CHEMICAL HYGIENE PLAN

UNIVERSITY OF HAWAII AT MANOA

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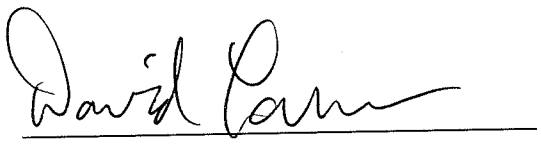
CONTENTS

PREFACE

The University of Hawaii has a fundamental obligation to safeguard the health, safety, and welfare of its students, personnel, and the visiting public whenever they participate in an official University activity. It is the policy of the University to provide for and maintain, through implementation of safety and health programs, conditions and practices that provide safe and healthful campus environments. In keeping with this commitment, this Chemical Hygiene Plan was developed as part of the UH Laboratory Safety Program.

The Chemical Hygiene Plan (CHP) is designed to protect laboratory personnel from potential hazards associated with the use of chemicals. It is for your reference while working with or around chemicals in laboratories at the University of Hawaii. Compliance is mandatory for all employees working in campus laboratories due to requirements of the Hawaii Occupational Safety and Health (HIOSH) division of the Department of Labor and Industrial Relations' standard on "Hazardous Chemicals In Laboratories". While these regulations pertain specifically to employees, provisions of the CHP apply to students and visitors depending on their activities when specified by supervisors.



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INTRODUCTION

The objective of this CHP is to provide uniform requirements for safe use and disposal of potentially hazardous substances in University laboratories. A variety of hazardous chemicals are used in small quantities in research and teaching laboratories creating a unique environment with a number of risks. These chemicals may cause injury or damage because they are toxic, flammable, corrosive, or reactive with water and other materials. How these substances are handled will determine the degree of risk. General standard operating procedures are outlined, including work with select carcinogens, reproductive toxins, and substance with a high degree of acute toxicity. Specific standard operating procedures must be developed by each lab for operations posing a special hazard, for example, heating phosphoric acid, working with pyrophorics, conducting electrophoresis, distillations, extractions, etc.

Maintaining a safe and healthy environment in the laboratory is ultimately the responsibility of the Supervisor or Principal Investigator. However, each individual is expected to conduct all operations and procedures involving chemicals in a safe and prudent manner.

I. **PROGRAM ADMINISTRATION**

A. WORKPLACE SAFETY COMMITTEE

1. Establish policies that will ensure that the University of Hawaii is in compliance with all federal, state, and local regulations, statutes, procedures, and principles relating to environmental and occupational safety, including in particular (1) the fire code, (2) the electrical code, and (3) the regulations relating to the purchase, storage, use, and disposal of hazardous chemicals. This task includes the review and maintenance of the UH Chemical Hygiene Plan (CHP).

2. Establish close-out procedures for hazardous chemical users that will minimize the hazardous waste burden to UH.

3. Review laboratory safety audit reports. In cases where problems have been noted by the Environmental Health and Safety Office (EHSO) and the responsible parties have been notified by the EHSO, initiate corrective actions if the problems have not been resolved within a reasonable amount of time.

4. Evaluate and approve the use of particularly hazardous substances such as select carcinogens, reproductive toxins, and highly acute toxins. Prepare a list of such substances to facilitate oversight and control/regulation of their use.

5. The EHSO will evaluate laboratory accidents and chemical spills and will ask the WSC to initiate corrective action if needed to prevent the recurrence of such incidents.

6. In cases where correction of a workplace safety problem requires the expenditure of money, authorize, with the approval of the appropriate Vice Chancellor, the funds needed to correct the problem.

7. Where necessary, intervene in EHSO inspection and enforcement actions (see Appendix XIII).

B. DEAN/DIRECTOR/DEPARTMENT CHAIR

1. Have the primary responsibility of establishing and maintaining a safe and healthy environment for their employees, students and visitors.

2. Ensure that PI's in charge of laboratories and other chemical storage sites within the department comply with all CHP requirements.

