouring down the sewer. Consult KGI Chemical Safety Officer prior to any sewer disposal.
- Chemicals with damaged, unlabeled, mislabeled, or do not contain adequate hazard warnings are also considered hazardous waste if not corrected within ten days.

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.

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 Jasmine Yu (7-8698) 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 Guideline 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 Jasmine Yu (7-8698). If an emergency arises, isolate the area and contact the CSO Jasmine Yu (7- 8698) when informed of an emergency situation, the CSO Jasmine Yu (7-8698) 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 spilledchemical).

   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 Guideline 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 Jasmine Yu (7-8698). If there is any doubt regarding the ability of local or spill team personnel to handle a chemical spill, always contact the CSO Jasmine Yu (7-8698).

5. Control and clean-up the spill.

   Spill Response Guideline 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.
   - Labels shall be informative and durable
   - Labels will identify contents and general hazards
   - Labels will include the plain-language chemical name
   - 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.
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

- 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.
- Plan operations, equipment and protective measures based on knowledge of the chemicals in use.
- Use engineering controls (e.g., hoods, centrifuge rotor hoods) appropriately to minimize chemical exposure.
- Wear appropriate protective equipment as procedures dictate and when necessary to avoid exposure.
- 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 forexposing 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:

- Keep the laboratory neat and free of clutter. Surfaces should be clean and free of infrequently used chemicals, glassware and equipment.
- Access to sinks, eyewashes, emergency showers and fire extinguishers must not be blocked.
- Properly dispose of chemicals and wastes. Old and unused chemicals should be disposed of promptly and properly, by removing barcode tag from inventory.
- Provide a workplace that is free of physical hazards. Aisles and corridors should be free of ripping 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.
- Remove unnecessary items on floors, under benches or in corners.
- Properly secure all compressed gas cylinders.
- Never use fume hoods for storage of chemicals or other materials.
- Promptly remove all autoclaved items from the autoclave room when sterilization is complete.
- 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 monthly by TCCS Campus Facilities Services (CFS). 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. Fire extinguishers are inspected monthly by KGI facility and annually by fire protection services: Marx Bros Fire Extinguisher. If a unit needs charging or replacing, Marx Brothers will be contacted.
3. Eyewash stations shall be inspected monthly by TCCS Campus Facility Services 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

- 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.
- 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.
- Engineering controls will not be modified unless approved by the Chemical Safety Officer.

2. Fume Hoods

- Hoods shall be utilized for chemical procedures that might result in release of hazardous chemical vapors or dust.
- Be certain that the hood is operating before using it. All hoods shall have a flow indicator on the sash.
- After using hoods, continue to operate the fan until residual contaminants clear the duct work.
- Inform the Chemical Safety Officer of the use of unfamiliar chemicals or procedures to determine if the ventilation system is adequate to protect employees.
- 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.
- Place sources of air contaminants as close to the back of the hood as possible, and always at least 6” back from the sash.
- Minimize storage of chemicals and equipment inside the hood. Minimize interference with the inward flow of air into the hood.
- 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.
- Hoods shall be inspected upon installation and annually thereafter. 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:

- Location and details of the KGI Chemical Hygiene Plan (this document) and, if applicable, the Laboratory Chemicals: Standard Operating Procedure (SOP)
- A review of the Laboratory Safety Rules
- How to use SDS's and their utility in the laboratory
- Location of the Permissible Exposure Limits (PELs) for OSHA-regulated substances.
- 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;
- Location and availability of reference material on chemical safety;
- 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;
- Location and use of fire extinguishers and other lab safety equipment and personal protective equipment relevant to the employee's work;
- Building escape routes for use in the event of a fire or serious release of agents that are hazardous. Supervisors are required to document all trainings.

B. Hazard Information

1. The CUC Hazard Communication booklet should be available in each laboratory.
2. Safety Data Sheets (SDS) describe relevant properties, safety precautions and health information for a chemical. According to OSHA Hazard Communication Standard, 29 CFR 1910.1200, "the employer shall maintain in the workplace copies of the required SDS for each hazardous chemical, and shall ensure that they are readily accessible during each work shift to employees when they are in their work areas."
3. Hard copies of SDS sheets for chemicals stored in a lab are kept in SDS binder in each lab. It is laboratory PI/staff's responsibility to update the binder.
4. KGI also maintain SDS inventory for all research labs on SDSonline.com. SDS can be obtained from SDSonline.com, vendor websites, or WISER app on smart phone.
5. All laboratory employee should be trained by PI or lab manager to know how to access SDS before working with chemicals.

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 chemicals 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 SDS'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:
3. Whenever an employee develops signs or symptoms associated with a hazardous agent to which the employee may have been exposed in the laboratory;
4. 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 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 Cheryl Merritt 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.

IX. 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
3. 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

1. 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.
2. The CSO must start an investigation beginning with an initial lab inspection.
3. Each person involved in the incident must fill out an Incident Report provided bythe CSO. The reports must be completed within five (5) business days following the reporting.
4. If deemed necessary the CSO may require an interview from each lab member.
5. 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.
6. The CSO will deliver a full report to the President, Dean and Human Resource Manager.
7. The CSO will provide the PI and lab members with a list of corrective actions, timelines for completion and follow up dates for a final inspection.

XI. Laboratory Inspections

1. The Chemical and Biological Safety Officer will inspect each laboratory annually.
2. 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.
3. A written inspection report (the checklist with correction actions) will be provided to the Lab Manager/Supervisor/PI and maintained on file by the Chemical Safety Officer.
4. 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.
5. At the end of one week following inspection the CSO will inspect the lab for compliance.
6. 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 noncompliant 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

1. Accident or over-exposure incident reports must be sent to KGI HR and must be retained for 5 years.
2. 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.
3. 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.
4. Results of area air sampling will be maintained by HR for 5 years.
5. Records of employee training will be maintained for 5 years in the employee's departmental personnel record.
6. Records of laboratory inspections will be maintained for 5 years by the Chemical Safety Officer.

XIV. Select Carcinogens: KGI Use Policy

A. References

1. California Code of Regulations, Title 8, General Industry Safety Orders
2. National Institute of Health, National Toxicology Program (NTP), Annual Report on Carcinogens
3. International Agency for Research on Cancer (IARC) Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans
4. Appendix J: Basis of OSHA Carcinogen Listing for Individual Chemicals.

B. 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 dot.gov
- EPA Environmental Protection Agency epa.gov
- OSHA Occupational Safety and Health Administration/ OSHA STANDARDS SUBPART Z - Toxic and Hazardous Substances Hazard Communication Standard CFR 1910.1200 osha.gov
- NIOSH National Institute of Occupational Safety and Health cdc.gov/niosh/homepage.html

B. Internet Sites: SDS and Chemical Information

Vermont SIRI siri.uvm.edu/index.html

- Fisher Scientific www1.fishersci.com/support/hlth/chemicals.jsp
- Sigma Aldrich sigmaaldrich.com/Area_of_Interest/The_Americas/United_States/Safety_Inf ormation.html
- SDSonline.com

Appendix A: Chemical Spill Response Guideline

1. Introduction

A chemical spill is defined as the uncontrolled release of a hazardous chemical, either as a solid, liquid or a gas. Chemical spills at Keck Graduate Institute may occur in a variety of worksites, from research & teaching laboratories, to facilities operations. The challenges related to dealing with chemical spills will vary with the type and volume of chemical involved. Chemical spills in laboratories generally involve small volumes of a potentially large number of chemicals.

Regardless of the type or quantity of hazardous chemical involved, all worksites must implement measures to reduce the potential for spills and have a plan for responding to chemical spills. This document describes generic methods for preventing chemical spills, responding to spills of low or moderate hazard and information on reporting and addressing higher hazard chemical spills at Keck Graduate Institute.

2. Roles and Responsibilities

2.1. Chemical Safety Officer

- Implement measures to prevent potential spills of hazardous materials.
- Develop “site specific” spill response procedures where controlled products are used or stored that present a special risk upon exposure.
- Appoint Chemical Spill Team members; and a Team Captain
- Provide support to the Chemical Spill Team.

2.2. The Worker

Under the OH&S Act, the worker has an obligation to protect their own health and safety and that of other workers present while they are working. The worker is also expected to cooperate with their employer for the purpose of protecting their health and safety and that of other workers. Specifically, these responsibilities include:

- Take all necessary steps to minimize the chance of spills when working with chemicals (see 3. Spill Prevention).
- Cooperate with their supervisor, the CSO, and the Chemical Spill Team to implement a chemical spill program in their area.

2.3. The Supervisor or Principal Investigator

Supervisors and Principal Investigators when involved in the supervision of staff members, students, post doctoral fellows or others are responsible for performing the duties of the employer specified under the Act as designated representatives of the University. Specifically, these include:

- Ensuring that an adequate number of persons are trained in chemical spill response for their specific area.
- Provide site-specific training for their area.
- Ensuring there is sufficient and appropriate spill response supplies in their area.
- Take all necessary steps to minimize the chance of spills when working with chemicals (see 3. Spill Prevention).
- Cooperate with the CSO and the Chemical Spill Team to implement a chemical spill program in their area.

2.4. The Chemical Spill Team and Team Captain

- Provide assistance in response to chemical spills. The extent to which the spill team and other personnel respond to chemical spills will vary with policy. The Spill Team Captain will coordinate response and summoning of additional response personnel, and will be available after hours to provide assistance in the event of a spill.
- Provide "site-specific" training to lab members who work with chemicals and will potentially be involved in chemical spill / emergency response situations.
- Regularly inspect labs to ensure that spill kits are available and that supplies are relevant to the chemicals being handled in the area for which the spill kit is designated for use.
- Maintain records regarding inspections conducted, training conducted and spill kit maintenance.

3. Spill Prevention

The first step in chemical spill response is to prevent the spill from happening in the first place. The worksite should be examined to identify measures that can be taken to minimize the risk of a chemical spill occurring. These measures can be identified during regular worksite safety inspections.

Chemical spills occur during five types of activities; storage, transport, transfers, usage and disposal.

3.1. Storage

- Ensure shelving units are sturdy, and not overcrowded with containers. Shelves used for chemical storage should be securely fastened to the wall or floor to provide added stability.
- Ensure chemicals are stored within easy reach of everyone in the lab, and no higher than eye level. Large bottles and containers should be stored as close to floor level as possible.
- Do not store chemical containers directly on the floor where they might be knocked over and broken, unless they are in approved safety cans or still in their original shipping carton and packing.
- Do not store chemical containers on top of flammable storage or acid storage cabinets.
- Minimize the number of chemicals and size of containers stored in the lab. For commonly used chemicals (i.e. acids, solvents), a good rule of thumb is to keep quantities in the lab to either a single bottle or a one-week supply, whichever is less.
- Ensure that lighting and ventilation is adequate is the storage area.
- Regularly inspect chemicals in storage to ensure there are no leaking or deteriorating containers Some items to note:
  - Keep the outside of containers clean and free of spills and stains.
  - Check that caps and closures are secure and free of deformation. Use only screw caps on chemical containers in storage; foil, ParafilmTM, corks or other plugs are not acceptable.
  - Ensure that metal containers are free of rust, bulges or signs of pressure buildup.
- Do not store chemicals in unsuitable containers or containers made of incompatible material (eg: no HF in glass containers).
- Do not store incompatible chemicals together (e.g. acids with bases). Chemicals must be stored by hazard category and not alphabetically (except within a hazard group).
- Purchase solvents in containers with a plastic safety coating
- Ensure that all gas cylinders are securely fastened and upright.

3.2. Transport

- When transporting large, heavy or a multitude of containers use a cart suitable for the load with high edges or spill trays that will contain any spills or leaks. Two people should be involved when transporting large amounts of chemicals.
- Carry glass containers in bottle carriers or another leak resistant, unbreakable secondary container.
- Use a gas cylinder handcart when transporting large gas cylinders. Ensure cylinder is securely strapped to the cart.
- Comply with the California DOT and Transportation of Dangerous Goods Regulations when transporting hazardous material on public roads. See internet links below for specific regulations.
  - chp.ca.gov/publications/pdf/chp800c.pdf
  - fmcsa.dot.gov/safety-security/hazmat/complyhmregs.htm#hm
  - DOT's Office of Hazardous Materials Safety: (800) 467- 4922 For assistance classifying shipments
  - hazmat.dot.gov/rules/98_3971.htm

3.3. Decanting

- When transferring chemicals between containers, pay careful attention to the size of the receiving container to prevent overfilling it.
- When transferring liquids from large containers, use pumps, siphoning (not initiated by mouth) or other mechanical means instead of pouring.
- Use spill containment trays to catch leaks and spills when transferring liquids.
- When transferring flammable liquid from drums, ensure that both the drum and receptacle are grounded and bonded together to avoid an explosion initiated by a static electric spark.

3.4. Handling & Use

- In laboratories, work in a fume hood whenever possible.
- When setting up and working with laboratory apparatus:
  - Inspect laboratory glassware for cracks or defects before using it.
  - Secure flasks and beakers to prevent them from tipping over.
  - Do not stage experiments below heavy objects which might fall on them. Ensure the work area is free of unnecessary clutter.
  - Select equipment that has a reduced potential for breakage (e.g. Pyrex).
  - Replace mercury with alcohol thermometers or other alternate type of temperature measuring device.
- When planning experiments, anticipate possible accidents and provide controls to deal with problems that may occur
- If you must work alone, ensure the working alone protocol addresses chemical spill response as part of the emergency procedures
- Check gas cylinder valves and gas tubing for leakage before use.
- If possible, keep cylinders of highly toxic or corrosive gases in a fume hood or other ventilated enclosure.
- Ensure you have access and know the location of a suitable chemical spill kit before you start working with chemicals.

3.5. Disposal

- Do not mix incompatible wastes together to avoid uncontrolled chemical reactions.
- Properly identify the contents of all waste containers to avoid inappropriate disposal.
- Leave at least 20% air space in bottles of liquid waste to allow for vapor expansion and to reduce the potential for spills due to overfilling.
- When not in use, keep waste containers securely closed or capped. Do not leave funnels in waste containers.
- Dispose of waste on a regular basis; do not allow excess waste to accumulate in the work area.

4. Spill Response Preparation

Emergency preparedness is an important element of a chemical spill plan. When worksites are prepared for chemical spills, fewer errors are made and there is a reduced risk to persons, property and the environment. The essential elements of spill response preparation are; training, hazard information, proper equipment, and written procedures as described below.

4.1. Training

HAZWOPER Training Certification is coordinated by the CSO and supported by KGI administration to interested individuals who wish to serve two years on the KGI Chemical Spill Team. The Designate(s) then use this to support spill response efforts and to assist laboratory specific training to individuals.

This training includes, guidelines for emergency response, review of laboratory specific chemical spill response plan development, instruction in spill cleanup techniques, and review of hazards found in the work area (chemical, physical, biological) which may be of concern during chemical spill response.

4.2. Hazard Information

Information on the chemical hazards present at the worksite must be kept up-to-date and readily available. Sources of information include Material Safety Data Sheets, signs, Chemical Inventory, container labels, posters, and reference books. The worksite supervisor, PI and CSO are responsible for ensuring that this information is readily available to worksite personnel.

4.3. Equipment

The Chemical Spill Team is responsible for ensuring that an adequate supply of spill response equipment is maintained in each laboratory as well as a Master Spill Kit, which is located in the autoclave room in building 535 and the small autoclave room in building 517. The equipment required includes; first-aid equipment, personal protective equipment, spill cleanup supplies.

4.4. Procedures

The procedures given in **Section IV (4) of KGI'S Chemical Hygiene Plan** provide general guidance for responding to chemical spills and Appendix B of this document includes a flow chart summarizing the actions which will be taken. A copy of this procedure should be made available to personnel at all worksites at KGI.

5. Spill Response Guides

Spill Response Guide No. 1: Flammable Liquids

Flammable liquids have **flash points below 37.8oC**, evaporate quickly, and within a short period of time can reach high vapor concentration. Some common examples of flammable liquids include ethanol, methanol, hexane, diethyl ether, and toluene. Larger spills of flammable liquids may require a response bythe fire department if vapor concentration exceeds the lower explosion limit (LEL). **A spill of more than 500mL is an emergency** that requires area evacuation and notification of the **Safety Manager Jasmine Yu (7- 8698) or Facility Supervisor Natalie Barnard (7-0339)**. Spills of less than 500mL can be cleaned-up by local personnel who are adequately trained and have the proper spill response equipment available. If this is the case, proceed as follows:

1. If spill absorbent is available in the immediate area, dike around the spill (see Step 6 below) if it is safe to do so. This will prevent the spill from spreading further.
2. Immediately extinguish any open flames and, and isolate and evacuate the spill area.
3. If the area's ventilation system recirculates the air throughout the building, call the **Facility Helpline (7-0144) or Facilities Supervisor Natalie Barnard (7-0339)** to have the ventilation shut down to prevent the spread of vapor throughout the building. In addition, close any open doors to also help prevent the spread of vapors.
4. Assemble spill team members and the spill response kit outside the spill area. Obtain and read the SDS for the substance to determine the hazards associated with it and any special precautions that will need to be taken.
5. Don the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
   - Gloves **as recommended by SDS or glove manufacturer.**
   - Splash goggles or face shield.
   - Shoe covers or rubber boots.
   - Lab coat or TyvekTM coveralls.
   - Half mask air-purifying respirator with **organic vapor or combination cartridges, or as otherwise recommended by the SDS or respirator manufacturer.**
6. If not already done, dike around the spill using spill absorbent or spill pillows. Do not use paper towels to absorb the spill since this increases the rate of evaporation and vapor concentration of the liquid.
7. Carefully cover the spill area with spill absorbent or spill pillows, starting at the outside and working inward.
8. Sweep up the residue using spark-proof tools and place the residue into a labeled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags). Store for disposal as hazardous waste.
9. Mop the affected area using detergent and water. Dispose of this water to the sanitary sewer.
10. Remove and bag personal protective equipment for cleaning or disposal.
11. If the ventilation system has been shut down, contact **Facility Helpline (7-0144) or Facilities Supervisor Natalie Barnard (7-0339)** to have it restarted.

