

Part I

Laboratory Health & Safety Responsibilities
A GUIDE FOR THE PRINCIPAL INVESTIGATOR
Regulatory Obligations and Compliance Tools



***University of California Santa Cruz
Environmental Health and Safety***

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Laboratory Health & Safety Responsibilities

A GUIDE FOR THE PRINCIPAL INVESTIGATOR

I. INTRODUCTION

State and Federal laws require UCSC to develop and maintain an effective occupational injury and illness prevention program. As a Principal Investigator (PI) much of the responsibility for compliance rests with you.

This document was written to give you, as a Principal Investigator at UCSC, an overview of your health and safety responsibilities for managing a laboratory and to identify tools available to assist you with meeting your regulatory obligations. This information is relevant to Principal Investigators, Lab Managers, Instructors and Supervisors in charge of a laboratory or a laboratory course.

You should realize that complying with regulatory obligations is in your personal best interest as well as important to the University. Simply put, the regulatory environment of our state is strict. This, coupled with public attitude toward risks associated with hazardous materials, has resulted in substantial pressure on UCSC and every other major university in California to assure regulatory compliance. Penalties for non-compliance can be severe ranging from general citations, to monetary fines, civil suits and even criminal indictment.

The Environmental Health and Safety Office (EH&S) serves as technical consultants to the campus in areas of occupational health, safety and environmental issues. EH&S can help you with regulatory interpretations relevant to your operation and is available to assist you with implementing your laboratory safety responsibilities. This document and all supporting EH&S laboratory safety tools are posted on our Web site at <http://ehs.ucsc.edu>.

II. RESPONSIBILITIES

Responsibilities for Health and Safety at UCSC have been clearly delineated by the Chancellor. Below is an overview of these responsibilities. A more detailed explanation of PI responsibilities for laboratory safety programs follows.

A. *Executive Responsibility*

The University of California Policy on Environmental Health and Safety gives ultimate responsibility for Injury and Illness Prevention (IIPP) and the Chemical Hygiene Program (CHP) to the Chancellor. Vice Chancellors assist the Chancellor and have direct responsibility for Divisions/Units under their authority.

B. *Deans*

Deans have direct responsibility for ensuring compliance in Units and Departments under their authority.

C. *Department Chairs Unit Heads,*

Direct responsibility for IIPP and Chemical Hygiene at the departmental level is with Department Chairs and Unit Heads. They may delegate authority for implementing the program, however, this does not eliminate personal responsibility for the program.

D. *Principal Investigators, Lab Managers, and Supervisors*

PI's, Lab Managers, and Supervisors have responsibility for ensuring compliance with health and safety regulations for all operations under their control. They are accountable for communicating expectations and for enforcing health and safety program compliance. This responsibility extends to employees and students under their supervision. Specific PI responsibilities are described in more detail in Sections III and IV.

E. *Employees/Students*

Each employee or student is responsible for knowing and following the policies and procedures established through the IIPP and CHP.

F. *Chemical Hygiene Committee*

The Campus Chemical Hygiene Committee is charged with developing, implementing, and periodically reviewing the Campus Chemical Hygiene Program. The committee recommends campus policy for laboratory safety procedures and provides a mechanism for *peer review* of work practices and materials used in campus laboratories.

G. *Chemical Hygiene Officer (CHO)*

The CHO is responsible for providing guidance to the Chemical Hygiene Committee and Chemical Hygiene Coordinators regarding development and implementation of individual Chemical Hygiene Plans.

H. *Chemical Hygiene Coordinator (CHC)*

The CHC is the individual in each laboratory appointed by the Principal Investigator to act as liaison to EH&S and coordinate CHP/IIPP activities in the laboratory.

I. *Environmental Health and Safety (EH&S)*

EH&S has responsibility to serve as technical consultants on Laboratory Safety and to monitor compliance through inspections and exposure monitoring. EH&S also has responsibility for conducting or facilitating safety education programs.