3. Take corrective action in cases where an inspection by the EHSO has indicated that a hazard exists in the workplace that has not been corrected in a timely manner, including (but not limited to) electrical hazards, fire safety hazards and chemical hazards. The WSC will stipulate the nature of the corrective action. The hazardous

condition will be judged to have been corrected only when an inspection by the EHSO indicates that the condition has been corrected.

4. Ensure that Principal Investigators follow the closeout procedures (see Appendix XI) and take measures to enforce them when necessary.

5. Assign responsibility for shared labs/facilities to one person.

C. ENVIRONMENTAL HEALTH AND SAFETY OFFICE

1. Provide technical assistance to the WSC, principal investigators, supervisors and employees.

2. Appoint a Chemical Hygiene Officer (CHO).

3. Conduct laboratory surveys, including air monitoring if required. The CHO must inform the WSC about any deficiencies that are not corrected in a timely manner.

4. Maintain all relevant records such as training, air monitoring results and laboratory surveys.

5. Assist principal investigators and supervisors in complying with the CHP.

6. Provide chemical safety training for all Manoa employees as required by the CHP.

D. PRINCIPAL INVESTIGATOR/SUPERVISOR

1. Have direct and overall responsibility for safety and chemical hygiene in the laboratory/workplace. This includes following the policies and procedures of the CHP and correcting deficiencies found during EHSO audits in a timely manner.

2. Ensure that employees are informed of and follow the rules and procedures of the CHP.

3. Inform personnel about their workplace hazards. This information must include written Standard Operating Procedures (SOP's) that detail operations the employees will conduct. These SOP's should include safety precautions that employees must follow.

4. Provide personal protective equipment (PPE), (gloves, lab coats, goggles, etc.) for employees and ensure that they are used.

5. Conduct and document the appropriate chemical hygiene training, including emergency procedures, for all workers.

6. Periodically survey the workplace to ensure safe working conditions. These surveys should include inspection of all emergency equipment such as eyewashes,

safety showers and spill kits. All defective equipment must be immediately reported to the appropriate department

7. Review MSDS and other sources for information about special first aid requirements for chemicals, e.g., hydrogen fluoride and cyanogen bromide, and prepare accordingly.

8. Restrict access to areas where an inspection by the EHSO indicates that a hazardous condition exists.

9. Follow the closeout procedures when departing from the University (see Appendix XI).

10. Keep lab equipment and chemicals secure against theft or tampering. Keep the laboratory doors closed and locked when no one is present.

E. LABORATORY WORKERS

1. Know the hazardous properties of the chemicals they use so that proper safety precautions can be determined and followed.

2. Plan and conduct each operation in accordance with the general safety procedures specified in the CHP, as well as whatever additional specific procedures are required by the principal investigator/supervisor.

3. Develop and maintain good personal chemical hygiene practices.

4. Immediately report improperly functioning safety equipment such as fume hoods directly to the principal investigator/supervisor.

5. Promptly complete required safety training sessions.

6. Immediately report any occupational injury or illness to your principal investigator/supervisor.

7. Know the location and operation of emergency equipment such as eyewashes, safety showers, etc.

8. Be aware of emergency reporting and evacuation procedures.

9. Immediately inform the principal investigator/supervisor about any unsafe workplace conditions.

II. EMPLOYEE INFORMATION AND TRAINING

All lab personnel need to take the appropriate training. All PI's shall attend EHSO initial lab safety training prior to setting up their lab. PI's shall ensure that information and training are 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. PI's may contact the CHO for assistance in providing training. Refresher training (Lab personnel safety checklist, attachment XIII) shall be conducted and documented at least annually by the PI or lab manager before work is started. All PI's must complete the Lab Hazard Assessment (LHA) in Ho'oponopono (UH Manoa software) for each of their laboratories.

A. INFORMATION

All laboratory personnel (entering or working) shall be informed of:

1. requirements of the OSHA Standard 29 CFR Part 1910.1450, "Occupational exposure to hazardous chemicals in laboratories"

2. the contents and availability of this Chemical Hygiene Plan;

3. permissible exposure limits (PELs) for HIOSH regulated substances (Appendix III) or recommended exposure limits where there is no applicable HIOSH standard;

4. signs and symptoms associated with exposures to hazardous chemicals used in their laboratory;

5. the location of reference materials (including electronic) on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Safety Data Sheets (SDS's).