Once the spill has been cleaned up, the area should not be reentered until it has been purged of all remaining vapor. In the absence of air monitoring equipment, wait at least 1 hour before reentering the area.

Spill Response Guide No. 2: Combustible & Other Nonflammable Organic Liquids

Combustible liquids (e.g. mineral spirits) have **flash points above 37.8oC but below 93.3 oC** and are not fire hazards at room temperature. The principal hazard from non-flammable, volatile liquid spills is exposure to the vapor by inhalation or skin absorption. **A spill of more than 1 liter is an emergency** that requires area evacuation and notification of the **Facilities Supervisor Natalie Barnard (7-0339), or Laboratory Safety Manager Jasmine Yu (7-8698)**. Spills of less than 1 liter can be cleaned up by local personnel who are adequately trained and have the proper spill response equipment available. If this is the case, proceed as follows:

1. If spill absorbent is available in the immediate area, dike around the spill (see Step 6 below) if it is safe to do so. This will prevent the spill from spreading further.
2. Immediately extinguish any open flames, and isolate and evacuate the spill area.
3. If the area's ventilation system recirculates the air throughout the building, call **Facility Helpline (7- 0144) or Facilities Supervisor Natalie Barnard (7-0339)** to have the ventilation shut down to vent the spread of vapor throughout the building. In addition, close any open doors to also help prevent the spread of vapors.
4. Assemble spill team members and the spill response kit outside the spill area. **Obtain and read the SDS** for the substance to determine the hazards associated with it and any special precautions that will need to be taken.
5. Don the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
   - Gloves **as recommended by SDS or glove manufacturer.**
   - Splash goggles or face shield.
   - Shoe covers or rubber boots.
   - Lab coat or TyvekTM coveralls.
   - Half mask air-purifying respirator with **organic vapor or combination cartridges, or as otherwise recommended by the SDS or respirator manufacturer.**
6. If not already done, dike around the spill using spill absorbent or spill pillows. Do not use paper towels to absorb the spill since this increases the rate of evaporation and vapor concentration of the liquid.
7. Carefully cover the spill area with spill absorbent or spill pillows, starting at the outside and working inward.
8. Sweep up the residue using spark-proof tools and place the residue into a labeled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags). Save for disposal as hazardous waste.
9. Mop the affected area using detergent and water. Dispose of this water to the sanitary sewer.
10. Remove and bag personal protective equipment for cleaning or disposal.
11. If the ventilation system has been shut down, contact **Facility Helpline (70144) or Facilities Supervisor Natalie Barnard (70339)** to have it restarted.

Once the spill has been cleaned up, the area should not be reentered until it has been purged of all remaining vapor. In the absence of air monitoring equipment, wait at least 1 hour before reentering the area.

Spill Response Guide No. 3: Acid Spills

The principal concern is the corrosive effect of these substances. Dilute solutions irritate the skin, while concentrated solutions can result in burns and also react violently with water.

Hydrofluoric acid can penetrate deeply and damage underlying tissue. **Note that hydrofluoric acid spills require special response procedures. If you work with hydrofluoric acid, you must have a site specific safe work procedure, that includes spill and emergency response procedures.**

A spill of more than 1 liter of liquid or 500g of solid acid is an emergency that requires area evacuation and notification of the **Facility Helpline (7-0144), Facilities Supervisor Natalie Barnard (7- 0339), or Safety Manager Jasmine Yu (7-8698)**. **All spills of concentrated hydrofluoric acid are emergencies** and require outside assistance. Spills of less than 1 liter / 500g can be cleaned up by local personnel who are adequately trained and have the proper spill response equipment available.

If this is the case, proceed as follows for a liquid acid spill:

1. If spill absorbent is available in the immediate area, dike around the spill (see Step 6 below) if it is safe to do so. This will prevent the spill from spreading further.
2. Isolate & evacuate the spill area.
3. If the spilled chemical is volatile, and the area's ventilation system recirculates the air throughout the building, call the **Facility Helpline (7-0144), Facilities Supervisor Natalie Barnard (7-0339), or Safety Manager Jasmine Yu (7-8698)** to have the ventilation shut down to prevent the spread of vapor throughout the building. In addition, close any open doors to also help prevent the spread of vapors.
4. Assemble spill team members and the spill response kit outside the spill area. **Obtain and read the SDS** for the substance to determine the hazards associated with it and any special precautions that will need to be taken.
5. Don the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
   - Gloves **as recommended by SDS or glove manufacturer.**
   - Splash goggles or face shield.
   - Shoe covers or rubber boots.
   - Lab coat or TyvekTM coveralls.
   - Half mask air-purifying respirator with **acid gas or combination cartridges, or as otherwise recommended by the SDS or respirator manufacturer.**
6. If not already done, dike around the spill using spill absorbent or spill pillows. Ideally, use spill absorbent that contains a mild neutralizing agent such as sodium carbonate (soda ash)
7. Carefully cover the spill area with spill absorbent or spill pillows, starting at the outside and working inward.
8. Sweep up the residue using spark-proof tools and place the residue into a labeled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags). Store for disposal as hazardous waste.
9. Check the pH of the spill area. If it is less than pH6, then neutralize with a dilute solution of 5% sodium bicarbonate (baking soda).
10. Mop the affected area using detergent and water. Dispose of this water to the sanitary sewer.
11. Remove and bag personal protective equipment for cleaning or disposal.
12. If the ventilation system has been shut down, contact **Facility Helpline (7-0144), Facilities**
13. **Supervisor Natalie Barnard (7-0339), or Safety Manager Jasmine Yu (7-8698)** to have it restarted.

Once the spill has been cleaned up, the area should be free of any acid fumes or vapors. However, if odors or irritation is still noted, isolate the area and wait at least 1 hour before reentering.

For a solid acid spill:

1. Isolate the spill area, and assemble spill team members and the spill response kit outside the spill area. Obtain and read the SDS for the substance to determine the hazards associated with it and any special precautions that will need to be taken.

2. Don the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
   - Gloves as **recommended by SDS or glove manufacturer.**
   - Safety glasses or goggles.
   - Lab coat.
   - Half mask air-purifying respirator with **N95 or greater protection particulate filter, or as otherwise recommended by the SDS or respirator manufacturer.**
3. If necessary, slightly moisten the solid, to minimize dust production. Use water, or if the material is water reactive, another inert liquid (e.g. ethylene glycol).
4. Sweep up the residue using spark-proof tools and place the residue into a labeled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags). Store for disposal as hazardous waste.
5. Remaining solid acid residue may be neutralized using a dilute solution of sodium bicarbonate (baking soda). Check the pH of the spill area; the final pH should be between pH 6 and pH 10. Use spill absorbent or spill pillows to absorb the neutralized residue.
6. Mop the affected area using detergent and water. Dispose of this water to the sanitary sewer.
7. Remove and bag personal protective equipment for cleaning or disposal

Spill Response Guide No. 4: Alkali & Base Spills

Like acids, the principal concern is the corrosive effect of these substances. Dilute solutions irritate the skin, while concentrated solutions can result in burns. Concentrated alkali compounds can penetrate deeply and damage underlying tissue.

A spill of more than **1 liter of liquid or 500g of solid alkali or base is an emergency** that requires area evacuation and notification of the **Facility Helpline (7-0144), Facilities Supervisor Natalie Barnard (7- 0339), or Safety Manager Jasmine Yu (7-8698)**. Spills of less than 1 liter / 500g can be cleaned up by local personnel who are adequately trained and have the proper spill response equipment available. If this is the case, proceed as follows for a liquid alkali or base spill:

1. If spill absorbent is available in the immediate area, dike around the spill (see Step 6 below) if it is safe to do so. This will prevent the spill from spreading further.
2. Isolate and evacuate the spill area.
3. If the spilled chemical is volatile, and the area's ventilation system recirculates the air throughout the building, call the **Facility Helpline (7-0144), Facilities Supervisor Natalie Barnard (7-0339), or Safety Manager Jasmine Yu (7-8698)** to have the ventilation shut down to prevent the spread of vapor throughout the building. In addition, close any open doors to also help prevent the spread of vapors.
4. Assemble spill team members and the spill response kit outside the spill area. Obtain and read the SDS for the substance to determine the hazards associated with it and any special precautions that will need to be taken.
5. Don the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
   - Gloves as **recommended by SDS or glove manufacturer.**
   - **Splash goggles or face shield.**
   - Shoe covers or rubber boots.
   - Lab coat or TyvekTM coveralls.
   - Half mask air-purifying respirator with **cartridges/filters as recommended by the SDS or respirator manufacturer.**

6. If not already done, dike around the spill using spill absorbent or spill pillows. Ideally, use spill absorbent that contains a mild neutralizing agent such as sodium carbonate (soda ash)
7. Carefully cover the spill area with spill absorbent or spill pillows, starting at the outside and working inward.
8. Sweep up the residue using spark-proof tools and place the residue into a labeled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags). Store for disposal as hazardous waste.
9. Check the pH of the spill area. If it is greater than pH10, then neutralize with a dilute solution of 5% citric acid.
10. Mop the affected area using detergent and water. Dispose of this water to the sanitary sewer.
11. Remove and bag personal protective equipment for cleaning or disposal.
12. If the ventilation system has been shut down, contact **Facility Helpline (7-0144), Facilities Supervisor Natalie Barnard (7-0339), or Safety Manager Jasmine Yu (7-8698**) to have it restarted.

Once the spill has been cleaned up, the area should be free of any alkali fumes or vapors. However, if odors or irritation is still noted, isolate the area and wait at least 1 hour before reentering.

For a solid alkali or base spill:

1. Isolate the spill area, and assemble spill team members and the spill response kit outside the spill area. Obtain and read the SDS for the substance to determine the hazards associated with it and any special precautions that will need to be taken.
2. Don the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
   - Gloves a**s recommended by SDS or glove manufacturer.**
   - Safety glasses or goggles.
   - Lab coat.
   - Half mask air-purifying respirator with **N95 or greater protection particulate filter or as recommended by the SDS or respirator manufacturer.**
3. If necessary, slightly moisten the solid, to minimize dust production. Use water, or if the material is water reactive, another inert liquid (e.g. ethylene glycol).
4. Sweep up the residue using spark-proof tools and place the residue into a labeled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags). Store for disposal as hazardous waste.
5. Remaining solid alkali or base residue may be neutralized using a dilute solution of 5% citric acid.
6. Check the pH of the spill area; the final pH should be between pH 6 and pH 10. Use spill absorbent or spill pillows to absorb the neutralized residue.
7. Mop the affected area using detergent and water. Dispose of this water to the sanitary sewer.
8. Remove and bag personal protective equipment for cleaning or disposal.

Spill Response Guide No. 5: Mercury Spills

Elemental mercury and mercury compounds are toxic by inhalation and in some cases, absorption through the skin. Although mercury evaporates slowly, in areas of poor ventilation the vapor concentration will increase over time and become a chronic or acute health hazard.

Spills in excess of 30mL are emergencies that require area evacuation and notification of the Facility Helpline (7-0144), Facilities Supervisor Natalie Barnard (7-0339), or Safety Manager Jasmine Yu (7- 8698). Spills of less than 30mL can be cleaned up by local personnel who are adequately trained and have the proper spill response equipment available.

If this is the case, proceed as follows for a mercury spill:

1. Isolate and evacuate the spill area.
2. Assemble spill team members and the spill response kit outside the spill area.
3. Don the appropriate personal protective equipment. Depending on the scale of the spill, this can include:
   - Nitrile gloves
   - Safety glasses or splash goggles.
   - Shoe covers or rubber boots.
   - Lab coat or TyvekTM coveralls.
   - Half mask air-purifying respirator with mercury vapor cartridges.
4. Using a razor blade, scrapper or similar tool, gently push small droplets of mercury together and remove them using a hand-held mercury aspirator or disposable pipette. Do not use a household vacuum cleaner since this will disperse mercury vapor throughout the room.
5. Pipette the aspirated mercury into a labeled glass waste container. Shine a flashlight on the surface to identify small mercury droplets that escape into cracks and crevices.
6. Spread a commercial mercury amalgam mix over the contaminated surface after all visible mercury droplets have been removed. Sweep up mercury amalgam using a small brush and dispose of it into a labeled glass waste container. Take care not to break up any mercury droplets. Alternately, wipe the surface using a mercury absorbent cloth (e.g. Mercon wipes) or suppressant and dispose of it into a labeled clear, plastic bag.
7. Send all mercury and contaminated material for disposal as hazardous.
8. Remove and bag personal protective equipment for cleaning or disposal.

Spill Response Guide No. 6: Oxidizer Spills

Oxidizing agents can ignite organic solvents and combustible materials. They are also skin and respiratory irritants. Examples include concentrated hydrogen peroxide, and permanganate, chlorate, nitrate and dichromate compounds. **Spills in excess of 1 liter of liquid or 500 grams of solid oxidizer areemergencies** and require area evacuation and notification of the **facility Helpline (7-0144), Facilities 34 Supervisor Natalie Barnard (7-0339), or Safety Manager Jasmine Yu (7-8698)**. Spills of less than 1liter / 500g can be cleaned up by local personnel who are adequately trained and have the proper spill response equipment available.

If this is the case, proceed as follows for a **liquid oxidizer spill**:

1. If spill is available in the immediate area, dike around the spill (see Step 5 below) if it is safe to do so. This will prevent the spill from spreading further.
2. Isolate and evacuate the spill area.
3. Assemble spill team members and the spill response kit outside the spill area. **Obtain and read the SDS** for the substance to determine the hazards associated with it and any special precautions that will need to be taken.
4. Don the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
   - Gloves as **recommended by SDS or glove manufacturer.**
   - Splash goggles or face shield.
   - Shoe covers or rubber boots.
   - Lab coat or TyvekTM coveralls.
   - Half mask air-purifying respirator with cartridges and/or filters as recommended by the SDS or respirator manufacturer.

5. If not already done, dike around the spill using spill absorbent or spill pillows. Remove or moisten with water any combustible affected by the spill.
6. Carefully cover the spill area with spill absorbent or spill pillows, starting at the outside and working inward.
7. Sweep up the residue using spark-proof tools and place the residue into a labeled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags). Store for disposal as hazardous waste.
8. Mop the affected area using detergent and water. Dispose of this water to the sanitary sewer.
9. Remove and bag personal protective equipment for cleaning or disposal.

For a solid oxidizer spill:

1. Isolate the spill area, and assemble spill team members and the spill response kit outside the spill area. **Obtain and read the SDS** for the substance to determine the hazards associated with it and any special precautions that will need to be taken.
2. Don the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
   - Gloves **as recommended by SDS or glove manufacturer.**
   - Safety glasses or goggles.
   - Lab coat.
   - Half mask air-purifying respirator with **N95 or greater protection particulate filter or as recommended by the SDS or respirator manufacturer.**
3. Sweep up the residue using spark-proof tools and place the residue into a labeled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags). Send them for disposal as hazardous waste.
4. If there is still oxidizer residue left in the spill area, neutralize with dilute 5% sodium thiosulfate solution. Use spill absorbent or spill pillows to absorb the neutralized residue.
5. Mop the affected area using detergent and water. Dispose of this water to the sanitary sewer.

Spill Response Guide No. 7: Highly Toxic Materials Spills

Highly toxic chemicals include those with high acute systemic toxicity, and substances with chronic toxic effects such as carcinogens, reproductive or developmental (embryo toxins, teratogens) toxins, and mutagens. Also included in this category are compounds that can easily produce toxic products. For example, cyanide and sulfide salts produce toxic hydrogen cyanide and hydrogen sulfide, respectively, in the presence of acids. I**n general, spills of more than 100mL of liquid or 50g of solid of these substances are emergencies** and require area evacuation and notification of the **Facility Helpline (7- 0144), Facilities Supervisor Natalie Barnard (7-0339), or Safety Manager Jasmine Yu (7-8698)**. Spills of less than 100mL / 50g can be cleaned up by local personnel who are adequately trained and have the proper spill response equipment available. **These chemicals, however, should always be evaluated on an individual basis.**

Proceed as follows for a **liquid spill:**

1. If spill absorbent is available in the immediate area, dike around the spill (see Step 5 below) if it is safe to do so. This will prevent the spill from spreading further.
2. If the spilled chemical is volatile, and the area's ventilation system recirculates the air throughout the building, call the **Facility Helpline (7-0144), Facilities Supervisor Natalie Barnard (7-0339), or Safety Manager Jasmine Yu (7-8698)** to have the ventilation shut down to prevent the spread of vapor throughout the building. In addition, close any open doors to also help prevent the spread of vapors.
3. Isolate the spill area and assemble spill team members and the spill response kit outside the spill area. Obtain and read the SDS for the substance to determine the hazards associated with it and any special precautions that will need to be taken.