III. OVERVIEW OF PI LABORATORY SAFETY OBLIGATIONS

As a Principal Investigator you have responsibility for the health and safety of everyone affected by your operation. The types of health and safety programs you are obligated to implement depends on the scope of your operations. There is a core level of compliance that everyone is obligated to meet; then, depending on materials, processes and activities, your obligations expand accordingly. Some of the more common laboratory safety obligations PIs have at UCSC are described below. This list is not intended to be comprehensive. Tools available to help you meet these obligations are described in Section IV.

A. *WRITTEN CHP/IIPP: (Core requirement)*

Each PI has a regulatory obligation to develop a written plan that describes how they will protect lab workers from health hazards associated with their assigned duties. Once developed, this plan must be implemented and all work must be done in accordance with the plan's specifications. EH&S has provided you with a copy of the campus Injury and Illness Prevention and Chemical Hygiene Plan binder, but it is your responsibility to tailor these plans to reflect practices in your specific operation.

B. *TRAINING: (Core requirement)*

Each PI must ensure all employees and/or students under their supervision are trained to carry out work assignments safely. A core level of training must be provided to all workers and includes topics such as emergency response measures, general accident prevention measures, and specific instruction on hazards unique to each worker's assigned responsibilities. All training must be documented and records kept for three years.

C. *STANDARD OPERATING PROCEDURES - PERSONAL PROTECTIVE EQUIPMENT - ENGINEERING CONTROLS: (Core requirement)*

The laboratory standard requires you to develop written standard operating procedures covering relevant health and safety information on hazardous processes, materials, and equipment used in the laboratory.

All persons in the laboratory must wear proper lab attire as defined in the chemical hygiene plan. Persons using hazardous materials or performing potentially hazardous tasks must be provided with appropriate personal protective equipment such as safety glasses, aprons, lab coats and gloves. Any use of respiratory protective equipment must be certified and approved by EH&S. Fume hoods must be checked and in proper working order prior to use, safety showers and eyewash stations must be kept readily accessible, equipment guards must be kept in place, corridors and exit paths must be kept clear and free of obstructions.

D. *CHEMICAL HYGIENE: (Laboratory specific)*

Hazardous chemicals must be used in accordance with your Chemical Hygiene Plan, your laboratory specific Standard Operating Procedures, or as recommended in certain reference materials such as chemical storage guidelines, MSDSs, etc. In general, all persons using chemicals must have access to information or knowledge about the hazards associated with the materials they handle including physical properties and biological effects of the chemical. Standard operating procedures should be developed or referenced where generally accepted practices are used, and a system for prior approval should be implemented for employees handling acutely toxic materials. At no time should employees be exposed above the Cal-OSHA permissible exposure levels established for the materials handled.

E. *IONIZING RADIATION: (Laboratory specific)*

Any laboratory operation using radioactive materials or radiation producing equipment, must receive authorization from the campus Radiation Safety/Biosafety Committee (RSBC) before starting work or ordering isotopes.

F. *NON-IONIZING RADIATION SAFETY: (Laboratory specific)*

Any PI planning to use potentially hazardous sources of non-ionizing radiation such as lasers should contact the Campus Radiation Safety Officer for authorization prior to purchasing equipment or beginning work.

G. BIOHAZARDS: (*Laboratory specific*)

Any PI wanting to do work with recombinant DNA or any biohazardous agent or material requiring Biosafety Level 2 or above must contact the UCSC Biosafety Officer at EH&S. Work involving "select agents" as defined by CDC must be approved by the Radiation Safety/Biosafety Committee (RSBC) before starting work.

H. CARCINOGENS: (*Laboratory specific*)

Use of regulated carcinogens must be in compliance with Cal/OSHA regulations. A list of regulated carcinogens, as well as a list of "select carcinogens" as defined by the Lab Standard, is available from EH&S and is part of the written Chemical Hygiene Plan.

I. FIRE SAFETY: (*Core requirement*)

Prevention measures must be instituted to eliminate fire hazards. Workers must be trained in fire safety techniques and flammable liquids must be properly managed in the lab.