6. Labeling of original containers based on the Global Harmonization System (GHS) in section 5 and appendix B: http://www.hawaii.edu/ehso/industrial/HAZCOM.pdf

B. TRAINING

Employee training shall include:

1. the physical and health hazards associated with chemicals stored and used in their work area;

2. the contents of this Chemical Hygiene Plan;

3. methods and observations that may be used to detect the presence or release of a hazardous chemical (e.g., exposure monitoring conducted by the CHO, visual appearance or odor of hazardous chemicals when being released, etc.).

III. PRIOR APPROVAL CIRCUMSTANCES

Employees must obtain prior approval to proceed with a laboratory task from the CHO or appropriate EHSO personnel when:

A. Radioactive materials will be used. Contact the EHSO Radiation Safety Program.

B. Recombinant DNA or any biological commodities will be used. Contact the Biological Safety Program.

C. It is likely that exposure limit concentrations could be exceeded or that other harm could occur. Contact the CHO.

D. Certain hazardous chemicals will be used which require prior approval from the EHSO Hazardous Material Management Program before purchase. Refer to Appendix IV for a list of these chemicals.

E. Shipping hazardous material(s) air or ground. Contact Hazardous Material Management Program before shipping.

Employees must stop working and contact EHSO to gain approval for continuing to work when:

A. There is failure or suspected failure of any equipment used in the process, especially of safeguards such as chemical fume hoods.

B. A member of the laboratory staff becomes ill and you know or suspect the illness is related to the work environment in the laboratory.

IV. STANDARD OPERATING PROCEDURES

A. <u>GENERAL RULES</u>

1. For chemicals they are working with, all employees should know:

   a. the chemical's hazards, as determined from a SDS and other appropriate references;

   b. appropriate safeguards for using that chemical, including personal protective equipment;

   c. how to properly store the chemical when it is not in use;

   d. proper chemical waste disposal procedures (Appendix IV);

   e. proper personal hygiene practices;

f. proper methods of transporting chemicals outside the laboratory;

g. appropriate procedures for emergencies, including first aid, evacuation r outes, and spill cleanup procedures.

2. Employees should not work alone. Arrangements should be made between individuals working in separate laboratories outside of regular working hours to crosscheck each other periodically. Alternatively, Campus Security may be asked to check on the employee. Experiments known to be hazardous should not be undertaken by an employee who is alone in the laboratory.

3. In the event of a power outage, the procedures listed in Appendix V should be followed.

4. Individuals who are not properly trained in laboratory safety and the University CHP (e.g. employees' children, guests, etc.) shall not be allowed in University laboratories unless closely supervised and monitored.

5. No animals, other than those approved for laboratory experimentation by the UH Institutional Animal Care and Use Committee (IACUC), shall be allowed in laboratories.

6. The use of open flames in UH Manoa laboratories is strongly discouraged by the Environmental Health and Safety Office. Every effort must be made to find alternatives to using open flames (electric sterilizers, disposable supplies, etc.)

B. PERSONAL HYGIENE

1. Wash promptly whenever a chemical has contacted your skin.

2. Avoid inhalation of chemicals. Do not "sniff" to test chemicals.

3. Do not use mouth suction to pipet anything. Pipetting aids must be used at all times.

4. Do not bring food (including gum and candy), beverages, tobacco, or cosmetic products into chemical storage or use areas. Eating, drinking, and applying cosmetics is allowed in designated areas only. Smoking is prohibited in all University facilities.

5. Wash well with soap and water before leaving the laboratory. Avoid the use of solvents for washing skin. Solvents remove the natural protective oils from skin and can cause irritation and inflammation. In some cases, washing with solvent may facilitate absorption of toxic chemicals.