4. Don the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
   - Gloves **as recommended by SDS or glove manufacturer.**
   - Splash goggles or face shield.
   - Shoe covers or rubber boots.
   - Lab coat or TyvekTM coveralls.
   - Half mask air-purifying respirator with cartridges and / or filters **as recommended by the SDS or respirator manufacturer.**
5. If not already done, dike around the spill using spill absorbent or spill pillows
6. Cover the spill area with spill absorbent or spill pillows, starting at the outside and working inward.
7. Sweep up the residue using spark-proof tools and place the residue into a labeled, plastic, waste container (plastic pail with lid or double heavy-duty plastic bags). Store for disposal as hazardous waste.
8. Remove any remaining residue using minimal detergent and water. Absorb this wash water using spill absorbent or spill pillows, and dispose of as hazardous waste as in Step 7 above.
9. Mop the affected area using detergent and water. Dispose of this water to the sanitary sewer.
10. Remove and bag personal protective equipment for cleaning or disposal.
11. If the ventilation system has been shut down, contact **Facility Helpline (7-0144),Facilities Supervisor Natalie Barnard (7-0339), or Safety Manager Jasmine Yu (7-8698**) to have it restarted.

For a solid spill:

1. Isolate the spill area, and assemble spill team members and the spill response kit outside the spill area. **Obtain and read the SDS** for the substance to determine the hazards associated with it and any special precautions that will need to be taken.
2. Don the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
   - Gloves **as recommended by SDS or glove manufacturer.**
   - Safety glasses or goggles.
   - Lab coat.
   - Half mask air-purifying respirator with **N95 or greater protection particulate filters, or cartridges and/or filters as recommended by the SDS or respirator manufacturer.**
3. Slightly moisten the solid, to prevent the spread of dust. Use water, or if the material is water reactive, another inert liquid (e.g. ethylene glycol).
4. Sweep up the residue using spark-proof tools and place the residue into a labeled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags). Store for disposal as hazardous waste.
5. Remove any remaining residue using minimal detergent and water. Absorb this wash water using spill absorbent or spill pillows, and dispose of as hazardous waste as in **Step 4 above.**
6. Mop the affected area using detergent and water. Dispose of this water to the sanitary sewer.
7. Remove and bag personal protective equipment for cleaning or disposal.

Spill Response Guide No. 8: Low Hazard Material Spills

Low hazard materials are those with no appreciable health hazard when encountered in quantities typical for University work sites. These include such solid materials as sodium chloride, calcium chloride, and liquids such as ethylene glycol, oils, and most paints. **In general, all spills of these materials may be cleaned up by local personnel unless there are other mitigating circumstances** that require outside assistance, area evacuation and notification of the **Facility Helpline (7-0144), Facilities Supervisor Natalie Barnard (7-0339), or Safety Manager Jasmine Yu (7-8698).** If this is not the case, proceed as follows for a **liquid spill:**

1. If spill absorbent is available in the immediate area, dike around the spill (**see Step 4 below**) if it is safe to do so. This will prevent the spill from spreading further.
2. Move outside the spill area. **Obtain and read the SDS** to confirm that the material is of low hazard and can be cleaned up safely following this procedure.
3. Don the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
   - Gloves **as recommended by SDS or glove manufacturer.**
   - Safety Glasses or Splash goggles.
   - Shoe covers or rubber boots.
   - Lab coat or TyvekTM coveralls.
4. If not already done, dike around the spill using spill absorbent or spill pillows
5. Cover the spill area with spill absorbent or spill pillows, starting at the outside and working inward.
6. Sweep up the residue using spark-proof tools and place the residue into a labeled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags). Store for disposal as hazardous waste. Mop the affected area using detergent and water. Dispose of this water to the sanitary sewer.
7. Remove and bag personal protective equipment for cleaning or disposal.

For a solid spill:

1. 1) Move outside the spill area. **Obtain and read the SDS** to confirm that the material is of low hazard and can be cleaned up safely following this procedure.
2. Don the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
   - Gloves **as recommended by SDS or glove manufacturer.**
   - Safety glasses or goggles.
   - Lab coat.
3. If necessary, use water to lightly moisten the solid, to minimize the spread of dust.
4. Sweep up the residue using spark-proof tools and place the residue into a labeled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags). Store for disposal as hazardous waste.
5. Mop the affected area using detergent and water. Dispose of this water to the sanitary sewer.
6. Remove and bag personal protective equipment for cleaning or disposal.

Spill Response Guide No. 9: Air & Water Reactive Material Spills

These materials are particularly hazards, since they will rapidly react with water and/or air to produce toxic products, and in many cases are also pyrophoric and may spontaneously ignite in the presence of water and/or air. Typical examples of water and air reactive materials include the alkali metals, metal hydrides and strong reducing agents such as sodium

borohydride. **All spills of air & water reactive materials are emergencies and require area evacuation and notification of Facility Helpline (7-0144), Facilities Supervisor Natalie Barnard (7-0339), or Safety Manager Jasmine Yu (7-8698).**

If a spill of a liquid reactive material occurs;

1. Isolate the spill area.
2. If an inert spill absorbent such as dry sand or kitty litter is available in the immediate area, dike around the spill if it is safe to do so. This will prevent the spill from spreading further.
3. Evacuate the area and, if not already done so, contact the **Facility Helpline (7-0144), Facilities Supervisor Natalie Barnard (7-0339), or Safety Manager Jasmine Yu (7-8698).** Meet emergency responders and provide information on the nature, extent and exact location of the spill.

For a solid spill:

1. Isolate the spill area.
2. If an inert spill absorbent such as dry sand or kitty litter is immediately available in the area, immediately smother the spilled material if it is safe to do so. For reactive metals (e.g. sodium, potassium), a Class D fire extinguisher may be used.
3. Evacuate the area and, if not already done so, contact the **Facility Helpline (7-0144), Facilities Supervisor Natalie Barnard (7-0339), or Safety Manager Jasmine Yu (7-8698)**. Meet emergency responders and provide information on the nature, extent and exact location of the spill.

Spill Response Guide No. 10: Compressed Gas Leaks

Compressed gas leaks can be roughly divided into two categories. The first are those leaks which occur away from the cylinder in gas lines, tubing, or apparatus. These, once detected, can generally be stopped by closing the main cylinder valve. The second are those leaks that occur at the cylinder itself, and that cannot be stopped by closing the cylinder valve. Similarly, in some cases, it may not be possible to close a cylinder valve due to age or poor condition of the valve. **All leaking gas cylinders are an emergency** If the leak cannot be stopped by closing the cylinder valve. Leaks of oxygen, flammable gas, or toxic38 gas are especially dangerous.

The following procedure should be followed:

1. If a leak is suspected, perform a leak test with a commercial leak detection solution or a non-reactive, detergent solution. If the leak is detected or is obvious, proceed to Step 2.
2. If the leak cannot be stopped by closing the cylinder valve, and it is an inert atmospheric gas (e.g. nitrogen, carbon dioxide, etc) clear the affected area and/or floor. If the leak is of a f**lammable, toxic, or corrosive gas and is outside of a ventilated enclosure that will contain the gas, immediately activate the building fire alarm system and evacuate the building.**
3. If not already done so, contact the **Facility Helpline (7-0144), Facilities Supervisor Natalie Barnard (7-0339), or Safety Manager Jasmine Yu (7-8698)**. Meet emergency responders and provide information on the nature, extent and exact location of the leak.

6. Reporting Chemical Spill Incidents

All chemical spills and gas releases must be reported in writing to the CSO. The report should include the date, time, location, description of the spill (e.g. type and quantity), personnel injuries or exposures, equipment damage, escape of material (e.g. into sewers or bodies of water), witnesses, and persons involved in supervision and clean-up of the spill. Use the **Keck Graduate Institute Incident/Near Miss Report Form** (see CSO for the form). The report should be submitted to the CSO within 72 hours of the spill occurring regardless of how minor it might seem. **The purpose of this reporting procedure is not to place blame, but to identify measures that may prevent similar incident.**

7. Chemical Spill Kits

Spills kits can be assembled from individual parts or suitable spill kits may be purchased from most chemical or safety supply companies. If you do choose to purchase a commercial kit, however, ensure that it contains all the necessary items as listed below. In addition, note that most commercial spill kits and the lists below are generic; it is important that spill kits be tailored to meet the specific spill control needs of each lab, work area, or department.

1. Small Chemical Spill Kit

   A small chemical spill kit should be available in each lab or work area that uses chemicals. It can be used for immediate response to most spills, and to clean up small, low hazard spills that may occur and do not require specialized personnel protective equipment or spill control supplies. Although most small spill kit components are common items found throughout the lab, there must be a consolidated spill kit for emergency use. Keck Graduate Institute has placed a small chemical spill kit in each laboratory that works with chemicals. As items are depleted it is the responsibility of each PI to replace the items, the kit will be checked periodically by the CSO to ensure that proper spill kit materials are maintained.

2. Large / Building Chemical Spill Kit

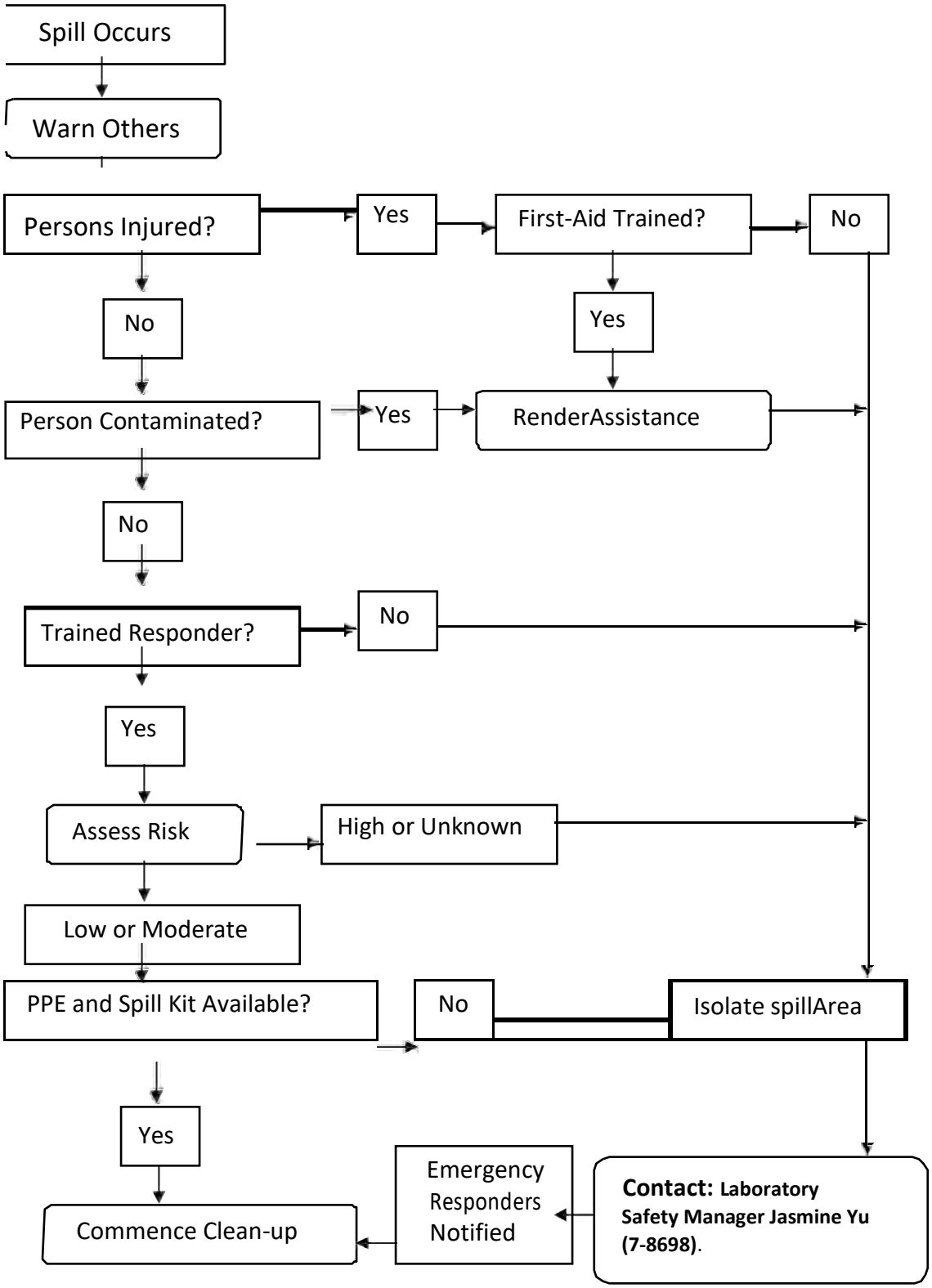
   KGI has one large Chemical Spill Kit per buildings 517 and 535. The spill kits contain PPE and spill cleanup supplies to compliment the smaller worksite kits, and as backup supplies for outside responders.

3. Mercury Spill Kit

   All areas that work with elemental mercury or mercury containing equipment (e.g. thermometers) must have a mercury spill kit available. The following list includes only those items specific to cleaning up a mercury spill, and must be used in conjunction with other items from a large / departmental spill kit.

- Mercury clean-up supplies (ex: Merconwipes™, Merconvap™, amalgamating powder, etc)
- Mercury aspirator, disposable pipettes & bulbs, or similar equipment.
- Razor blades or scrapers.
- Plastic, zip-lock bags, flashlight and Mercury Vapor Respirator Cartridges

Appendix B: Chemical Spill Response Flowchart



Appendix C: Chemical Spill Report

Location of Spill

Place

Date and time of Spill

What was spilled?

How much was spilled?

Is anyone injured? Yes No

(If yes, please fill out the KGI Accident Investigation Form)

Medium Spilled On/In:

- Floor (Carpet /Tile / Wood / Other)
- Ground (Paved / Dirt / Gravel)
- Water (Drain / Sewer / Ground Water) Air

Cause of Spill:

Person Responsible for Spill

Name Title

Address

Phone

Others Involved/Witnesses

Person Who Cleaned Spill

Name Title

Address

Phone

What containment measures were taken to control the spill:

What corrective actions were taken to control and clean up the spill:

List any existing or potential hazards that either caused or resulted from the incident:

Any additional information relating to the incident:

KGI Hazardous Waste Identification Tag

Date Place

Contact Person Ext.

Waste located in bld Lab#

Substance Identification	Quantity

Solid Liquid

Gas (do not mix liquids and solids)

Organic liquids only

Halogenated Non-Halogenated

DOT Hazard Class

Flammable/Combustible

Corrosive/caustic

Oxidizer

Poison/highly toxic

Organic peroxides

Other

KGI Hazardous Waste Identification Tag

Date Place

Contact Person Ext.

Waste located in bld Lab#

Substance Identification	Quantity

Solid Liquid

Gas (do not mix liquids and solids)

Organic liquids only

Halogenated Non-Halogenated

DOT Hazard Class

Flammable/Combustible

Corrosive/caustic

Oxidizer

Poison/highly toxic

Organic peroxides

Other

KGI Hazardous Waste Identification Tag

Date Place

Contact Person Ext.

Waste located in bld Lab#

Substance Identification	Quantity

Solid Liquid

Gas (do not mix liquids and solids)

Organic liquids only

Halogenated Non-Halogenated

DOT Hazard Class

Flammable/Combustible

Corrosive/caustic

Oxidizer

Poison/highly toxic

Organic peroxides

Other

KGI Hazardous Waste Identification Tag

Date Place

Contact Person Ext.

Waste located in bld Lab#

Substance Identification	Quantity

Solid Liquid

Gas (do not mix liquids and solids)

Organic liquids only

Halogenated Non-Halogenated

DOT Hazard Class

Flammable/Combustible

Corrosive/caustic

Oxidizer

Poison/highly toxic

Organic peroxides

Other

Policy 535

Regulation of Controlled Substances Used in Research

Responsible Office: Dean of Research | Approved by: President Sheldon Schuster | Effective Date: 7/30/2014

This policy and its procedures apply to all KGI personnel engaged in research that requires use of controlled substances.

I. Purpose

Keck Graduate Institute (KGI) researchers may, in the course of lawful research, teaching or testing, find it necessary to use substances regulated by the Drug Enforcement Administration (DEA) and other agencies. These substances are known as "controlled substances," and their possession and use is governed by regulations that require specific procedures be established to ensure safety and prevent abuse. Various Federal and state statutes and regulations address the need for a written policy that describes responsibilities and procedures for research or instructional activities by persons or groups working with controlled substances under the auspices of KGI.