J. HAZARDOUS WASTE DISPOSAL: (*Core requirement*)

All hazardous materials must be properly disposed. Environmental regulations specifically prohibit the disposal of hazardous material via the sewer system, regular trash, or other unsafe routes. A comprehensive waste handling program is managed by EH&S.

IV. COMPLIANCE - INSTRUCTIONS AND TOOLS

Provided below is specific information on regulatory compliance obligations followed by instructions on what you can do to meet these obligations and a list of tools currently available to assist you. As new tools become available they will be posted on the EH&S web site.

A. IIPP/CHP

Compliance Obligation

Each PI must develop and implement a written Injury and Illness Prevention Program and Chemical Hygiene Plan. This is a "performance-based" requirement with the objective of getting employers to put (in writing) policies and procedures they will use to protect workers. Also mandated are specific requirements for clearly identifying and naming individual(s) responsible for health and safety in the workplace. The University has chosen to develop one generic document that meets the requirements of both regulatory standards. The generic IIPP/CHP document must be adapted to reflect specifics of individual laboratory operations.

Instructions

As a lab manager, you should:

1. Review your IIPP/CHP binder and modify Appendix J (Chemical Hygiene Plan) as necessary to ensure it describes laboratory policies and procedures for your specific operations.
2. Identify a Chemical Hygiene/Lab Safety Coordinator and submit name to EH&S; (Fill out Laboratory Identification of Responsible Persons form).
3. Know that the IIPP/CHP program has been endorsed by the Chancellor and compliance is expected as part of your performance. Also know that Regulators view this as a legally binding document; therefore, the University is obligated by law to comply with provisions of the document.

Tools and Resources

1. IIPP/CHP binder (Available from EH&S).

2. The Chemical Hygiene Plan is available in *pdf* format on our web page at <http://ehs.ucsc.edu/chp.pdf>
3. Laboratory Identification of Responsible Persons form.
4. Lab Safety Compliance Worksheet for the PI. (handout).

B. TRAINING AND EDUCATION

Compliance Obligations

Safety education must be provided “at the time of an **employee's initial assignment** to a work area where hazardous chemicals are present” and “**prior to assignments involving new exposure situations**”. The **training must be documented**.

Most PIs already incorporate safety training into their ongoing operations. A few procedural adjustments may be needed to ensure your training program is consistent with requirements of the regulations. EH&S has found the lack of consistent documentation of training activities to be a key compliance deficiency with most labs. Documentation is typically the first thing a compliance officer will want to see during an inspection.

Instructions

1. Have all workers review your Chemical Hygiene Plan – then have them read and sign the IIPP/CHP orientation sheet.
2. Provide new employee orientation to all workers and maintain an ongoing training and education program to ensure workers are aware of hazards present in their work area and hazards associated with individual work tasks. Elements that must be covered include:
 - Measures workers can take to protect themselves from hazards including; any operational specific procedures you have implemented; appropriate work practices to be followed in the lab; emergency procedures; and personal protective equipment to be used.
 - Overview of the contents of the standards and where workers can get access to the standards.
 - Location and availability of the Chemical Hygiene Plan.
 - Knowledge of permissible exposure limits.
 - Location and availability of reference material on hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory.
 - Methods and observations that may be used to detect the presence or release of a hazardous chemical.
 - Physical and health hazards of chemicals in the work area, including signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.

Tools and Resources

1. Training Needs Identification Worksheet - (handout).
2. Training Requirements According to the Lab Standard - (handout).
3. "Read and Sign" informational sheets such as:
 - General laboratory policy fact sheets; (e.g. Lab Safety Essentials A-Z)
 - IIPP/CHP orientation read and sign sheet;
 - Laboratory specific SOPs;
4. Howard Hughes Medical Institute - online laboratory safety training module.
5. University of California online MSDS databases, and access to TOMES toxicological database.
6. EH&S laboratory safety classes. (Scheduled upon request)
7. MSDS Use Instructional Sheet.
8. EH&S Web Site

C. GENERAL LAB SAFETY RULES and POLICIES

Compliance Obligations

You are responsible for implementing and communicating comprehensive safety policies specific to your laboratory's hazards and risks. The Lab Standard provides strict requirements for laboratory safety especially with regards to chemicals, but you must also consider other safety considerations (such as ergonomics) when selecting tools and equipment.