C. PROTECTIVE CLOTHING AND EQUIPMENT

1. Carefully inspect all protective equipment prior to use. Do not use defective equipment.

2. When the potential for a splash hazard is present (e.g. chemistry laboratories), eye protection in the form of chemical-resistant goggles shall be worn at all times in the laboratory. Ordinary prescription glasses and/or standard safety glasses are not considered effective eye protection since they lack necessary shielding. Chemical-resistant goggles should be worn over the glasses for employees who wear corrective lenses.

3. Consult with an optometrist prior to wearing contacts in the laboratory. Chemical-resistant goggles must be worn over contacts at all times.

4. When working with corrosive, toxic, allergenic, or sensitizing chemicals, rough or sharp-edged objects, very hot or very cold materials, gloves made of material known to be protective for the hazard shall be worn.

   No one glove can protect against all hazards. Cloth gloves, while not appropriate for use around liquids, can protect against light abrasive materials and moderate temperature changes. Synthetic or rubber gloves protect against corrosives, solvents, and poisons. Leather gloves, often used for tasks like welding, protect against sparks, heat, & rough abrasives.

   Consult the manufacturer's performance chart or contact the CHO to determine the proper choice of glove material. Appendix IX has a glove selection chart that can be used to determine glove choices.

5. Low-heeled shoes with fully covered uppers shall be worn at all times in the laboratory. Shoes or sandals with open toes shall not be worn.

6. Long pants and garments with long sleeves must be worn when working with or around chemicals.

7. Long hair should be secured behind the head, to prevent it from being pulled into machinery or catch fire.

8. Caution should be taken when wearing loose clothing not to inadvertently allow cuffs, sleeves, or other materials to knock over or absorb chemicals.

9. A full-body-length rubber, plastic, or neoprene apron appropriate for the material being handled should be worn if there is risk of splash or spill.

10. A proper respirator must be worn whenever exposure by inhalation is likely to exceed the action level (AL) or permissible exposure limits (PEL) and a fume

hood is not accessible. Procedures specified in the UHM Respiratory Protection Program must be followed. Employees must be medically qualified, trained, and fit-tested prior to using a respirator. Contact the CHO before doing any work requiring a respirator.

11. Remove all PPE before leaving the laboratory.

D. HOUSEKEEPING

Housekeeping is directly related to safety and must be given importance of equal value to other procedures. Lack of good housekeeping reduces work efficiency and may result in accidents. Laboratory personnel must adhere to the following:

1. All work areas, especially laboratory bench tops, should be kept clear of clutter.

2. Access to emergency equipment, showers, eyewashes, fire extinguisher, exits and circuit breakers shall never be blocked or obstructed.

3. All aisles, corridors, stairs, and stairwells shall be kept clear of chemicals, equipment, supplies, boxes, and debris.

4. Each laboratory must have a puncture resistant container (e.g., cardboard box) lined with plastic specifically designated for glassware disposal.

5. Food and drink for human consumption shall not be kept in the same refrigerator used to store chemicals and laboratory samples. Eating and office areas must be clearly separated from laboratory and chemical storage areas.

E. CHEMICAL MANAGEMENT

1. Chemical containers should be regularly monitored for proper labeling and container integrity. Labels which are fading, falling off, or deteriorating must be promptly replaced. Improperly or unlabeled chemicals make hazard identification and disposal difficult, and may create a health hazard. Abbreviations or other acronyms may be used to label containers of chemicals generated in the laboratory as long as all personnel working in the laboratory understand the meaning of the label, or know the location of information, such as a laboratory notebook or log sheet that contains the code associated with content information. In addition, small containers, such as vials and test tubes, can be labeled as a group by labeling the outer container (e.g., rack or box). Alternatively, a placard can be used to label the storage location for small containers (e.g., shelf, refrigerator, etc.).

2. Segregate all chemicals in storage according to hazard class. The main hazard classes are flammable/combustible, oxidizer, acid, and base. See Appendix X for more detailed chemical storage guidelines.

3. All chemicals should be placed in their proper storage areas at the end of each workday. Chemicals shall not be stored on desks, laboratory bench tops, floors, or in aisles.