Controlled Substances are subject to extensive licensing, storage, use, disposal, and inventorying requirements. The regulations governing Controlled Substances include the U.S. Department of Justice (DOJ), the U.S. Drug Enforcement Agency (DEA), 21 CFR Section 1300, and the California Department of Justice (CA-DOJ).

Drugs and other substances that are considered controlled substances under the Controlled Substances Act (CSA) are divided into five schedules. An updated and complete list of the schedules is published annually in Title 21 Code of Federal Regulations 1308.11 through 1308.15. Substances are placed in their respective schedules based on whether they have a currently accepted medical use in treatment in the United States, their relative abuse potential, and likelihood of causing dependence when abused. Researchers acquiring these materials will be required to obtain a DEA license. Laboratory Safety Committee will aid each Principle Investigator (PI) in obtaining his/her licenses for the purchase of controlled drugs if necessary.

Violations of the Controlled Substance laws, even when unintentional, may lead to substantial civil and criminal liability.

II. Scope

Controlled Substances may only be used for duly authorized, legitimate medical or scientific research purposes to the extent permitted by the registrant's license and registration and in conformity with state and Federal statutes and regulations. The purpose of this guide is to set forth these policies and procedures for research or instructional activities by Licensed PIs or persons working under the auspices of KGI.

III. Policy

A. Definitions

- Licensed Principle Investigator (PI): The lead scientist or engineer for a particular project, such as a laboratory study or clinical trial. It is often used as a synonym for "head of the laboratory," not just for a particular study. This person holds a license with the DEA for use of the specified controlled substances.
- Authorized Individuals (AI): Lab personnel who handle or manage Controlled Substances in approved research. Authorized Individuals must be trained in Controlled Substance shipping, receiving, security, inventorying, and recordkeeping procedures as outlined in this policy.
- Reverse Distributors: Companies licensed and permitted to recycle and/or destroy Controlled
- Substances.

B. Responsibilities

KGI does not hold an "institutional license" for use of controlled substances in research. In order to ensure compliance with KGI's obligations under the Controlled Substance regulations, it is important that authorized Principle Investigators (PIs) and research staff, understand their responsibility in connection with obtaining, preparing, handling, and using Controlled Substances.

Licensed PIs shall have the responsibility for managing the use of Controlled Substances in their labs. In the event that the PIs are on leave or are otherwise absent, they may designate another appropriate Authorized Individual to carry out the duties under the Controlled Substance program on their behalf.

Controlled Substance schedules periodically change to add new drugs or substances. It is the responsibility of the licensed PI to know whether any substances currently in their possession are scheduled as a Controlled Substance, and if so to ensure compliance with this policy. Additionally, the PI must obtain a license to continue to use the substance and follow the guidelines set forth in this policy. Licensed PIs should notify the Dean of Research and Laboratory Safety Chair if they intend to remove or add any Controlled Substances to their licenses.

Licensed PIs shall be responsible for:

- Proper DEA registration and permitting procedures ensuring that Controlled Substances are licensed and registered for use in their lab.
- Ensuring that the Controlled Substances are maintained in a manner that is indicated on the license.
- Restricting access to Controlled Substances to only users they authorize.
- Ensuring that research or instructional activities under their direction is in compliance with university, federal and state regulations applicable to their research use of the controlled substances.
- Maintaining usage logs, purchase orders, and inventories for Controlled Substances.
- Ensuring that security and access procedures are in place for any labs or facilities where Controlled Substances are located.
- Ensuring their licenses for Controlled Substances are regularly updated.
- Implementing administrative controls on the ordering, receipt, disposition, storage and disposal of these Controlled Substances.
- Providing inventory control by audits and inspections, maintaining records and reports and maintaining strict control over inventory and security for the drugs.
- Providing training to research staff concerning obligations for handling Controlled Substances under the license.
- Proper disposal of leftover Controlled Substances with the proper Reverse Distributors.
- Implementation of necessary corrective actions.

C. Security

The DEA requires that any person who will have access to controlled substances as a result of his or her status as an employee or agent of a DEA registrant complete a Questionnaire, located at the end of this policy. It is the responsibility of licensed PI to communicate with Human Resources (HR) this requirement prior to beginning work in the lab where Controlled Substances will be used.

Persons previously convicted of a felony offense related to Controlled Substances or who had an application for registration with a state or federal agency denied or who surrendered a registration for cause may not be authorized to work with these materials.

At no time should a licensed PI allow other researchers to purchase Controlled Substances using their license. This practice is called “piggybacking” and is a violation of this policy and may lead to substantial civil and criminal liability. Any licensed PI requiring the use of Controlled Substances in their research must obtain their own license and operate within the guidelines of this policy.

Controlled Substances shall be stored in “securely locked, substantially constructed drug cabinets or safes” in locations where access is limited. Any Licensed PI who has concerns with security locations will contact the Laboratory Safety Officer to ensure the cabinets or safes used to store Controlled Substances conform to the Federal and state requirements. Generally, standard file cabinets are not sufficient for the storage of Controlled Substances. All Controlled Substances must be kept locked in their storage location except when it is necessary for authorized individuals to remove, legitimately work with and replace the Controlled Substances. Controlled Substances must not be left unattended, and when they are not being used for research, they must be securely stored in the drug cabinet or safe.

Controlled access to the drug cabinet or safe is critical to establishing security for Controlled Substances. For this reason, keys and/or combinations to the cabinet or safe shall be secure and under the direct control of the Licensed PI and their AIs.

KGI

Procedure 535

Regulation of Controlled Substances Used in Research

A. Receiving

Two employees must be present to receive samples. The contents must be inspected and counted as soon as the package arrives. The licensed PI must then assign the samples a unique identification number. The licensed PI must establish reconciliation limits, based on the company's processes and as close to 100% as possible. The package may then be removed to a secure storage unit by the PI.

Samples must never be left unattended on the receiving dock. As soon as samples arrive the PI must be notified. Immediately following the receiving process the PI should transport the samples to a secured area for proper storage. Access to receiving docks should be restricted to an absolute minimum number of authorized employees.

B. Reporting of Loss, Destruction, Theft, or Unauthorized Use

Thefts, suspect thefts, unauthorized use, or other losses of any Controlled Substance must be reported immediately to Laboratory Safety Chair, and Campus Security upon discovery. The licensed PI or his or her staff may also have an obligation to report promptly the loss to the state or Federal authorities. DEA Form 106, available on DEA's website, is required to be used by the DEA when a formal report is made, after an initial investigation within one business day of discovery. Please read the guidelines carefully as strict time limits apply.

The form must be submitted even if substances are recovered. Link to Form 106 and instructions: deadiversion.usdoj.gov/webforms/dtlLogin.jsp

In addition, any unauthorized persons who gain access to Controlled Substances for the purpose of diversion or theft must be reported to Campus Security and may be subject to the disciplinary policies of KGI and the DEA.

C. Recordkeeping and Inventory

Licensed PIs are required to keep track of each Controlled Substance using a DEA Controlled Substance Log or equivalent. Usage log sheets shall be numbered, bound, and if the size of the cabinet permits, maintained at all times in the locked safe or cabinet along with the Controlled Substances. Usage log sheets must be maintained for a minimum of three years after complete use and disposal of Controlled Substances and be readily available for inspection by the DEA, or Laboratory Safety.

All authorized users that work with Controlled Substances are to conduct self- inspections on a quarterly basis to ensure that the laboratory's Controlled Substance Usage Logs match the physical inventory. The results of those self- inspections shall be recorded.

Laboratory Safety will conduct annual compliance inspections for users of Controlled Substances. The inspection will consist of reviewing recordkeeping, disposal, storage, and use.

D. Disposal and Destruction of Controlled Substances

Controlled Substances consumed in a reaction or converted into a hazardous waste mixture from which a Controlled Substance is not recoverable may be disposed of through routine waste disposal with KGI waste management following all procedures by KGI waste management program.

If a Controlled Substance has expired, is no longer needed, or if the licensed PI is discontinuing research due to retirement or new employment, then the PI should contact a disposal service in a timely manner for disposal procedures. A licensed PI should never abandon Controlled Substances after their employment with KGI is complete. Abandoning Controlled Substances may affect the PI's future ability to attain a license to work with Controlled Substances and may also carry a civil penalty.

E. Enforcement, Authority and Regulatory Compliance

The U.S. Department of Justice (DOJ), Drug Enforcement Administration (DEA) administers the federal law. KGI does not hold an "institutional license" for use of controlled substances in research.

Licensed PI's and staff involved in research or instructional activities where Controlled Substances will be used will operate under their own DEA Registration Numbers and will maintain their own purchase, record keeping, disposal and other regulated practices. Compliance with federal and state laws and KGI procedures is expected by all individuals and groups associated with KGI. These regulations include the following:

Code of Federal Regulations: Title 21, Chapter II (Parts 1300 to end)
These regulations implement the Controlled Substances Act of 1970, the Diversion Control Amendments of 1984, 1985, 1986 and subsequent amendments.

Health and Safety Code Division 10: California Uniform Controlled Substances Act. All records regarding the use of controlled substances are subject to review by representatives of KGI, (Public Safety, Human Resources, etc.), officials and auditors from the U.S. Drug Enforcement Agency, California Bureau of Narcotic Enforcement, and California Department of Justice.

This procedure is not to be construed as a summary of all regulations that may be pertinent to handling of controlled substances. Individuals who bear responsibility in this area are encouraged to read for themselves the federal and state regulations that govern use of the materials and to be aware of the fines and penalties associated with their misuse.

Questionnaire for employees or students who will have access to substances regulated by the drug enforcement administration of the United States of America

The Drug Enforcement Administration requires that any person who will have access to controlled substances as a result of his or her status as an employee or agent of a DEA registrant at Keck Graduate Institute of Applied Life Sciences (KGI) answer the following questions. Any false information or omission of information may jeopardize your position with respect to KGI. Information revealed by this questionnaire will not necessarily preclude employment or educational status, but will be considered as part of an overall evaluation of your qualifications. The responses on this questionnaire will be held in the strictest confidence.

1. In the past five years, have you been convicted of a felony or within the past two years of any misdemeanor or are you presently charged with committing a criminal offense? (Do not include traffic violations, juvenile offenses or military convictions, except by general court- martial.) If the answer is yes, furnish details of convictions, offense, location, date, and sentence. Please use additional page if necessary for details.

   ☐ Yes ☐ No

2. In the past three years, have you ever knowingly used any narcotics, amphetamines or barbiturates, other than those prescribed to you by a physician? If the answer is yes, furnish details. Please use additional page if necessary for details.

   ☐ Yes ☐ No

Student or Employee

Signature

Print name

Date

Licensed Principal Investigator or Supervisor

Signature

Print name

Date

Appendix F: Chemical Storage Guidelines

Proper chemical storage is essential in assuring a safe work environment.

Segregate Chemicals - Store by Hazard Class

Do Not Store Chemicals Alphabetically, except within a hazard class. Hazard classes that should be stored separately include:

- radioactive materials
- pyrophoric materials
- flammable materials
- oxidizing materials
- water reactive substances
- oxidizing acids
- inorganic acids
- organic acids
- caustics (bases)
- poisons (general laboratory reagents separated into organic and inorganic groups)

Provide physical segregation (sills, curbs, trays) or separation between hazard classes.

Keep flammable materials by themselves in approved storage cans, cabinets, or rooms. Store oxidizers well away from flammable materials.

Store Chemicals To Minimize The Risk From Damaged Containers

- **Store large bottles and containers** close to but not on the floor
- **Store acids and caustics below eye level**
- **Shelves should be securely fastened** to the wall and have lips or restraining cord to prevent bottles from falling
- **Secondary containment** such as polyethylene or stainless steel trays as appropriate should be provided for spill protection

Label Chemical Containers and Storage Areas Properly

- **Chemical containers** should have the chemical name, a warning label identifying the major hazards, and information about handling precautions
- **Storage areas** should be labeled with hazard class

Chemical Hazard Classes - Examples

Pyrophoric- (many are also water reactive)

- phosphorous (red, white)
- methylmagnesium bromide (and other grignard reagents
- diethylzinc
- triethylaluminum

Oxidizing Materials

- nitrates
- perchlorates
- permanganates
- iodates
- chromium (VI) compounds
- bromine
- nitrates
- iodine

Water Reactive

- alkaline earth metals (sodium, potassium, lithium, calcium)
- calcium carbide
- hydrides
- titanium tetrachloride
- acetic anhydride

Flammable solvents

- sulfur
- sodium metal
- sodium sulfide

Inorganic Acids

- hydrochloric acid
- hydroiodic acid
- phosphoric acid
- hydrobromic acid
- hydrofluoric acid

Inorganic Acids - Oxidizing

- sulfuric acid
- nitric acid
- perchloric acid

Organic Acids

- formic acid
- acetic acid
- propionic acid
- butyric acid

Caustics

- hydroxides of sodium, potassium, calcium, lithium

Appendix G: Chemicals Requiring Designated Areas

The OSHA Laboratory Standard 29 CFR 1910.1450 mandates that an employer's Chemical Hygiene Plan will provide for establishment of designated areas " which 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 a laboratory or a device such as a laboratory hood."

The sticker shown here (available from REM) is to be used to designate areas for use of the following select carcinogens, reproductive hazards, and/or substances having a high degree of acute toxicity. Affix one or more stickers at all work and storage locations associated with these materials. If you store but are not using one or more of these materials, please sticker the storage area, and if the material is stored in a work area, designate a work area in that room as well. (The simple existence of the material in a work room implies the likelihood of its being used at some time.)

NOTE: Designating an entire room by placing this sticker at the entrance will simplify this necessity, and will also prohibit all eating, drinking, and storage or preparation of food or beverages anywhere in the room (if such are not already prohibited for other reasons).

Select carcinogens, reproductive hazards, and substances having a high degree of acute toxicity.

CAS #	Name List last updated spring 1999	CAS #	Name List last updated spring 1999
13909-09-6	1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (MeCCNU, methylCCNU)	[95-95-4]	2, 4, 5-Trichlorophenol
[13010-47-4]	1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU, Lomustine)	[3296-90-0]	2,2-Bis(bromomethyl)-1,3-propanediol
[79-34-5]	1,1,2,2-Tetrachloroethane	[1746-01-6]	2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)
[79-00-5]	1,1,2-trichloroethane (vinyl trichloride)	[96-13-9]	2,3-Dibromo-1-propanol
[75-34-3]	1,1-Dichloroethane	[137-17-7]	2,4,5-Trimethylaniline 2,4,5-Trimethylaniline and its strong acid salts
[75-35-4]	1,1-Dichloroethylene (vinylidene chloride)	[88-06-2]	2,4,6-Trichlorophenol
[57-14-7]	1,1-dimethylhydrazine (UDMH)	[615-05-4]	2,4-Diaminoanisole
[96-18-4]	1,2,3-Trichloropropane	[95-80-7]	2,4-Diaminotoluene
[96-12-8]	1,2-dibromo-3-chloropropane (DBCP, Fumazone)	[94-75-7]	2,4-Dichlorophenoxyacetic acid (2,4-D)
[78-87-5]	1,2-Dichloropropane	[1836-75-5]	2,4-Dichlorophenyl-p-nitrophenyl ether (nitrofen)
[1615-80-1]	1,2-Diethylhydrazine	[97-02-9]	2,4-Dinitroaniline
[540-73-8]	1,2-Dimethylhydrazine	[121-14-2]	2,4-Dinitrotoluene

Select carcinogens, reproductive hazards, and substances having a high degree of acute toxicity.