Instructions

1. Conduct and document periodic "in-house" inspections of your laboratories (required annually by policy, recommended monthly by EH&S).
2. Develop and enforce comprehensive policies and procedures for compliance with general lab safety rules, (e.g. PPE policy).
3. Provide information (particularly to new lab workers) on fundamental lab safety policies and procedures for your operation, (see training and education above).
4. Ensure proper equipment, tools and furniture are provided to reduce the risk of injury, (e.g. ergonomically adjustable furniture).

Tools and Resources

1. Laboratory Self-Inspection Form (handout).
2. General Fact Sheets (e.g. Laboratory Use of Organic Solvents (handout)).
3. EH&S ergonomics web page
4. All provisions of this document can be used as part of your core laboratory safety program.

D. STANDARD OPERATING PROCEDURES - SOPs

Compliance Obligations

You are required to develop Standard Operating Procedures that indicate specific measures you will take to ensure laboratory employee protection. The Lab standard requires that SOPs be relevant to safety and health considerations particularly when laboratory work involves the use of hazardous chemicals. Generally recognized procedures may be adopted by references.

Instructions

1. Develop or make available written SOPs since they are a required element of the Chemical Hygiene plan. Generic SOPs are appropriate for many laboratory functions but specific SOPs are required for high hazard operations conducted under your authority. High hazard operations may include:
 - Use of "particularly hazardous materials" defined as select carcinogens, acute toxins and reproductive toxins;
 - High or low temperature and pressure operations;
 - Explosive or highly flammable chemical use;
 - Use of radioisotopes;
 - High-voltage electrical equipment;
 - Use of high-powered laser systems.

Tools and Resources

1. Guidelines for writing SOPs (handout).
2. Chemical specific SOPs (handouts); e.g. acrylamide, benzene, ethidium bromide, formaldehyde, hydrogen peroxide, mineral acids, organic acids, osmium tetroxide, phenol
3. General Chemical SOPs (handouts); e.g. corrosives, flammables, organic solvents, cryogenics
4. Equipment / Procedure SOPs (handouts); autoclave, electrophoresis, gas cylinders, roto-evaporators

E. PERSONAL PROTECTIVE EQUIPMENT - PPE

Compliance Obligations

Personal protective equipment and personal hygiene are basic aspects of laboratory safety. Wearing appropriate personal protective equipment and practicing good personal hygiene as described below will minimize exposures to hazardous chemicals.

1. **Attire** - Require appropriate lab attire such as a lab coat or apron; cover legs (i.e. wear long pants; no shorts or skirts) and cover feet (no sandals or open-toed shoes); confine loose clothing and long hair. Nylons and/or pantyhose are not recommended because they may melt upon contact with certain chemicals.
2. **Eye protection** - State law and campus policy require all personnel including students, staff and visitors in laboratories wear safety glasses, goggles, or face shields at all times where eye hazards are present. Goggles are recommended when chemical splashes are possible. Contact lenses may be worn in the laboratory; however, they do not provide any protection for the eyes. Persons who wear contacts must use the same eye protective equipment as persons who do not wear contacts.
3. **Face shields** - Full-face shields must be worn in addition to eye protection when conducting a procedure that may result in a violent reaction. Full-face shields with bottom caps to protect the neck provide the best protection.
4. **Gloves** - Gloves are essential when working with hazardous substances. Proper gloves can prevent skin absorption, infection and chemical burns. Glove materials vary in their effectiveness at protecting against chemical hazards. Consult a chemical resistance chart, the glove manufacturer, or contact EH&S (459-4454) for assistance in appropriate selection.
5. **Personal hygiene** - Hands should be washed frequently throughout the day, after glove removal, before leaving the lab, after contact with any hazardous material, and before eating, drinking, smoking, or applying cosmetics.
6. **Respiratory protection** - Always work in a fume hood or provide other local exhaust ventilation when working with materials that produce hazardous vapors or fumes. If the use of a respirator is required, you must comply with UCSC's Respirator Program, which includes a medical assessment, fit testing, and instructions on proper use. Contact EH&S (459-4454) for more information or assistance with respiratory protection concerns.