4. Secondary containers (flasks, beakers, reaction vessels, etc.) should be labeled unless they are under the immediate control of the user. At the end of each workday, all unlabeled containers are to be labeled as to their contents or the contents must be disposed of as waste.

5. Chemical wastes must be clearly labeled including hazard identification, and stored according to hazard class. Refer to the Hazardous Material Management Plan in Appendix IV for requirements.

6. Maintain an inventory of all chemicals in the laboratory, including all containers of chemicals in use or in storage, but excluding working solutions, synthetic intermediates, biological samples, chemical extracts, and waste. The chemical inventory should be kept in the laboratory's Chemical Hygiene Plan binder and updated annually. The inventory should include, at a minimum, the chemical name, the amount, the storage location, and the hazard class (see Appendix X for guidelines). Appendix X contains a sample inventory form that may be used.

7. Hazardous materials should not be stacked or laid on their side. Stacking bottles can cause pressure and lead to bottles cracking or breaking. Laying a bottle on its side can lead to the bottle leaking.

F. FLAMMABLE MATERIALS

Flammable materials are substances that can ignite easily and burn rapidly. Flammable materials are either in gas, liquid, and solid form.

Precautions for safe handling of flammable materials include the following:

1. Storage and handling of flammable and combustible liquids shall be conducted in accordance with the requirements in Appendix VI.

2. Flammable substances shall be handled only in areas free of ignition sources.

3. Flammable substances should never be heated by using an open flame. Preferred heat sources include steam baths, water baths, oil baths, heating mantles, and hot air baths.

4. Class I liquids (see Appendix VI) shall not be transferred from one vessel to another in any exit passage way.

5. Transfer of flammable liquids shall be conducted in a laboratory fume hood or an approved flammable liquid storage room.

6. Empty containers (no pourable liquid remaining) shall be treated in the following manner:

   a. For water soluble solvents: triple rinse, deface the label, and dispose empty container appropriately.

   b. For non-water soluble solvents: allow to evaporate to dryness in a hood, deface the label, and dispose empty container appropriately.

G. REACTIVE CHEMICALS

A reactive chemical is one that:

1. "Unstable (reactive) means a chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure, or temperature, or

2. Is ranked by the National Fire Protection Association (NFPA) as 3 or 4 for reactivity, or

3. Is identified by the Department of Transportation (DOT) as:

   a. an oxidizer, or

   b. an organic peroxide, or

   c. a class A, B, or C explosive

4. Violently reacts with exposure to water or air.

Handle reactive chemicals with all proper safety precautions. This includes designating a separate storage area, monitoring periodically for degradation, and using appropriate personal protection.

H. CORROSIVE CHEMICALS

1. Materials are classified as corrosive if they:

   a. are capable of rapidly eroding building materials or metals, or

   b. burn, irritate or destructively attack organic tissues such as skin, eyes, lungs and stomach.

   Examples of commonly used chemicals that have corrosive properties are:

   glacial acetic acid hydrofluoric acid hydrochloric acid

fluorine	nitric acid	bromine
sulfuric acid	chlorine	sodium hydroxide

Safe handling procedures will vary with each operation and the type and concentration of the corrosive chemical. Refer to the SDS for specific safe handling procedures.

2. The following general guidelines should be followed for procedures involving acids and bases:

   a. Never pour water into acid. Slowly add the acid to the water and stir.

   b. Open bottles or carboys slowly and carefully, wearing protective equipment to guard hands, face, and body.

   c. Suitable facilities, such as a safety shower and eyewash, shall be located within 50 feet or 10 seconds of the work area for quick drenching or flushing of the eyes and body. PI's shall ensure eyewash stations are flushed once every quarter.

   d. Procedures requiring the use of concentrated acids and bases should be conducted in a fume hood.

   e. Never mix acid wastes with other materials such as solvents, metal-contaminated solutions, etc. Noncontaminated acid wastes can be easily disposed by neutralization. Never dispose of acids or bases in the sanitary sewer system (i.e., down the drain) until neutralized (pH 5.5-8.5). Neutralization should be conducted in a fume hood, then the solution poured slowly down the drain with copious amounts of water; i.e., leave the water running for approximately 5 minutes.

   f. When disposable containers are completely emptied of their contents, flush them thoroughly with water before throwing them away.

   g. Contact EHSO Hazardous Material Management Program (see Appendix IV) for assistance with disposal of large quantities (more than 2 gallons or 1 pound) of acids and bases.