CAS #	Name List last updated spring 1999	CAS #	Name List last updated spring 1999
[106-99-0]	1,3-Butadiene	[87-62-7]	2,6-Dimethylaniline (2,6-Xylidine)
[542-75-6]	1,3-Dichloropropene	[606-20-2]	2,6-Dinitrotoluene
[1120-71-4]	1,3-Propane sultone	[53-96-3]	2-Acetylaminofluorene
[55-98-1]	1,4-butanediol dimethanesulfonate (Busulphan, Myleran)	[105650-23-5]	2-Amino-1-methyl-6-phenylimidazol[4,5-b]pyridine (PhIP)
[764-41-0]	1,4-Dichloro-2-butene	[77094-11-2]	2-Amino-3,4-dimethylimidazo[4,5-f] quinoline (MeIQ)
[123-91-1]	1,4-Dioxane	[59716-87-9]	2-Amino-5-(5-nitro-2 furyl)-1,3,4-thiadiazole
[42397-64-8]	1,6-Dinitropyrene	[712-68-5]	2-Amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole
[117-10-2]	1,8-Dihydroxyanthraquinone (Danthron, Chrysazin)	[117-79-3]	2-Aminoanthraquinone
[42397-65-9]	1,8-Dinitropyrene	[153-78-6]	2-Aminofluorene
[555-84-0]	1-[(5-nitrofurfurylidene)-amino]-2-imidazolidinone (Nifuradene)	[504-29-0]	2-Aminopyridine
[81-49-2]	1-Amino-2,4-dibromoanthraquinone	[129-15-7]	2-Methyl-1-nitroanthraquinone
[82-28-0]	1-Amino-2-methylanthraquinone	[607-57-8]	2-Nitrofluorene
[598-92-5]	1-Chloro-1-nitroethane	[79-46-9]	2-Nitropropane
[97-00-7]	1-Chloro-2,4-Dinitrobenzene	[60153-49-3]	3-(N-Nitrosomethylamino)propionitrile
[5522-43-0]	1-Nitropyrene	[28434-86-8]	3,3'-Dichloro-4,4'-diaminodiphenyl ether
[3570-75-0]	2-(2-Formylhydrazino)-4-(5-nitro-2-furyl)thiazole	[91-94-1]	3,3'-Dichlorobenzidine
[119-90-4]	3,3'-Dimethoxybenzidine (o-dianisidine)	[612-83-9]	3,3'-Dichlorobenzidine dihydrochloride
[20325-40-0]	3,3'-dimethoxybenzidine dihydrochloride (o- dianisidine dihydrochloride)	[107-02-8]	Acrolein (2-Propenal)
[119-93-7]	3,3'-dimethylbenzidine (o-tolidine)	[79-06-1]	Acrylamide
[612-82-8]	3,3'-Dimethylbenzidine dihydrochloride	[107-13-1]	Acrylonitrile
[105735-71-5]	3,7-Dinitrofluoranthene	[814-68-6]	Acrylyl Chloride
[22506-53-2]	3,9-Dinitrofluoranthene	[50-76-0]	Actinomycin D
[6109-97-3]	3-Amino-9-ethylcarbazole hydrochloride	[23214-92-8]	Adriamycin (Doxorubicin hydrochloride)
[106-96-7]	3-Bromopropyne (Propargyl Bromide)	[7220-81-7]	Aflatoxin
[56-49-5]	3-Methylcholanthrene	[6795-23-9]	Aflatoxin M1
[64091-91-4]	4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1- butanone (NNK)	[1402-68-2]	Aflatoxins
[101-80-4]	4,4'-diaminodiphenyl ether (4,4'-oxydianiline)	[15972-60-8]	Alachlor
[838-88-0]	4,4'-Methylene bis (2-methylaniline)	[309-00-2]	Aldrin Alkylaluminums
[101-14-4]	4,4'-Methylenebis(2-chloraniline) (MBOCA)	[302-79-4]	All-trans retinoic acid

Select carcinogens, reproductive hazards, and substances having a high degree of acute toxicity.

CAS #	Name List last updated spring 1999	CAS #	Name List last updated spring 1999
[101-61-1]	4,4'-methylenebis(N,N-dimethylaniline) (tetramethyldiaminodiphenylmethane)	[107-18-61]	Allyl alcohol [2-Propen-l-ol]
[101-77-9]	4,4'-Methylenedianiline (4,4'-diaminodiphenylmethane)	[107-05-1]	Allyl chloride
[13552-44-8]	4,4'-Methylenedianiline Dihydrochloride	[107-11-9]	Allylamine
[139-65-1]	4,4'-Thiodianiline	[319-84-6]	alpha-Hexachlorocyclohexane
[119-34-6]	4-Amino-2-nitrophenol	[134-32-7]	alpha-Naphthylamine (1-napthylamine)
[92-67-1]	4-aminodiphenyl (4-aminobiphenyl)	[28981-97-7]	Alprazolam
[95-83-0]	4-Chloro-o-phenylenediamine	[39831-55-5]	Amikacin sulfate
[60-11-7]	4-dimethylaminoazobenzene (p-dimethylaminoazobenzene)	[125-84-8]	Aminoglutethimide Aminoglycosides
[92-93-3]	4-Nitrobiphenyl (4-Nitrodiphenyl)	[54-62-6]	[54-62-6]
[57835-92-4]	4-Nitropyrene	[19774-82-4]	Amiodarone hydrochloride
[106-87-6]	4-vinyl-1-cyclohexene diepoxide (vinyl cyclohexenedioxide)	[61-82-5]	Amitrole (3-amino-1,2,4-triazole)
[100-40-3]	4-Vinylcyclohexene	[7664-41-7]	Ammonia (gas, liquified)
[139-91-3]	5-(Morpholinomethyl)-3-[(5-nitro-furfurylidene)- amino]-2-oxazolidinone	[7790-98-9]	Ammonium Perchlorate
[3795-88-8]	5-(Morpholinomethyl)-3-[(5-nitrofurfurylidene)amino]-2-oxazolidinone	[7787-36-2]	Ammonium Permanganate
[94-79-4]	5-Chloro-o-toluidine 5-chloro-o-toluidine, strong acid salts	[14028-44-5]	Amoxapine Anabolic steroids (androgenic steroids) Analgesic mixtures containing phenacetin Angiotensin converting enzyme (ACE) inhibitors
[51-21-8]	5-Fluorouracil	[62-53-3]	Aniline
[484-20-8]	5-Methoxypsoralen (bergapten, heraclin, majudin)	[142-04-1]	Aniline hydrochloride
[3697-24-3]	5-Methylchrysene	[117-37-3]	Anisindione
[602-87-9]	5-Nitroacenaphthene	[1309-64-4]	Antimony oxide (Antimony trioxide)
[99-59-2]	5-Nitro-o-anisidine	[140-57-8]	Aramite (butylphenoxyisopropyl chloroethyl sulfite)
[56-04-2]	6-methyl-2-thiouracil (methylthiouracil)	[12767-79-2]	Aroclor
[7496-02-8]	6-Nitrochrysene	[11097-69-1]	Aroclor 1254
[57-97-6]	7,12-Dimethylbenz(a)anthracene	[11096-82-5]	Aroclor 1260
[194-59-2]	7H-Dibenzo[c,g]carbazole	[7440-38-2]	Arsenic Arsenic compounds Arsenic compounds, inorganic Arsenic oxides, inorganic

Select carcinogens, reproductive hazards, and substances having a high degree of acute toxicity.

CAS #	Name List last updated spring 1999	CAS #	Name List last updated spring 1999
[26148-68-5]	A-alpha-C (2-Amino-9H-pyrido[2,3-b]indole)	[7784-34-1]	Arsenous tri-chloride
[75-07-0]	Acetaldehyde	[7784-42-1]	Arsine (AsH3)
[60-35-5]	Acetamide	[12172-73-5]	Asbestos (amosite)
[34256-82-1]	Acetochlor	[1332-21-4]	Asbestos (ascarite, tremolite)
[546-88-3]	Acetohydroxamic acid	[12001-28-4]	Asbestos (crocidolite)
[79-27-6]	Acetylene tetrabromide	[12001-29-5]	Asbestos (serpentine chrysotile)
[62476-59-9]	Acifluorfen		

CAS #	Name List last updated spring 1999	CAS #	Name List last updated spring 1999
[50-78-2]	Aspirin	[11056-06-7]	Bleomycins
[29122-68-7]	Atenolol	[10294-34-5]	Boron Trichloride
[1912-24-9]	Atrazine	[7637-07-2]	Boron trifluoride
[2465-27-2]	Auramine O	[353-42-4]	Boron trifluoride compound with methyl ether Bracken fern
[320-67-2]	Azacytidine(Azacitidine, Mylosar, 5-azacytidine)	[7726-95-6]	Bromine
[115-02-6]	Azaserine	[13863-41-7]	Bromine Chloride
[446-86-6]	Azathioprine	[7789-30-2]	Bromine Pentafluoride
[103-33-3]	Azobenzene Barbiturates	[7787-71-5]	Bromine Trifluoride
[5534-09-8]	Beclomethasone dipropionate	[75-27-4]	Bromodichloromethane
[17804-35-2]	Benomyl	[75-25-2]	Bromoform
[56-55-3]	Benz[a]anthracene (benzo[a]anthracene)	[1689-84-5]	Bromoxynil
[98-87-3]	Benzalchloride(benzylidinechloride, alpha, alpha-dichlorotoluene)	[143-81-7]	Butabarbital sodium
[71-43-2]	Benzene	[75-91-2]	Butyl Hydroperoxide (Tertiary)
[92-87-5]	Benzidine Benzidine salts Benzidine-based dyes	[614-45-9]	Butyl Perbenzoate (Tertiary)
[50-32-8]	Benzo[a]pyrene	[25013-16-5]	Butylated Hydroxyanisole (BHA)
[205-99-2]	Benzo[b]fluoranthene	[842-07-9]	C.I. 12055 (C.I. Solvent Yellow 14, Sudan I)
[205-82-3]	Benzo[j]fluoranthene	[3468-63-1]	C.I. 12075 (D&C Orange No. 17, Permanent Orange)
[207-08-9]	Benzo[k]fluoranthene Benzodiazepines	[2646-17-5]	C.I. 12100 (Oil Orange SS)

CAS #	Name List last updated spring 1999	CAS #	Name List last updated spring 1999
[271-89-6]	Benzofuran	[6358-53-8]	C.I. 12156 (C.I. solvent red 80, Citrus Red No. 2)
[98-07-7]	Benzotrichloride (alpha,alpha,alpha-trichlorotoluene)	[2092-56-0]	C.I. 15585 (D&C Red No. 8)
[7787-56-6]	Beryllium sulfate tetrahydrate	[1694-09-3]	C.I. 42640 (Benzyl violet 4B)
[39413-47-3]	Beryllium zinc silicate (zinc beryllium silicate)	[81-88-9]	C.I. 45170 (D&C Red No. 19, Rhodamine B, Basic Violet 10))
[3068-88-0]	beta-Butyrolactone	[2475-45-8]	C.I. 64500 (Disperse Blue 1)
[319-85-7]	beta-Hexachlorocyclohexane	[75-60-5]	Cacodylic acid
[91-59-8]	beta-naphthylamine (C.I. 37270, 2- aminonaphthalene)	[7440-43-9]	Cadmium
[57-57-8]	beta-Propiolactone Betel quid with tobacco	[10108-64-2]	Cadmium Chloride Cadmium compounds
[111-44-4]	Bis(2-chloroethyl)ether	[1306-19-0]	Cadmium Oxide
[117-81-7]	Bis(2-ethylhexyl) Phthalate (Dioctyl phthalate , Di-sec-octyl phthalate, DEHP)	[10124-36-4]	Cadmium Sulfate
[542-88-1]	bis(chloromethyl) ether	[1306-23-6]	Cadmium Sulfide
[154-93-8]	Bischloroethylnitrosourea(BCNU, Carmustine)	[331-39-5]	Caffeic acid
[8052-42-4]	Bitumens , extracts of steam-refined and air- refined Bitumens, extracts of steam-refined and air refined	[7778-44-1]	Calcium arsenate
		[2425-06-1]	Captafol
		[2939-80-2]	Captafol (Crisfolatan, Difolatan, Folcid)
		[133-06-2]	Captan
[63-25-2]	Carbaryl (Sevin)	[87-29-6]	Cinnamyl anthranilate
[86-74-8]	Carbazole	[15663-27-1]	Cisplatin
[1333-86-4]	Carbon black	[4291-63-8]	Cladribine
[75-15-0]	Carbon disulfide	[81103-11-9]	Clarithromycin
[630-08-0]	Carbon monoxide	[25122-46-7]	Clobetasol propionate
[56-23-5]	Carbon tetrachloride	[637-07-0]	Clofibrate
	Carbon-black extracts	[50-41-9]	Clomiphene citrate
[353-50-4]	Carbonyl Fluoride	[57109-90-7]	Clorazepate dipotassium
[41575-94-4]	Carboplatin	[8007-45-2]	Coal tars (coke oven emissions)
[9000-07-1]	Carrageenan, degraded	[65996-93-2]	Coal-tar pitches
[9004-70-0]	Cellulose Nitrate (concentration greater than 12.6% nitrogen Ceramic fibers (airborne particles of respirable size)	[7440-48-4]	Cobalt (powder)
[474-25-9]	Chenodiol	[1307-96-6]	Cobalt [II] oxide Cobalt compounds
[2439-01-2]	Chinomethionat (Oxythioquinox)	[50-36-2]	Cocaine

[2439-01-2]	Chinomethionat (Oxythioquinox)	[52-28-8]	Codeine phosphate Coke Oven Emissions
[305-03-3]	Chlorambucil	[64-86-8]	Colchicine
[56-75-7]	Chloramphenicol (chloromycetin)	[80-15-9]	Commune Hydroperoxide
[1620-21-9]	Chlorcyclizine hydrochloride	[8001-58-9]	creosote (coal tar creosote, creosote oil, liquid pitch oil)
[57-74-9]	Chlordane	[8021-39-4]	Creosote (wood creosote) Cresols
[143-50-0]	Chlordecone (Kepone)	[123-73-9]	Crotonaldehyde (E) - [2-Butenal, (E) -]
[58-25-3]	Chlordiazepoxide	[4170-30-3]	Crotonaldehyde [2-Butenal]
[438-41-5]	Chlordiazepoxide hydrochloride	[135-20-6]	Cupferron (ammonium N-nitrosophenylhydroxylamine)
[6164-98-3]	Chlordimeform	[21725-46-2]	Cyanazine
[115-28-6]	Chlorendic acid	[460-19-5]	Cyanogen (oxalonitrile, oxalic acid dinitrile)
[108171-26-2]	Chlorinated Paraffins (avg C12 , 60% Chlorine)	[506-77-4]	Cyanogen chloride
[7782-50-5]	Chlorine	[675-14-9]	Cyanuric fluoride
[10049-04-4]	Chlorine dioxide	[14901-08-7]	Cycasin
[13637-63-3]	Chlorine Pentrafluoride	[108-93-0]	Cyclohexanol
[7790-91-2]	Chlorine Trifluoride	[66-81-9]	Cycloheximide
[494-03-1]	Chlornaphazine (N,N-bis(2-chloroethyl)-2- naphthylamine)	[108-91-8]	Cyclohexylamine [Cyclohexanamine]
[124-48-1]	Chlorodibromomethane	[50-18-0]	Cyclophosphamide
[96-10-6]	Chlorodiethylaluminum (also called Diethylaluminum Chloride)	[6055-19-2]	Cyclophosphamide hydrate
[75-00-3]	Chloroethane (Ethyl chloride)	[59865-13-3]	Cyclosporin A (Cyclosporine A; Ciclosporin)
[593-70-4]	Chlorofluoromethane (fluorocarbon 31)	[13121-70-5]	Cyhexatin
[67-66-3]	Chloroform	[147-94-4]	Cytarabine
[107-30-2]	Chloromethyl methyl ether (methyl chloromethyl ether) Chlorophenols Chlorophenoxy herbicides	[21739-91-3]	Cytembena
[76-06-2]	Chloropicrin	[4342-03-4]	Dacarbazine
	Chloropicrin and Methyl Bromide mixture	[1596-84-5]	Daminozide
	Chloropicrin and Methyl Chloride mixture	[17230-88-5]	Danazol
[126-99-8]	Chloroprene (2-chloro-1,3-butadiene)	[20830-81-3]	Daunomycin
[1897-45-6]	Chlorothalonil	[23541-50-6]	Daunorubicin hydrochloride
[569-57-3]	Chlorotrianisene	[72-54-8]	DDD (Dichlorodiphenyldichloroethane)
[54749-90-5]	Chlorozotocin Chromium Hexavalent Compounds	[72-55-9]	DDE (Dichlorodiphenyldichloroethylene)