Instructions

1. Establish and enforce a lab apparel and personal protective equipment policy for your laboratory. The campus requirements are stated above and are included in your Injury and Illness Prevention binder.

Tools and Resources

1. PPE Guidelines (App. J of IIPP / CHP).
2. Glove selection chart (web).
3. Respiratory Protection Information Guide (handout).

F. ENGINEERING CONTROLS

Compliance Obligations

OSHA regulations require employers to "engineer out the hazard" in lieu of using personal protective equipment where feasible. Engineering controls typically found in research laboratories include: Chemical fume hoods, biological safety cabinets, clean benches, snorkel hoods, other specialty safety ventilation, and safety shower/eyewash stations.

Instructions

1. Provide training to lab personnel on the proper use of engineering controls and any other type of safety systems associated with your operation.
2. Ensure all engineering controls are working properly prior to use.

3. Have workers read and sign the Fume Hood Operation and Laboratory Ventilation fact sheet.

Tools and Resources

1. Fume Hood Operation and Laboratory Ventilation (handout).
2. Safety Shower / Eye Wash station fact sheet (handout).
3. Laboratory fume hood training videos available through EH&S.
4. Individualized training sessions provided by EH&S on request.

G. *SPILLS & EMERGENCIES*

Compliance Obligations

Develop policies and procedures describing measures workers can use in the event of an emergency to: Protect themselves; Protect others working in the lab; Protect the environment; Protect University facilities.

Instructions

1. Instruct new workers on your specific laboratory emergency response procedures.
2. Ensure all lab workers know the location(s) of and how to use emergency equipment such as safety shower/eyewash stations, fire alarm pull boxes, fire extinguishers, and emergency spill supplies.
3. Inform lab workers about what to do in the event of a chemical spill.
4. Be prepared to take immediate steps in situations that are life threatening or facility damage is imminent.
5. Make available information on your department's disaster preparedness.

Tools and Resources

1. Emergency Response Guidelines (App. J of IIPP/CHP binder).
2. CHP Emergency Response Flip Chart. (handout web).
3. Laboratory Emergency guidelines (web).
4. Natural Sciences Emergency Action Plan (<http://natsci.ucsc.edu/admin/safety/evac.html>).
5. Campus Emergency Response Plan (web).

H. *FIRE SAFETY*

Compliance Obligations

Regulations require workers to be trained in fire safety techniques and the proper management of flammable materials.

Instructions

1. Ensure all lab personnel receive training on what to do in the event of a fire as well as how to store and handle flammable materials properly.
2. Know the location of the nearest fire alarm pull box and fire extinguisher; ensure they know how to use them.
3. Keep no more than 10 gallons of flammable liquid outside of a flammable storage cabinet.
4. Never put flammables in a refrigerator that is not "lab safe" and make sure equipment is properly labeled.

Tools and Resources

1. Flammables in refrigerator/freezer guidelines (handout).
2. Flammable Materials general SOP (handout).
3. UCSC Fire Department Web and site for reference information.

I. ELECTRICAL/MECHANICAL***Compliance Obligations***

You must ensure your operation is in compliance with general industry "safety standards" for electrical safety and equipment guarding.

Instructions

1. Conduct routine inspections of your electrical and mechanical equipment and make sure lab workers are trained on the safety aspects of this equipment.
2. Develop SOPs for any specialty equipment such as high-voltage transformers and power supplies.
3. Manage the use of extension cords, repair any frayed wiring, eliminate octopus wiring and keep electrical panels clear (no storage within three feet).
4. Make sure all mechanical equipment with pinch points is guarded (e.g. vacuum pump belts) and ensure guards remain in place.