I. COMPRESSED GAS CYLINDERS

Use of compressed gases in the laboratory requires anticipating chemical, physical, and health hazards. Cylinders that are knocked over or dropped can be very dangerous. If a valve is knocked off, the cylinder can become a lethal projectile. Accidental releases may result in an oxygen deficient atmosphere or adverse health effects. In short, improper handling and use can cause structural damage, severe injury, and possibly death.

The following guidelines will help ensure safe handling, use, and storage of compressed gas cylinders, including flammable gas, such as Hydrogen.

1. RECEIVING AND STORAGE

a. Be sure to arrange a return agreement with suppliers prior to purchase since disposal of compressed gas cylinders is difficult and very expensive. Retain all documentation such as purchase orders to facilitate return of cylinders to the manufacturer.

b. Cylinders should not be accepted unless the cylinder contents are clearly labeled. Color code only should not be accepted, since it does not constitute adequate labeling.

c. Do not accept cylinders which are damaged or do not have a valve protection cap.

d. All gas cylinders in use shall be secured in an upright position in racks, holders, or clamping devices. When cylinders are grouped together, they should be individually secured and conspicuously labeled on the neck area.

e. Oxygen cylinders shall be separate from combustible materials (e.g. oils, greases, fuels, acetylene, flammable gas etc.) a minimum distance of 20 ft or by a noncombustible barrier at least five feet high having a fire resistant rating of at least 1/2 hour. Systems and components used for other gases and must never be used for oxygen or interconnected with oxygen.

f. Cylinders should have current hydrostatic test date (normally less than 5 years old for steel and 3 years old for aluminum) engraved on the cylinder. Cylinders should be returned to the supplier for servicing prior to the expiration date.

g. Do not place cylinders near heat, sparks, or flames or where they might become part of an electrical circuit.

h. Do not store cylinders in exit corridors or hallways.

2. HANDLING AND USE

a. Only Compressed Gas Association fittings and components are permitted for use with gas cylinders. Only use regulators approved for the type of gas in the cylinder. Do not use adapters to interchange regulators. Never lubricate any fitting or component of a gas cylinder.

b. Before opening the cylinder valve, be sure that the T-valve is backed out and turns loosely. Open cylinder valves slowly and be sure that the T-valve is not facing anyone, including yourself. Never force a gas cylinder valve. If the valve cannot be opened by the wheel or small wrench provided, the cylinder should be returned

c. No attempt shall be made to transfer gases from one cylinder to another, to refill cylinders, or to mix gases in a cylinder in the laboratory, unless the cylinder is designed for that purpose, labeled properly, and a SOP/Job Hazard analysis is created by the PI or a competent person.

d. All cylinders are to be considered full unless properly identified as empty by the user. Empty cylinders must be returned to the supplier and not accumulated.

e. Compressed gases must not be used to clean your skin or clothing.

f. Never heat cylinders to raise internal pressure.

g. Do not use copper (>65%) connectors or tubing with acetylene. Acetylene can form explosive compounds with copper, silver, and mercury.

h. Always leave at least 30 psig minimum pressure in all "empty" cylinders. Do not leave an empty cylinder attached to a pressurized system.

V. CONTROL MEASURES

A. VENTILATION

1. Laboratory ventilation is normally designed to provide approximately eight air changes per hour. This flow is not necessarily sufficient to prevent accumulation of chemical vapors. Laboratory work shall be conducted in a fume hood, glove box, or similar device when:

   a. Procedures call for work with toxic substances which are volatile; i.e., evaporate at normal temperature and pressure, or

   b. There is a possibility the action level or PEL (see Appendix III) will be exceeded.

2. The protection provided by the laboratory fume hoods is dependent upon two important factors:

   a. proper use of the hood, and

   b. maintenance of adequate airflow through the hood.