		[50-29-3]	DDT (dichlorodiphenyltrichloroethane, 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane)
[218-01-9]	Chrysene	[17702-41-9]	Decaborane
[79217-60-0]	Ciclosporin (Cyclosporine, Sandimmune, Neoral)	[[13654-09-6]	Decabromobiphenyl
[64-73-3]	Demeclocycline hydrochloride (internal use)	[1937-37-7]	Direct Black 38
[110-22-5]	Diacetyl Peroxide	[16071-86-6]	Direct Brown 95 (technical grade)
	Diaminotoluene (any isomer or mixed)	[110-05-4]	Di-t-butyl Peroxide
[439-14-5]	Diazepam	[25316-40-9]	Doxorubicin hydrochloride (Adriamycin)
[334-88-3]	Diazomethane	[564-25-0]	Doxycycline (internal use)
[226-36-8]	Dibenz[a,h]acridine	[94088-85-4]	Doxycycline calcium (internal use)
[53-70-3]	Dibenz[a,h]anthracene	[24390-14-5]	Doxycycline hyclate (internal use)
[224-42-0]	Dibenz[a,j]acridine	[17086-28-1]	Doxycycline monohydrate (internal use)
[192-65-4]	Dibenzo[a,e]pyrene	[72-20-8]	Endrin
[189-64-0]	Dibenzo[a,h]pyrene	[106-89-8]	Epichlorohydrin
[189-55-9]	Dibenzo[a,i]pyrene	[379-79-3]	Ergotamine tartrate
[191-30-0]	Dibenzo[a,l]pyrene	[12510-42-8]	Erionite
[94-36-0]	Dibenzoyl Peroxide	[66733-21-9]	Erionite
[19287-45-7]	Diborane	[50-28-2]	Estradiol 17B
[79-43-6]	Dichloroacetic acid		Estrogens, conjugated
[7572-29-4]	Dichloroacetylene		Estrogens, nonsteroidal
[75-09-2]	Dichloromethane (Methylene Chloride)		Estrogens, steroidal
[4109-96-0]	Dichlorosilane	[53-16-7]	Estrone (1,3,5(10)-estratrien-3-ol-17-one, beta- Estrone)
[62-73-7]	Dichlorvos(No-Pest Strip,2,2-dichloroethenyl dimethyl phosphate, DDVP)	[1239-45-8]	Ethidium bromide
[66-76-2]	Dicumarol	[57-63-6]	Ethinyl estradiol
[60-57-1]	Dieldrin	[536-33-4]	Ethionamide
[84-17-3]	Dienestrol	[140-88-5]	Ethyl acrylate
[1464-53-5]	Diepoxybutane	[62-50-0]	Ethyl methanesulfonate
	Diesel engine exhaust	[109-95-5]	Ethyl Nitrite
[64-67-5]	Diethyl sulfate	[510-15-6]	Ethyl-4,4’-dichlorobenzilate
[56-53-1]	Diethylstilbestrol (DES)	[75-04-7]	Ethylamine
[557-20-0]	Diethylzinc	[107-07-3]	Ethylene chlorohydrin
[2238-07-5]	Diglycidyl ether (di(2,3-epoxypropyl) ether)	[106-93-4]	Ethylene Dibromide [1,2-Dibromoethane (EDB)]
[101-90-6]	Diglycidyl resorcinol ether (DGRE)	[107-06-2]	Ethylene Dichloride (1,2-Dichloroethane)
[6190-39-2]	Dihydroergotamine mesylate	[371-62-0]	Ethylene fluorohydrin
[94-58-6]	Dihydrosafrole	[110-80-5]	Ethylene glycol monoethyl ether
[105-64-6]	Diisopropyl Peroxydicarbonate	[111-15-9]	Ethylene glycol monoethyl ether acetate

[2973-10-6]	Diisopropyl sulfate	[109-86-4]	Ethylene glycol monomethyl ether
[105-74-8]	Dilauroyl Peroxide	[110-49-6]	Ethylene glycol monomethyl ether acetate
[77-78-1]	Dimethyl sulfate (methyl sulfate)	[75-21-8]	Ethylene oxide
[124-40-3]	Dimethylamine, Anhydrous	[96-45-7]	Ethylene thiourea
[75-78-5]	Dimethyldichlorosilane	[107-15-3]	Ethylenediamine [1,2-Ethanediamine]
[624-92-0]	Dimethyldisulfide	[151-56-4]	Ethyleneimine (aziridine)
[68-12-2]	Dimethylformamide	[33419-42-0]	Etoposide
[75-18-3]	Dimethylsulfide (methyl sulfide)	[54350-48-0]	Etretinate
[513-37-1]	Dimethylvinyl chloride (1-chloro-2-methylpropene)		FireMaster BP-0
		[69806-50-4]	Fluazifop butyl
[25321-14-6]	Dinitrotoluene	[3385-03-3]	Flunisolide
	Dinitrotoluene mixture, 2,4-/2,6-	[7782-41-4]	Fluorine
[39300-45-3]	Dinocap	[76-43-7]	Fluoxymesterone
[88-85-7]	Dinoseb	[1172-18-5]	Flurazepam hydrochloride
[136-45-8]	Di-n-propyl isocinchomeronate (MGK Repellent 326)	[13311-84-7]	Flutamide
[78-34-2]	Dioxathion	[80474-14-2]	Fluticasone propionate
		[69409-94-5]	Fluvalinate
[57-41-0]	Diphenylhydantoin (phenytoin)	[133-07-3]	Folpet
[630-93-3]	Diphenylhydantoin (Phenytoin), sodium salt	[3778-73-2]	Ifosfamide
[50-00-0]	Formaldehyde (gas or mixture of any concentration)	[193-39-5]	Indeno[1,2,3-cd]pyrene
[110-00-9]	Furan	[7553-56-2]	Iodine
[67-45-8]	Furazolidone	[10043-66-0]	Iodine-131
[60568-05-0]	Furmecyclox	[36734-19-7]	Iprodione
[3688-53-7]	Furylfuramide (2-(2-furyl)-3-(5-nitro-2- furyl)acrylamide, AF-2)	[76180-96-6]	IQ (2-Amino-3-methylimidazo[4,5-f]quinoline)
[79748-81-5]	Fusarin C	[9004-66-4]	Iron dextran complex
[96-48-0]	gamma-Butyrolactone	[13463-40-6]	Iron pentacarbonyl
		[542-56-3]	Isobutyl nitrite
[82410-32-0]	Ganciclovir sodium		
	Gasoline engine exhaust (condensates/extracts)	[78-82-0]	Isobutyronitrile [Propanenitrile,2-methyl-]
[7782-65-2]	Germane	[78-79-5]	Isoprene
	Glasswoolfibers (airborneparticles of respirable size)	[108-23-6]	Isopropylchloroformate[Carbonochloridicacid, 1-methylethylester]
[67730-11-4]	Glu-P-1 (2-Amino-6- methyldipyrido[1,2-a:3',2'- d]imidazole)	[625-55-8]	Isopropyl formate
[67730-10-3]	Glu-P-2 (2-Aminodipyrido[1,2-a:3',2'- d]imidazole)	[75-31-0]	Isopropylamine

[765-34-4]	Glycidaldehyde	[120-58-1]	Isosafrole
[556-52-5]	Glycidol	[4759-48-2]	Isotretinoin
[765-34-4]	Glycol ethers	[37317-41-2]	Kanechlor 500 (under Polychlorinated Biphenyls)
		[463-51-4]	Ketene
[65807-02-5]	Goserelin acetate	[3031-51-4]	L-5-Morpholinomethyl)-3-[(5nitro- furfurylidene)amino]-2-oxazolidinone hydrochloride
[126-07-8]	Griseofulvin	[77501-63-4]	Lactofen
[16568-02-8]	Gyromitrin (Acetaldehyde	[303-34-4]	Lasiocarpine
[23092-17-3]	Halazepam	[7439-92-1]	Lead
[151-67-7]	Halothane	[301-04-2]	Lead acetate
[2784-94-3]	HC Blue No. 1	[7784-40-9]	Lead arsenate
[76-44-8]	Heptachlor	[7758-97-6]	Lead Chromate (under Chromium and Certain Chromium Compounds)
[1024-57-3]	Heptachlor epoxide	[7758-97-6]	Lead compounds
[118-74-1]	Hexachlorobenzene (benzene hexachloride, C6Cl6)		Lead compounds, inorganic
[87-68-3]	Hexachlorobutadiene	[7446-27-7]	Lead Phosphate
[608-73-1]	Hexachlorocyclohexanes	[1335-32-6]	Lead subacetate
[34465-46-8]	Hexachlorodibenzodioxin	[74381-53-6]	Leuprolide acetate
[684-16-2]	Hexafluoroacetone	[797-63-7]	Levonorgestrel implants
[680-31-9]	Hexamethyl phosphoramide (HMPA)	[58-89-9]	Lindane (gamma hexachlorocyclohexane, BHC gamma)
[822-06-0]	Hexamethylene diisocyanate	[554-13-2]	Lithium carbonate
	Histrelin acetate	[919-16-4]	Lithium citrate
[10034-93-2]	Hydrazine Sulfate	[846-49-1]	Lorazepam
[302-01-2]	Hydrazine, anhydrous	[75330-75-5]	Lovastatin
[122-66-7]	Hydrazobenzene (1,2-diphenylhydrazine)	[632-99-5]	Magenta
[1333-74-0]	Hydrogen	[8018-01-7]	Mancozeb
[10035-10-6]	Hydrogen Bromide	[12427-38-2]	Maneb
[7647-01-0]	Hydrogen chloride (gas)	[108-43-0]	m-Chlorophenol
[74-90-8]	Hydrogen Cyanide, Anhydrous	[39156-41-7]	m-diaminoanisole sulfate (2,4-diaminoanisole sulfate)
[7664-39-3]	Hydrogen fluoride		
[7722-84-1]	Hydrogen Peroxide (52% by weight or greater)	[99-65-0]	m-Dinitrobenzene
[7783-07-5]	Hydrogen Selenide	[68006-83-7]	Me-A-alpha-C (2-Amino-3-methyl-9H-pyrido[2,3- b]indole, MeA-C)
[7783-06-4]	Hydrogen sulfide	[71-58-9]	Medroxyprogesterone acetate
[7803-49-8]	Hydroxylamine	[595-33-5]	Megestrol acetate

[127-07-1]	Hydroxyurea	[77500-04-0]	MeIQx (2-Amino-3,8-dimethylimidazo[4,5- f]quinoxaline)
[7500-04-1]	MeIQx(2-Amino-3,8-dimethylimidazo[4,5-f]quinoxaline)	[7500-04-1]	MeIQx(2-Amino-3,8-dimethylimidazo[4,5- f]quinoxaline)
[148-82-3]	Melphalan	[148-82-3]	Melphalan
[9002-68-0]	Menotropins	[9002-68-0]	Menotropins
[57-53-4]	Meprobamate	[57-53-4]	Meprobamate
[6112-76-1]	Mercaptopurine	[6112-76-1]	Mercaptopurine
[7439-97-6]	Mercury	[7439-97-6]	Mercury
	Mercury compounds		Mercury compounds
	Mercury, organic cmpds		Mercury, organic cmpds
[531-76-0]	Merphalan	[531-76-0]	Merphalan
[72-33-3]	Mestranol	[72-33-3]	Mestranol
[78-85-3]	Methacrylaldehyde	[78-85-3]	Methacrylaldehyde
[920-46-7]	Methacryloyl chloride	[920-46-7]	Methacryloyl chloride
[30674-80-7]	Methacryloyloxyethyl isocyanate	[30674-80-7]	Methacryloyloxyethyl isocyanate
[3963-95-9]	Methacycline hydrochloride	[3963-95-9]	Methacycline hydrochloride
[137-42-8]	Metham sodium	[137-42-8]	Metham sodium
[60-56-0]	Methimazole	[60-56-0]	Methimazole
[59-05-2]	Methotrexate	[59-05-2]	Methotrexate
[15475-56-6]	Methotrexate sodium	[15475-56-6]	Methotrexate sodium
[298-81-7]	Methoxsalen (8-Methoxsypsoralen)	[298-81-7]	Methoxsalen (8-Methoxsypsoralen)
[76-38-0]	Methoxyflurane	[76-38-0]	Methoxyflurane
[126-98-7]	Methyl acrylonitrile	[126-98-7]	Methyl acrylonitrile
[563-47-3]	Methyl allyl chloride (3-chloro-2-methylpropene)	[563-47-3]	Methyl allyl chloride (3-chloro-2-methylpropene)
[74-83-9]	Methyl bromide	[74-83-9]	Methyl bromide
[598-55-0]	Methyl carbamate	[598-55-0]	Methyl carbamate
[74-87-3]	Methyl chloride	[74-87-3]	Methyl chloride
[79-22-1]	Methyl chloroformate	[79-22-1]	Methyl chloroformate
[1338-23-4]	Methyl Ethyl Ketone Peroxide	[1338-23-4]	Methyl Ethyl Ketone Peroxide
[453-18-9]	Methyl fluoroacetate	[453-18-9]	Methyl fluoroacetate
[421-20-5]	Methyl Fluorosulfate (Methyl fluorosulfonate)	[421-20-5]	Methyl Fluorosulfate (Methyl fluorosulfonate)
[60-34-4]	Methyl hydrazine (monomethylhydrazine)	[60-34-4]	Methyl hydrazine (monomethylhydrazine)
[74-88-4]	Methyl iodide	[74-88-4]	Methyl iodide
[624-83-9]	Methyl isocyanate	[624-83-9]	Methyl isocyanate
[74-93-1]	Methyl mercaptan	[74-93-1]	Methyl mercaptan

	Methyl mercury compounds		Methyl mercury compounds
[66-27-3]	Methyl methanesulfonate (methyl mesylate)	[66-27-3]	Methyl methanesulfonate (methyl mesylate)
[555-64-9]	Methyl thiocyanate [Thiocyanic acid, methylester]	[555-64-9]	Methyl thiocyanate [Thiocyanic acid, methylester]
[78-94-4]	Methyl vinyl ketone	[78-94-4]	Methyl vinyl ketone
[74-89-5]	Methylamine, anhydrous	[74-89-5]	Methylamine, anhydrous
[590-96-5]	Methylazoxymethanol	[590-96-5]	Methylazoxymethanol
[592-62-1]	Methylazoxymethanol acetate	[592-62-1]	Methylazoxymethanol acetate
[101-68-8]	Methylene biphenyl isocyanate	[101-68-8]	Methylene biphenyl isocyanate
	Methylhydrazine salts		Methylhydrazine salts
	Methylmercury compounds		Methylmercury compounds
[58-18-4]	Methyltestosterone	[58-18-4]	Methyltestosterone
[75-79-6]	Methyltrichlorosilane	[75-79-6]	Methyltrichlorosilane
[9006-42-2]	Metiram	[9006-42-2]	Metiram
[443-48-1]	Metronidazole	[443-48-1]	Metronidazole
[90-94-8]	Michler's Ketone [4,4'- (Dimethylamino) benzophenone]	[90-94-8]	Michler's Ketone [4,4'- (Dimethylamino) benzophenone]
[59467-96-8]	Midazolam hydrochloride Mineral Oils	[126-85-2]	Nitrogen mustard N-oxide
[13614-98-7]	Minocycline hydrochloride (internal use)	[302-70-5]	Nitrogen mustard N-oxide hydrochloride (2- chloro-N-(2-chloroethyl)-N-methylethanamine HCl)
[2385-85-5]	Mirex (Dechlorane)		Nitrogen Oxides (NO; NO(2); N2O4; N2O3)
[59122-46-2]	Misoprostol	[101022-44-0]	Nitrogen tetroxide
[50-07-7]	Mitomycin C	[10544-72-6]	Nitrogen Tetroxide (Nitrogen Peroxide)
[70476-82-3]	Mitoxantrone hydrochloride	[7783-54-2]	Nitrogen Trifluoride
[315-22-0]	Monocrotaline	[10544-73-7]	Nitrogentrioxide (dinitrogentrioxide)
	MOPP and other combined chemotherapy including alkylating agents	[75-52-5]	Nitromethane
[505-60-2]	Mustard gas (2,2'-dichlorodiethyl sulfide, Sulfur mustard)	[10024-97-2]	Nitrous oxide
[613-35-4]	N,N'-Diacetylbenzidine	[70-25-7]	N-methyl-N'-nitro-N-nitrosoguanidine
[79-44-7]	N,N-dimethylcarbamoyl chloride (dimethylcarbamoyl chloride)	[684-93-5]	N-methyl-N-nitrosourea (N-nitroso-N-methylurea)
[531-82-8]	N-[4-(5-Nitro-2-furyl)-2-thiazolyl] acetamide	[615-53-2]	N-Methyl-N-nitrosourethane (N-Nitroso-N- methylurethane)
[86220-42-0]	Nafarelin acetate	[924-42-5]	N-Methylolacrylamide
[3771-19-5]	Nafenopin	[38252-74-3]	N-Nitroso- n-butyl- N-(3-carboxypropyl)amine
[389-08-2]	Nalidixic acid	[3817-11-6]	N-Nitroso- n-butyl- N-(4-hydroxybutyl)amine
8030-30-6]	Naphtha (coal tar naphtha, coal tar, petroleum benzine)	[1116-54-7]	N-Nitrosodiethanolamine