Tools and Resources

1. Electrical safety (handout, TO BE DEVELOPED).
2. Equipment guard (handout, TO BE DEVELOPED).
3. Contact EH&S for assistance with specific equipment.
4. Laboratory Self-Inspection Form (handout).

J. CHEMICAL HYGIENE***Compliance Obligations***

The word "hygiene" refers to conditions and practices that serve to promote or preserve health. Hence, the Lab Standard places emphasis on the "Chemical *Hygiene* Plan" and laboratory procedures that promote chemical hygiene.

Instructions

1. Develop work practices, policies, and procedures for the proper use and management of all hazardous chemicals used by your operation.
2. Teach workers about hazardous materials references (e.g. MSDS's) and ensure workers are knowledgeable about the hazards associated with chemicals they use.
3. Review Permissible Exposure Limits (PELS) of materials you use and ensure workers are not exposed above the limit. (EH&S is available to assist you with exposure determinations).

Tools and Resources

1. The Campus Chemical Hygiene Plan – (App J of the IIPP/CHP binder)
2. All tools and resources listed in this document are applicable toward developing a good chemical hygiene program in your laboratory operation.

K. PARTICULARLY HAZARDOUS SUBSTANCES - CARCINOGENS AND "SELECT CARCINOGENS"***Compliance Obligations***

All particularly hazardous substances must be handled in accordance with specific requirements of the regulations. "Particularly Hazardous Substances" are defined in the CAL-OSHA Lab Standard as "*Select Carcinogens*", reproductive toxins and substances that have a high degree of acute toxicity.

UCSC policy considers a chemical a carcinogen if it is: 1) designated by the Occupational Safety and Health Administration [OSHA or Cal-OSHA] as a carcinogen; or 2) it is listed by the American Conference of Governmental Industrial Hygienists (ACGIH) as a Category A1 (confirmed human) or Category A2 (suspected human) carcinogen.

The term "**Select Carcinogen**" is used in the Lab Standard and means any substance which meets one of the following criteria:

- (i) It is regulated by OSHA as a carcinogen; or
- (ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) latest edition; or
- (iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) latest editions; or
- (iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
 - (A) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m³;
 - (B) After repeated skin application of less than 300 mg/kg of body weight per week; or
 - (C) After oral dosages of less than 50 mg/kg of body weight per day.

Instructions

1. Review your inventory and identify the "Particularly Hazardous Substances" you own.
2. Develop and implement written SOPs for any work involving particularly hazardous substances. SOPs should specify training requirements, personal protective equipment to be used and procedures for safe removal of contaminated waste.
3. Provide training and personal protective equipment to anyone working with or around carcinogens in your laboratory operation.
4. Establish a designated area for handling particularly hazardous materials. (This can be your entire laboratory but it must be designated as such.)
5. Use containment devices such as fume hoods or glove boxes when handling carcinogens.
6. Contact EH&S for assistance with initial exposure determinations where required (e.g. formaldehyde use).
7. The location and use of all regulated carcinogens at UCSC must be registered with the State of California. Notification is done by EH&S, therefore, you must notify EH&S prior to purchase or use of any regulated chemical carcinogen.

Tools and Resources

1. Regulated Carcinogen List (web).
2. Abbreviated carcinogen list (CHP template).
3. ACGIH TLV book listings available at EH&S.
4. Chemical specific SOPs for Particularly Hazardous Materials (handouts); acrylamide, benzene, ethidium bromide, formaldehyde, hydrogen peroxide, mineral acids, organic acids, osmium tetroxide, phenol.
5. EH&S inventory report listing particularly hazardous materials are available on request.

L. CHEMICAL INVENTORY

Compliance Obligations

UCSC is required to submit a comprehensive inventory of hazardous materials to the County each year as part of our Business Plan. The Lab Standard also references requirements for maintaining an inventory of hazardous materials.