[1405-10-3]	Neomycin sulfate (internal use)	[55-18-5]	N-nitrosodiethylamine (diethylnitrosamine; DEN)
[759-73-9]	N-ethyl-N-nitrosourea	[62-75-9]	N-Nitrosodimethylamine (Dimethylnitrosamine)
[13256-13-8]	N-Ethyl-N-nitrosovinylamine	[924-16-3]	N-nitrosodi-n-butylamine (N-butyl-N-nitroso-1- butylamine)
[56391-57-2]	Netilmicin sulfate	[86-30-6]	N-Nitrosodiphenylamine
[7440-02-0]	Nickel	[10595-95-6]	N-Nitrosomethylethylamine
[12054-48-7]	Nickel [II] Hydroxide	[4549-40-0]	N-Nitrosomethylvinylamine
[373-02-4]	Nickel Acetate	[59-89-2]	N-Nitrosomorpholine
	Nickel alloys	[621-64-7]	N-nitroso-N-dipropylamine (N-nitroso-N-di-n- propylamine, N-nitroso-N-propyl-1- propanamine)
[3333-67-3]	Nickel Carbonate	[16543-55-8]	N-Nitrosonornicotine
[13463-39-3]	Nickel Carbonyl (Nickel Tetracarbonyl)	[100-75-4]	N-Nitrosopiperidine
	Nickel compounds	[930-55-2]	N-nitrosopyrrolidine
[11113-74-9]	Nickel Hydroxide	[13256-22-9]	N-Nitrososarcosine
[1313-99-1]	Nickel II Oxide	[68-22-4]	Norethisterone (Norethindrone)
	Nickelrefinerydustfrom thepyrometallurgical process	[51-98-9]	Norethisterone acetate (Norethindrone acetate)
[12035-72-2]	Nickel subsulfide	[6533-00-2]	Norgestrel
[1271-28-9]	Nickelocene	[135-88-6]	N-Phenyl beta-naphthylamine
[54-11-5]	Nicotine	[789-02-6]	o,p'-DDT
[61-57-4]	Niridazole	[97-56-3]	o-Aminoazotoluene
[7697-37-2]	Nitric Acid (94.5% by weight or greater)	[90-04-0]	o-Anisidine
[10102-43-9]	Nitric oxide (nitrogenmonoxide)	[134-29-2]	o-Anisidine hydrochloride
[139-13-9]	Nitriloacetic acid	[95-57-8]	o-Chlorophenol
	Nitrilotriacetic acid salts	[303-47-9]	Ochratoxin A
[18662-53-8]	Nitrilotriacetic acid, trisodium salt monohydrate	[61288-13-9]	Octabromobiphenyl
[98-95-3]	Nitrobenzene	[95-50-1]	o-Dichlorobenzene
[67-20-9]	Nitrofurantoin	[528-29-0]	o-Dinitrobenzene
[59-87-0]	Nitrofurazone	[8014-94-6]	Oleum (65% to 80% by weight; also called Fuming Sulfuric Acid)
[10102-44-0]	Nitrogen Dioxide	[8014-95-7]	Oleum (Fuming Sulfuric acid) [Sulfuric acid, mixture with sulfur trioxide]1
[51-75-2]	Nitrogen mustard (N,N-bis(2-chloroethyl)methylamine, Mechloroethamine)	[91-23-6]	o-Nitroanisole (2-Nitroanisole)
[55-86-7]	Nitrogen mustard hydrochloride (Mechloroethamine hydrochloride)	[88-72-2]	o-Nitrotoluene
[95-54-5]	o-Phenylenediamine and its salts	[63-92-3]	Phenoxybenzamine hydrochloride
	Oral contraceptives, combined	[435-97-2]	Phenprocoumon
	Oral contraceptives, sequential	[122-60-1]	Phenyl glycidyl ether

	Organo tin compounds	[100-63-0]	Phenylhydrazine
[20816-12-0]	Osmium tetroxide		Phenylhydrazine salts
[95-53-4]	o-Toluidine	[75-44-5]	Phosgene (carbonyl chloride)
[636-21-5]	o-Toluidine Hydrochloride	[7803-51-2]	Phosphine (Hydrogen Phosphide)
[19666-30-9]	Oxadiazon	[10025-87-3]	Phosphorus oxychloride (phosphoryl chloride)
[604-75-1]	Oxazepam	[7647-19-0]	Phosphorus pentafluoride
[301-12-2]	Oxydemeton methyl	[7719-12-2]	Phosphorus trichloride
[7783-41-7]	Oxygen Difluoride (Fluorine Monoxide)	[7280-37-7]	Piperazine estrone sulfate (Estropipate)
[434-07-1]	Oxymetholone	[110-89-4]	Piperidine
[79-57-2]	Oxytetracycline (internal use)	[54-91-1]	Pipobroman
[2058-46-0]	Oxytetracycline hydrochloride (internal use)	[18378-89-7]	Plicamycin
[10028-15-6]	Ozone	[100-01-6]	p-Nitroaniline
[5216-25-1]	p-a,a,a-Tetrachlorotoluene	[156-10-5]	p-nitrosodiphenylamine (4-nitrosodiphenylamine)
[33069-62-4]	Paclitaxel		Polybrominated biphenyls (PBBs)
[12174-11-7]	Palygorskite(attapulgite) (longfibres, > 5 micrometers)	[59536-65-1]	Polybrominated biphenyls (PBBs)
[60-09-3]	p-Aminoazobenzene	[67774-32-7]	Polybrominated Biphenyls (PBBs)
[794-93-4]	Panfuran S		Polychlorinated biphenyls (PCBs)
[104-94-9]	p-Anisidine	[1336-36-3]	Polychlorinated Biphenyls (PCBs)
[115-67-3]	Paramethadione		Polychlorinated dibenzofurans
[3165-93-3]	p-Chloro -o-toluidine Hydrochloride		Polychlorinated dibenzo-p-dioxins
[106-47-8]	p-Chloroaniline		Polycyclic Aromatic Hydrocarbons (PAHs)
[20265-96-7]	p-Chloroaniline hydrochloride	[53973-98-1]	Polygeenan
[95-69-2]	p-Chloro-o-toluidine	[7758-01-2]	Potassium bromate
	p-Chloro-o-toluidine strong acid salts	[671-16-9]	Procarbazine
[106-48-9]	p-Chlorophenol	[366-70-1]	Procarbazine Hydrochloride
[120-71-8]	p-cresidine (5-methyl-o-anisidine)	[32809-16-8]	Procymidone
[106-46-7]	p-dichlorobenzene (1,4-dichlorobenzene)	[57-83-0]	Progesterone
[100-25-4]	p-Dinitrobenzene		Progestins
[52-67-5]	Penicillamine	[23950-58-5]	Pronamide
[19624-22-7]	Pentaborane	[2312-35-8]	Propargite
[87-86-5]	Pentachlorophenol	[107-12-0]	Propionitrile [Propanenitrile]
[57-33-0]	Pentobarbital sodium	[109-61-5]	Propyl chloroformate [Carbonochloridic acid, propylester]
[53910-25-1]	Pentostatin		
[79-21-0]	Peracetic acid (peroxyacetic acid)	[627-3-5]	Propyl Nitrate

[7601-90-3]	Perchloric Acid (concentrationgreaterthan 60% by weight)	[75-56-9]	Propylene oxide
		[75-55-8]	Propylenimine (2-Methylaziridine)
[127-18-4]	Perchloroethylene (tetrachloroethylene)	[51-52-5]	Propylthiouracil
[594-42-3]	Perchloromethyl Mercaptan	[106-49-0]	p-Toluidine
[7616-94-6]	Perchloryl Fluoride	[36735-22-5]	Quazepam
[63-98-9]	Phenacemide	[91-22-5]	Quinoline
[62-44-2]	Phenacetin (p-acetophenetidide, p- ethoxyacetanilide)		Quinoline strong acid salts
			Radionuclides
[94-78-0]	Phenazopyridine	[10043-92-2]	Radon
[136-40-3]	Phenazopyridine hydrochloride		Radon decay products
[3546-10-9]	Phenesterin	[50-55-5]	Reserpine (Regroton)
[50-06-6]	Phenobarbital		Residual (heavy) fuel oils
[77-09-8]	Phenolphthalein	[10453-86-8]	Resmethrin
[59-96-1]	Phenoxybenzamine	[108-46-3]	Resorcinol
	Retinol/retinyl esters		Talc containing asbestiform fibers
[36791-04-5]	Ribavirin	[10540-29-1]	Tamoxifen
	Rockwool	[54965-24-1]	Tamoxifen citrate
[81-07-2]	saccharin (benzisothiazol-3(2H)-one-1,1- dioxide)		Tamoxifen salts
		[7783-80-4]	Tellurium hexafluoride
[128-44-9]	Saccharin, sodium	[846-50-4]	Temazepam
[94-59-7]	Safrole	[29767-20-2]	Teniposide
[599-79-1]	Salicylazosulfapyridine	[2593-15-9]	Terrazole
[107-44-8]	Sarin (isopropyl methanefluorophosphonate)	[58-22-0]	Testosterone and its esters
[309-43-3]	Secobarbital sodium	[58-20-8]	Testosterone cypionate
[7782-49-2]	Selenium	[315-37-7]	Testosterone enanthate
[7783-79-1]	Selenium hexafluoride	[60-54-8]	Tetracycline (internal use)
[7446-34-6]	Selenium sulfide	[64-75-5]	Tetracycline hydrochloride (internal use)
	Selenium, and all cmpds	[116-14-3]	Tetrafluoroethylene
[68308-34-9]	Shale-oils	[10036-47-2]	Tetrafluorohydrazine
[7699-41-4]	Silica - amorphous	[75-74-1]	Tetramethyl Lead
[60676-86-0]	Silica - amorphous, fused	[3333-52-6]	Tetramethyl succinonitrile
[1317-95-9]	Silica - crystalline, tripoli	[509-14-8]	Tetranitromethane
[15468-32-3]	Silica - Tridymite (respirable)	[50-35-1]	Thalidomide
[14808-60-7]	Silica (quartz, respirable)	[62-55-5]	Thioacetamide

	Silica, crystalline(airborneparticlesofrespirable size)	[154-42-7]	Thioguanine
[14464-46-1]	Silica, crystalline, cristobalite	[7719-09-7]	Thionyl chloride
[7783-61-1]	Silicon tetrafluoride	[52-24-4]	Thiotepa (tris(1-aziridinyl)phosphine sulfide)
	Slagwool	[62-56-6]	Thiourea
[16680-47-0]	Sodium Equilin Sulfate (under Conjugated Estrogens)	[1314-20-1]	Thorium Dioxide
[438-67-5]	Sodium Estrone Sulfate (under Conjugated Estrogens)	[7550-45-0]	Titanium tetrachloride [Titanium chloride (TiCl4) (T-4)-]
		[49842-07-1]	Tobramycin sulfate
[62-74-8]	Sodium fluoroacetate	[108-88-3]	Toluene
[132-27-4]	Sodium o-phenylphenate	[91-08-7]	Toluene 2, 6- diisocyanate [Benzene, 1,3- diisocyanato-2-methyl-]1
	Soots, tars, and mineral oils (untreated and mildly treated oils and used engine oils)	[26471-62-5]	Toluene diisocyanates (any isomer or mixed)
[52-01-7]	Spironolactone	[584-84-9]	Toluene-2,4-diisocyanate
[10418-03-8]	Stanozolol	[8001-35-2]	Toxaphene (chlorinated camphene)
[10048-13-2]	Sterigmatocystin	[25962-77-0]	trans-2-[(Dimethylamino)methylimino]-5-[2-(5-nitro-2-furyl)-vinyl]-1,3,4-oxadiazole
[7803-52-3]	Stibine (antimony trihydride)		
[3810-74-0]	Streptomycin sulfate	[55738-54-0]	trans-2-[(Dimethylamino)methylimino]-5-[2-(5-nitro-2-furyl)vinyl]-1,3,4-oxadiazole
[18883-66-4]	Streptozotocin	[299-75-2]	Treosulfan (Treosulphan)
[7789-06-2]	Strontium Chromate (under Chromium and Certain Chromium Compounds)	[28911-01-5]	Triazolam
[100-42-5]	Styrene (phenylethylene, vinyl benzene)	[817-09-4]	Trichlormethine (trimustine hydrochloride, 2,2',2''-trichlorotriethylamine hydrochloride)
[96-09-3]	Styrene oxide (styrene-7,8-oxide)	[1558-25-4]	Trichloro (chloromethyl) silane
[95-06-7]	Sulfallate(diethyldithiocarbamic acid 2-chlorallyl ester)	[27137-85-5]	Trichloro (dichlorophenyl) Silane
[7446-09-5]	Sulfur dioxide	[79-01-6]	Trichloroethylene
[10025-67-9]	Sulfur monochloride (sulfur chloride, disulfur dichloride)	[10025-78-2]	Trichlorosilane
		[121-44-8]	Triethylamine (TEA)
[5714-22-7]	Sulfur pentafluoride (disulfur decafluoride)	[79-38-9]	Trifluorochloroethylene
[10546-01-7]	Sulfur pentafluoride (radical)	[13647-35-3]	Trilostane
[7783-60-0]	Sulfur tetrafluoride	[127-48-0]	Trimethadione
[7446-11-9]	Sulfur trioxide (sulfuric anhydride)	[75-77-4]	Trimethlchlorosilane [Silane, chlorotrimethyl-]
[7791-25-5]	Sulfuryl chloride	[512-56-1]	Trimethyl phosphate
[14807-96-6]	Talc (fibrous)	[75-50-3]	Trimethylamine
[2487-90-3]	Trimethyoxysilane	[99-66-1]	Valproate (Valproic acid)
[82952-64-5]	Trimetrexate glucuronate	[143-67-9]	Vinblastine sulfate

[76-87-9]	Triphenyltin hydroxide	[50471-44-8]	Vinclozolin
[126-72-7]	Tris(2,3-dibromopropyl) phosphate	[57-22-7]	Vincristine
[115-96-8]	Tris(2-chloroethyl) phosphate	[2068-78-2]	Vincristine sulfate
[68-76-8]	Tris(aziridinyl)-p-benzoquinone (Triaziquone)	[108-05-4]	Vinyl acetate
[62450-06-0]	Tryptophan-P-1 (3-Amino-1,4-dimethyl-5H- pyrido[4,3-b]indole, Trp-P-1)	[593-60-2]	Vinyl bromide
[62450-07-1]	Tryptophan-P-2 (3-Amino-1-methyl-5H-pyrido[4,3-b]indole, Trp-P-2)	[75-01-4]	Vinyl chloride
		[75-02-5]	Vinyl fluoride
[66-75-1]	Uracil mustard	[75-38-7]	Vinylidene fluoride (1,1-difluoroethylene)
	Uranium, all cmpds	[81-81-2]	Warfarin (in any quantity or concentration)
[7440-61-1]	Uranium, natural		Wood dusts (hardwoods)
[51-79-6]	Urethane (Urethan; Ethyl carbamate)	[13530-65-9]	Zinc Chromate
[26995-91-5]	Urofollitropin	[12122-67-7]	Zineb

Appendix H: Examples of Incompatible Chemicals

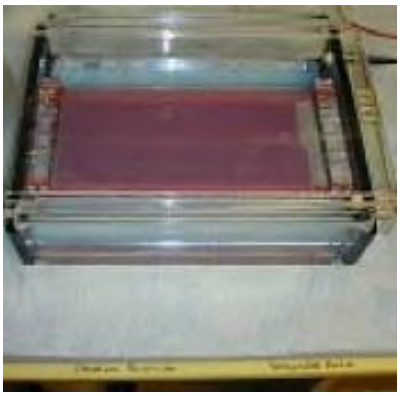
From: "Safety in Academic Chemistry Laboratories," American Chemical Society

Chemical	Is Incompatible With
Acetic Acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Acetone	Concentrated nitric and sulfuric acid mixtures
Alkali and alkaline earth metals (such as powdered aluminum or magnesium, calcium, lithium, sodium, potassium)	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia (anhydrous)	Mercury (in manometers, for example), chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid (anhydrous)
Ammonium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitries, sulfur, finely divided organic combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids
Bromine	See chlorine
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chromic acid and chromium	Acetic acid, naphthalene, camphor, glycerol, alcohol, flammable liquids in general
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Fluorine	All other chemicals
Hydrocarbons (such as butane, propane, benzene)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali

Chemical	Is Incompatible With
Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, combustible materials
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen: flammable liquids, solids or gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalies, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids
Potassium perchlorate (see also chlorates)	Sulfuric and other acids
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartartic acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)
Tellurides	Reducing agents

Appendix I: Working Safely with Ethidium Bromide

Description



Ethidium bromide, (Dromilac, homidium bromide), CAS # 1239-45-8, is commonly used in molecular biology laboratories forvisualizing nucleic acids using electrophoresis and other gel-based nucleic acid separation methods. Ethidium bromide fluoresces when exposed to ultraviolet light and exhibits a vivid red-orange color when bound to nucleicacids.

Hazards

Ethidium bromide is a potent mutagen and is an irritant to the eyes, skin and respiratory tract. Ethidium bromide can be absorbed through exposed skin and mucus membranes.

Personal Protective Equipment

Protective Clothing: Wear standard laboratory apparel including a fully-buttoned lab coat, long pants and closed-toe shoes.

Eye Protection: Wear safety glasses with side shields at all times within the laboratory. Wear chemical splash goggles when there is a splash hazard.

Gloves: Wear disposable nitrile gloves to protect exposed skin on the hands. Wash hands thoroughly after removing gloves.

Special Work Practices

Locations where ethidium bromide is used or stored must be identified as “Designated Areas.”

Procedures requiring the use of ethidium bromide powder or having the potential to generate aerosols must be performed in a fume hood. To minimize inhalation exposure, purchase ready-made stock solutions or tablets in lieu of preparing stock solutions from ethidium bromide powder.

During normal use, small spills may occur and residues may build up on equipment and other laboratory surfaces. A solution of soap and water is recommended for cleaning small spills and removing residues on equipment and laboratory surfaces.

Due to the potential for equipment contamination, ethidium bromide-containing agarose gel should not be heated in a microwave.

Emergency Procedures

Eye Contact: Immediately irrigate. Hold eyes open and irrigate for 15 minutes. Obtain medical attention.

Skin Contact: Remove contaminated clothing. Immediately wash affected areas with soap and water. Obtain medical attention.

Ingestion: Obtain medical attention immediately.

Inhalation: Seek medical attention if symptoms develop (wheezing, coughing, shortness of breath, burning in mouth, throat or chest).

Medical Attention: Between the hours of 8:30 AM and 5:00 PM, staff should visit contact Cindy Ferrini at x77853.

Ethidium Bromide Waste Disposal

Ethidium Bromide waste in concentrated or solid form is collected as hazardous waste and should not be flushed down the drain or disposed of in the trash. Waste should properly labeled and handled as follows:

Write the date received and the date opened on all containers of ether. Discard open containers of ether within six months of opening.

Liquids: Small quantities of aqueous solutions containing an ethidium bromide concentration of less than 10 µg/ml (10 ppm) may be flushed down the drain. Non-aqueous solutions and solutions containing an ethidium bromide concentration of greater than 10 µg/ml will be picked up by waste management.

Laboratories are responsible for providing small volume waste containers.

Contaminated sharps (needles, syringes, slides, broken glass, etc.): Discard in an infectious waste sharps container clearly labeled “CHEMICAL CONTAMINATED SHARPS-DO NOT AUTOCLAVE”. Discard the sharps container as infectious waste without autoclaving when it is 2/3 to 3/4 full.

Solids (contaminated gloves, centrifuge tubes, towels, etc.): Store in a properly labeled translucent polyethylene container for disposal as chemical waste. Do not use glass containers.

Gels: Low concentration gels (< 10 µg/ml) may be wrapped in plastic wrap and discarded in the trash. Higher concentration gels should be disposed of as contaminated solids described above.

Spill Procedures

Small spills of ethidium bromide solutions should be cleaned by laboratory staff. For large spills outside the fume hood, evacuate/restrict access to the laboratory and contact Barb Erwin x70160 for assistance.

Individuals cleaning spills must wear appropriate protective equipment as described in the Personal Protective Equipment section of this document.

Spills of ethidium bromide solutions should be cleaned using absorbent pads followed by surface decontamination using soap and water. Spilled dry material should first be covered with moist absorbent pads to avoid generation of dust.

Ensure all materials contaminated as a result of the cleanup process are collected and disposed of as hazardous waste as described in the Ethidium Bromide Waste Disposal section of this document.

Appendix J: Basis of OSHA Carcinogen Listing for Individual Chemicals

Appendix C — Basis of OSHA Carcinogen Listing for Individual Chemicals

Under section 313, a chemical does not have to be counted towards threshold determinations and release and other waste management calculations if it is present ina mixture below a certain concentration. This is known as the section 313 “de min- imus” concentration in mixture. When the section 313 rule was developed, EPA adopt- ed the de minimus percentages from the Occupational Safety and Health Administration’s (OSHA)

Hazard Communication Standards (29 CFR 1910.1900) because much of the information that industry would have relating to chem- icals in mixtures would most likely be from the material safety data sheet (MSDS) on that mixture. The OSHA de minimus limitation is 0.1 percent if the chemical is a known or suspect carcinogen by virtue of appearing in one of three sources:

1. National Toxicology Program (NTP), “Annual Report on Carcinogens” (Latest Edition);
2. International Agency for Research on Cancer (IARC) “Monographs” (Latest Edition); or
3. 29 CFR 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration

The de minimus limitation is 1.0 percent for chemicals that do not meet the above OSHA carcinogen criteria. The carcinogen designation in the list of chemicals relates to any chemical that the Agency deter- mined met the above OSHA criteria for the 0.1 percent de minimus limitation. Certain metal compound categories have two de minimus limitions. For example, hexava- lent chromium compounds and inorganic arsenic compounds meet the OSHA car- cinogen criteria, while trivalent chromium compounds and organic arsenic do not meet the OSHA criteria.

Table C–1 shows the specific bases for which the individual chemical was desig- nated as a known or suspect carcinogen. This list was updated for the 1999 TRI Public Data Release, based on a review of the most current NTP, IARC, and OSHA sources.

Table C–1 Basis of OSHA Carcinogen Listing for Individual Chemicals

Chemical	IARC	NTP	OSHA–Z	Chemical	IARC	NTP	OSHA–Z
Acetaldehyde	2B	P	-	Catechol	2B	-	-
Acetamide	2B	–	–	Chlordane	2B	–	–
2-Acetylaminofluorene	–	P	Z	Chlorendic acid	2B	P	–
Acrylamide	2A	P	–	p-Chloroaniline	2B	–	–
Acrylonitrile	2B	P	Z	Chloroform	2B	P	–
2-Aminoanthraquinone	–	P	–	Chloromethyl methyl ether	1	K	Z
4-Aminoazobenzene	2B	–	–	3-Chloro-2-methyl-1-propene	–	P	–
4-Aminobiphenyl	1	K	Z	Chlorophenols	2B	–	–
1-Amino-2-methylanthraquinone	–	P	–	Chloroprene***	2B	P	–
Amitrole	2B	P	–	Chlorothalonil	2B	–	–
o-Anisidine	2B	–	–	p-Chloro-o-toluidine	2A	P	–
o-Anisidine hydrochloride	–	P	–	Chromium (VI) compounds	1	K	–
Arsenic and inorganic arsenic compounds	1	K*	Z	Cobalt and cobalt compounds	2B	–	–
Asbestos (friable)	1	K	Z	Creosote	2A	K	–
Atrazine**	–	–	–	p-Cresidine	2B	P	–
Benzene	1	K	Z	Cupferron	–	P	–
Benzidine	1	K	Z	2,4-D****	2B	–	–
Benzoic trichloride	2B	P	–	2,4-D butoxyethyl ester****	2B	–	–
Beryllium and beryllium compounds	1	P*	–	2,4-D butyl ester****	2B	–	–
Bis(chloromethyl)ether	1	K	Z	2,4-D chlorocrotyl ester****	2B	–	–
1,3-Butadiene	2A	K	–	2,4-D 2-ethylhexyl ester****	2B	–	–
1,2-Butylene oxide	2B	–	–	2,4-D 2-ethyl-4-methylpentyl ester****	2B	–	–
C.I. Acid Red 114	2B	–	–	2,4-Diaminoanisole	2B	–	–
C.I. Direct Black 38	2A	K	–	2,4-Diaminoanisole sulfate	–	P	–
C.I. Direct Blue 6	2A	K	–	4,4'-Diaminodiphenyl ether	2B	–	–
C.I. Direct Brown 95	2A	–	–	2,4-Diaminotoluene	2B	P	–

C.I. Food Red 5	2B	–	–	Diaminotoluene (mixed isomers)	2B	P	–
C.I. Solvent Yellow 3 (o-aminoazotoluene)	2B	P	–	1,2-Dibromo-3-chloropropane	2B	P	Z
C.I. Solvent Yellow 34 (Auramine)	2B	–	–	1,2-Dibromoethane	2A	P	–
Cadmium and cadmium compounds	1	K*	–	1,4-Dichlorobenzene	2B	P	–
Carbon tetrachloride	2B	P	–	Dichlorobenzene (mixed isomers)	2B	P	–

Note: The list of TRI chemicals meeting the OSHA carcinogen standard and, therefore, reported when in a mixture at a concentration level below the de minimus level of 0.1% has been updated, and this list reflects the update.

IARC: 1–The chemical is carcinogenic to humans; 2A–The chemical is probably carcinogenic to humans; 2B–The chemical is possibly car- cinogenic to humans.

NTP: K–The chemical is known to be carcinogenic; P–The chemical may reasonably be anticipated to be carcinogenic. OSHA: Z–The chemical appears at 29 CFR part 1910 Subpart Z.

*Certain compounds.

**IARC classification was recently downgraded and the chemical no longer meets the OSHA carcinogen criteria (effective for the 2000 reporting year).

***NTP classification meets OSHA carcinogen criteria (effective for the 2001 reporting year)

****Chlorophenoxy herbicides (IARC 2B).

*****IARC classification meets OSHA carcinogen criteria (effective for the 2001 reporting year)

Table C–1 Basis of OSHA Carcinogen Listing for Individual Chemicals (continued)

Chemical	IARC	NTP	OSHA–Z	Chemical	IARC	NTP	OSHA–Z
3,3'-Dichlorobenzidine	2B	P	Z	2,4-D propylene glycol butyl ether ester****	2B	-	-
3,3'-Dichlorobenzidine sulfate	2B	P	–	Epichlorohydrin	2A	P	–
Dichlorobromomethane	2B	P	–	Ethyl acrylate	2B	–	–
1,2-Dichloroethane	2B	P	–	Ethyl benzene*****	2B	–	–
Dichloromethane	2B	P	–	Ethyleneimine	–	–	Z
trans-1,3-Dichloropropene	2B	–	–	Ethylene oxide	1	K	Z
1,3-Dichloropropylene	2B	P	–	Ethylene thiourea	2B	P	–
Dichlorvos	2B	–	–	Formaldehyde	2A	P	Z
Diepoxybutane	2B	P	–	Heptachlor	2B	–	–
Di-(2-ethylhexyl)phthalate	–	P	–	Hexachlorobenzene	2B	P	–
Diethyl sulfate	2A	P	–	alpha-Hexachlorocyclohexane	2B	P	–
Diglycidyl resorcinol ether	2B	P	–	Hexachloroethane	2B	P	–
Dihydrosafrole	2B	–	–	Hexamethylphosphoramide	2B	P	–
3,3'-Dimethoxybenzidine	2B	P	–	Hydrazine	2B	P	–
3,3'-Dimethoxybenzidine dihydrochloride	2B	P	–	Hydrazine sulfate	–	P	–
3,3'-Dimethoxybenzidine hydrochloride	2B	P	–	Lead and inorganic lead compounds	2B	–	Z
4-Dimethylaminoazobenzene	2B	P	Z	Lindane	2B	P	–
3,3'-Dimethylbenzidine	2B	P	–	Mecoprop****	2B	–	–
3,3'-Dimethylbenzidine dihydrochloride	2B	P	–	Methoxone****	2B	–	–
3,3'-Dimethylbenzidine dihydrofluoride	2B	P	–	Methoxone sodium salt****	2B	–	–
Dimethylcarbamyl chloride	2A	P	–	4,4-Methylenebis (2-chloroaniline)	2A	P	–
N,N-Dimethylformamide**	–	–	–	4,4'-Methylenebis (N,N-dimethyl) benzeneamine	2B	P	–
1,1-Dimethylhydrazine	2B	P	–	4,4'-Methylenedianiline	2B	P	Z
Dimethyl sulfate	2A	P	–	Michler 's ketone	–	P	–
2,4-Dinitrotoluene	2B	–	–	Mustard gas	1	K	–
2,6-Dinitrotoluene	2B	–	–	alpha-Naphthylamine	–	–	Z
1,4-Dioxane	2B	P	–	beta-Naphthylamine	1	K	Z
1,2-Diphenylhydrazine	–	P	–	Nickel	2B	P	–
2,4-D isopropyl ester****	2B	–	–	Nickel compounds	1	P*	–
2,4-DP****	2B	–	–	Nitrilotriacetic acid	–	P	–

Note: The list of TRI chemicals meeting the OSHA carcinogen standard and, therefore, reported when in a mixture at a concentration level below the de minimus level of 0.1% has been updated, and this list reflects the update.

IARC: 1–The chemical is carcinogenic to humans; 2A–The chemical is probably carcinogenic to humans; 2B–The chemical is possibly car- cinogenic to humans.

NTP: K–The chemical is known to be carcinogenic; P–The chemical may reasonably be anticipated to be carcinogenic. OSHA: Z–The chemical appears at 29 CFR part 1910 Subpart Z.

*Certain compounds.

**IARC classification was recently downgraded and the chemical no longer meets the OSHA carcinogen criteria (effective for the 2000 reporting year).

***NTP classification meets OSHA carcinogen criteria (effective for the 2001 reporting year)

****Chlorophenoxy herbicides (IARC 2B).

*****IARC classification meets OSHA carcinogen criteria (effective for the 2001 reporting year)

Table C–1 Basis of OSHA Carcinogen Listing for Individual Chemicals (continued)

Chemical	IARC	NTP	OSHA–Z	Chemical	IARC	NTP	OSHA–Z
Nitrobenzene	2B	-	-	7,12–Dimethylbenz(a) anthracene	2B	-	-
4-Nitrobiphenyl	–	–	Z	Indeno[1,2,3–cd]pyrene	2B	P	–
Nitrofen	2B	P	–	5–Methylchrysene	2B	P	–
Nitrogen mustard	2A	–	–	1–Nitropyrene	2B	P	–
2-Nitropropane	2B	P	–	Potassium bromate	2B	–	–
N-Nitrosodi-n-butylamine	2B	P	–	Propane sultone	2B	P	–
N-Nitrosodiethylamine	2A	P	–	beta-Propiolactone	2B	P	Z
N-Nitrosodimethylamine	2A	P	Z	Propyleneimine	2B	P	–
N-Nitrosodi-n-propylamine	2B	P	–	Propylene oxide	2B	P	–
N-Nitroso-N-ethylurea	2A	P	–	Saccharin (manufacturing)**	–	–	–
N-Nitroso-N-methylurea	2A	P	–	Safrole	2B	P	–
N-Nitrosomethylvinylamine	2B	P	–	Sodium o-phenylphenoxide	2B	–	–
N-Nitrosomorpholine	2B	P	–	Styrene	2B	–	–
N-Nitrosonornicotine	2B	P	–	Styrene oxide	2A	–	–
N-Nitrosopiperidine	2B	P	–	Tetrachloroethylene	2B	P	–
Pentachlorophenol	2B	–	–	Thioacetamide	2B	P	–
Phenytoin	2B	P	–	4,4'-Thiodianiline	2B	–	–
Polychlorinated alkanes (C12, 60% chlorinated)	–	P	–	Thiourea	2B	P	–
Polybrominated biphenyls (PBBs)	2B	P	–	Toluene-2,4-diisocyanate	2B	P	–
Polychlorinated biphenyls (PCBs)	2A	P	–	Toluene-2,6-diisocyanate	2B	P	–
Polycyclic aromatic compounds (PACs):				Toluene diisocyanate (mixed isomers)	2B	P	-
Benz(a)anthracene	2A	P	–	o-Toluidine	2A	P	–
Benzo(b)fluoranthene	2B	P	–	o-Toluidine hydrochloride	–	P	–
Benzo(j)fluoranthene	2B	P	–	Toxaphene	2B	P	–
Benzo(k)fluoranthene	2B	P	–	Trichloroethylene	2A	P	–
Benzo(rst)pentaphene	2B	–	–	2,4,6-Trichlorophenol	2B	P	–
Benzo(a)pyrene	2A	P	–	1,2,3-Trichloropropane	2A	P	–
Dibenz(a,h)acridine	2A	P	–	Tris(2,3-dibromopropyl) phosphate	2A	P	–
Dibenz(a,j)acridine	2B	P	–	Trypan blue	2B	–	–

Dibenzo(a,h)anthracene	2B	P	–	Urethane	2B	P	–
7H–Dibenzo(c,g)carbazole	2B	P	–	Vinyl acetate	2B	–	–
Dibenzo(a,e)pyrene	2B	P	–	Vinyl bromide	2A	–	–
Dibenzo(a,h)pyrene	2B	P	–	Vinyl chloride	1	K	Z
Dibenzo(a,l)pyrene	2B	P	–	2,6-Xylidine	2B	–	–

Note: The list of TRI chemicals meeting the OSHA carcinogen standard and, therefore, reported when in a mixture at a concentration level below the de minimus level of 0.1% has been updated, and this list reflects the update.

IARC: 1–The chemical is carcinogenic to humans; 2A–The chemical is probably carcinogenic to humans; 2B–The chemical is possibly carcino- genic to humans.

NTP: K–The chemical is known to be carcinogenic; P–The chemical may reasonably be anticipated to be carcinogenic. OSHA: Z–The chemical appears at 29 CFR part 1910 Subpart Z.

*Certain compounds.

**IARC classification was recently downgraded and the chemical no longer meets the OSHA carcinogen criteria (effective for the 2000 report- ing year).

***NTP classification meets OSHA carcinogen criteria (effective for the 2001 reporting year)

****Chlorophenoxy herbicides (IARC 2B).

*****IARC classification meets OSHA carcinogen criteria (effective for the 2001 reporting year)

Emergency Contact Information

Emergency Contacts	Name	Title	Work Phone	Cell Phone
Primary	Jasmine Yu	Lab Manager	909 607 8698	949 572 7207
Claremont Colleges Campus Safety			909 607 2000	
Alternate # 1	Trevor Garrett	AVP Financial Planning & Analys	909 607 0002	909 560 7610
Alternate # 2	Larry Grill	Dean of Research	909 607 0715	
Alternate # 3	Abel Quevedo	Facilities Supervisor	909 607 0027	909 461 5343
Alternate # 4	Robert Hoffman	Facilities Operations Supervisor	909 607 8722	909 480 5117
Emergency Contacts				
Fire Department/Ambulance/Police			**911**	
LA County Hazardous Materials Divison			323 890 4045	
LA County Hazardous Materials Divison(East County)			626 430 3260	
Local NonEmergency(Fire/Police)			909) 399-5411	
Medical Attention				
Pomona Valley Hospital			909 865 9500	
Kaiser Permanente Ontario			833 574 2273	
San Antonio Community Hospital			909 985 2811	