Instructions

To date, EH&S has collected and been the curator of the campus chemical inventory program. During the 1999 - 2000 school year responsibility for collecting and maintaining chemical inventory will be shifted to chemical owners. More information on this will be provided as details are worked out through the Campus Chemical Hygiene Committee.

Tools and Resources

1. Campus Chemical Inventory Program FAQ (handout).
2. Web access to Inventory for database searches.

M. BIOHAZARDS***Compliance Obligations***

Microbiological laboratories are special, often unique work environments that may pose identifiable pathogenic or infectious disease risks to persons, plants or animals. The term "containment" is used to describe safe methods for managing biohazardous materials in the lab. Four (4) levels of biosafety containment are clearly identified by the National Institutes of Health (NIH) and any research requiring Biosafety level 2 or higher must be registered with EH&S and/or the Campus Institutional Biosafety Committee.

Instructions

1. Investigators must register any project involving a pathogenic agent (risk group 2 or higher) with EH&S. Any work requiring biosafety level 2 or higher must be registered with the Institutional Biosafety Committee (IBC). The Researcher must receive committee approval before starting work.
2. Work with all genetically engineered organisms is to be done in compliance with the *NIH Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines)*. These guidelines classify recombinant DNA experiments into four levels of containment (BL1, BL2, BL3, and BL4)
3. Many experiments involving rDNA molecules require registration and approval by the IBC before work may be initiated. Experiments that require IBC approval before initiation include those:
 - that use Risk Group 2, 3, 4, or Restricted Agents as host-vector systems.
 - in which DNA from Risk Group 2, 3, 4, or Restricted Agents is cloned into nonpathogenic prokaryotic or lower eukaryotic host-vector systems.
 - that involve infectious virus, or defective virus in the presence of helper virus in tissue culture systems.
 - that involve whole plants or animals.
 - that involve more than 10 liters of culture.
4. Experiments that must be registered at the time of initiation include those:
 - involving the formation of recombinant DNA molecules containing no more than 2/3 of the genome of any eukaryotic virus propagated in tissue culture.
 - involving recombinant DNA-modified whole plants, and/or recombinant DNA-modified organisms associated with whole plants, except those that fall under Section III-A, III-B, III-C, or III-E of the Guidelines.
5. Manage biohazardous waste properly.

Tools and Resources

1. UCSC Biological Agent Use Authorization Form (handout).
2. UCSC Biological Agent Protocol Form and Instructions (handout).
3. [NIH Guidelines on Recombinant DNA Molecules](#)
4. [CDC/NIH: Biosafety in Microbiological and Biomedical Laboratories.](#)

N. RADIATION SAFETY - Ionizing and Non-Ionizing***Compliance Obligations***

UCSC has a broad scope license to use radioactive materials. Enforcement is done through the state's Radiation Protection Branch of the Department of Health Services.

Instructions

1. You must contact the Campus Radiation Safety Officer for authorization prior to the purchase or use of any ionizing radioactive materials or ionizing radiation generating devices.
2. Potentially hazardous non-ionizing radiation producing devices such as lasers, microwave transmitters and RF ovens etc., must also be registered with the Radiation Safety Officer prior to purchase and use.

Tools and Resources

1. Applications, forms, and other information for radioactive materials use authorization and radiation generating equipment is available online at the EH&S web site ehs.ucsc.edu/rs/. If you cannot find the information you need contact the campus Radiation Safety Officer (9-3911) for further assistance.

O. ANIMAL RESEARCH

Compliance Obligations

There are many regulations and policies that affect the use of animals in research, teaching, and testing programs. Accordingly, PIs have both legal and ethical obligations for all use of animals on or off campus. This includes observation, contact, and manipulation of living or dead animals, or significantly altering their environments. Failure to comply with these regulations and policies may lead to various actions, including the termination of support for all projects. The Chancellors Animal Research Committee (CARC) regularly reviews all matters relating to animals for research and teaching purposes. The committee must assure that the use of animals considers both scientific and humane values.

Instructions

1. PIs must ensure that collaborators, technicians, and students use animals according to their CARC approved application and with respect for all applicable laws, regulations, and policies. While the PI has ultimate responsibility for compliance, CARC provides approvals and monitors compliance.
2. PIs must contact the CARC office or consult the CARC web site for specific information on how to get approval prior to beginning work or acquiring animals.
3. Any member of the campus community who wants to use animals in their research or teaching (including those whose research consists of field work involving animals) must submit a written application to CARC.
4. The PI must conform to the basic regulations and policies governing animal use including:
 - acquisition, care, and use of animals;
 - efforts to minimize animal pain and distress;
 - training of personnel using animals;
 - consideration of alternatives to animal use; and
 - methods whereby deficiencies in animal care and treatment are reported.
5. All research involving the use of animals must be reviewed and approved by the Campus Animal Research Care Committee (CARC).

Tools and Resources

1. CARC links (web) <http://natsci.ucsc.edu/admin/carc/carc2.htm>

P. HAZARDOUS WASTE DISPOSAL

Compliance Obligations

There are many rules and regulations on both the state and federal level, which dictate requirements for handling and disposal of hazardous waste. Given the complexity of these requirements and the severity of penalties for non-compliance (possibly \$25,000 per occurrence),

PIs must be very conscientious about work practices regarding the disposal of chemical wastes and materials that become contaminated with chemicals.

The State Department of Toxic Substances Control (DTSC) and the Santa Cruz County Environmental Health Services Agency have authority for enforcing hazardous waste regulations.

Instructions

1. Work closely with EH&S in developing your hazardous waste disposal program. Simply stated, any waste material that is not obviously non-hazardous, like wastepaper, should be evaluated to determine whether or not it meets the definition of a hazardous waste.
2. Train employees and students in proper management and disposal practices.
3. Dispose of hazardous materials only via EH&S approved routes. (No hazardous materials may be disposed of via the sewer system or regular trash.)
4. Use hazardous materials only when absolutely necessary.
5. Substitute non-hazardous (or less hazardous) materials for hazardous materials whenever possible.

Tools and Resources

1. Hazardous Waste Determination and Guidelines (handout).
2. Hazardous Waste Generator Fact Sheet (handout).
3. Chemical Waste Pick Up Form Instructions (handout).
4. Sharps Disposal Information (web).

Q. ENVIRONMENTAL PROGRAMS

Compliance Obligations

Local environmental regulations impose specific operational restrictions on science building fume hoods and wastewater discharges to ensure these effluents do not have a significant environmental impact. PIs have direct responsibility for managing air emissions from their equipment as well as discharges to wastewater systems. As a PI, you may be requested to provide handling and use information for specific chemicals to meet science building air permit renewal requirements.

Instructions

1. Do not use chemical fume hoods as a disposal method for hazardous materials such as volatile solvents. Chemicals not being actively used in a hood should be sealed to prevent evaporation.
2. Use cold traps suitable to adequately capture and retain solvent when rotovapping or distilling solvent under reduced pressure.
3. Ensure hazardous wastes are never discharged to the sewer.

Tools and Resources

1. Drain Disposal flow chart.
2. Secondary Containment Guidelines.
3. EH&S - Environmental Program Manager (9-3541).

A continuation of this document (*Part II - A Toolbox Sampler for Laboratory Managers*) provides examples of tools described above and is available on the UCSC Environmental Health & Safety web site <http://ehs.ucsc.edu>. Hardcopies of Part II are available to PIs or Lab Managers who cannot access the information via the web site. Please contact EH&S 459-5394 or 459-2553 to request a copy, but we encourage you to access the information from the web since it contains the complete set of tools rather than just a few samples. The web site will be kept current as additional resources are developed or existing tools enhanced.

Please feel free to contact EH&S for assistance if you have specific health and safety resource needs.