3. The way the hood is used will determine the degree of protection it will provide. Each employee is responsible for implementing the following work practices when using a hood.

   a. Continually monitor air being drawn into the hood by attaching a kim wipe or light-weight strip of paper to the bottom of the sash.

   b. Operate the hood at the lowest working sash height; i.e., recommended maximum 18 inch sash height for hoods with vertical sliding (up and down) sashes and the sashes closed as much as possible for hoods with horizontal sliding (left and right) sashes. This helps to ensure optimum protection when conducting operations in the hood. The lowest working sash height opening maximizes air velocity through the hood face and may provide additional protection from unexpected splashes or chemical reactions.

   c. Avoid using the hood for storage of bottles and equipment, especially along the back wall. Any apparatus that must be housed within the hood should fit completely inside the hood. Elevate the apparatus on blocks (at least 2 inches off the benchtop) to allow air to flow freely around and beneath.

   d. Manipulations within the hood should be performed at least 6 inches inside the face of the hood or as far towards the back of the hood as possible. This minimizes the possibility of contaminants escaping from the hood.

   e. Fully close the hood sash and turn off the fan (if possible) when the hood is not in use. The fan should remain on if volatile materials are being <u>temporarily</u> (i.e., for the duration of a current project) stored in the hood.

   f. Things which cause air turbulence across the face of the hood such as fans, window air conditioning units, or excessive movement should be avoided.

   g. Exhaust hoods do not provide adequate protection for all operations involving toxic materials. A higher level of containment should be used for procedures where minor contamination can be serious. If you are in doubt about the level of containment needed for your operation, ask your PI or contact the CHO.

4. EHSO conducts annual surveys of fume hoods to ensure adequate airflow is maintained through the hood face. Face velocities should be between 80 and 120 feet per minute (fpm) with the sash lowered to within 18 inches of the bottom of the hood. Hoods that do not meet these minimum standards are considered "inadequate" and should not be used for protection from toxic or volatile materials. Call x67937 if you suspect the hood is not working properly.

5. At no time shall laboratory fume hood alarms be tampered with or disabled. Upon activation of the alarm, work within the hood should cease and facilities and/or the CHO must be notified.

B. SPILL CLEAN-UP PROCEDURES

The range and quantity of hazardous substances used in laboratories requires preplanning to respond safely to chemical spills. The cleanup of a chemical spill should only be done by knowledgeable and experienced personnel. Spill kits with instructions, adsorbents, reactants, and protective equipment should be available to clean up minor spills. A minor spill is one that does not spread rapidly, does not endanger people or property except by direct contact, does not endanger the environment, and the laboratory staff is capable of handling safely without the assistance of safety and emergency personnel. All other chemical spills are considered major.

In the event of a major spill the following procedures shall be carried out:

1. Attend to anyone who may be hurt or contaminated if it can be accomplished without endangering yourself.

2. If flammable materials are spilled, de-energize electrical devices if can be done without endangering yourself.

3. Call Campus Security at x66911.

In the event of a minor spill the following procedures shall be carried out:

1. Attend to anyone who may have been contaminated or hurt.

2. Ensure that the fume hood(s) is on. Open windows where possible to increase exhaust ventilation and if the spilled material is flammable, turn off all ignition and heat sources.

3. Secure cleanup supplies. Neutralize acids and bases, if possible. Ensure protective apparel is resistant to the spill material.

4. Control the spread of the liquid by containing the spill.

5. Absorb the liquid by adding appropriate absorbent materials from the spill's outer edges toward the center.

6. Collect and contain the cleanup residues by scooping it into a plastic bucket or other appropriate container.

7. Properly dispose of the waste as hazardous waste.

8. Decontaminate the area and affected equipment. Ventilating the spill area may be necessary.

9. Document what happened, why, what was done, and what was learned. Such documentation can be used to avoid similar instances in the future. Major incidents are almost always preceded by numerous near misses.

In any event, there should be supplies and equipment on hand to deal with the spill, consistent with the hazards and quantities of the spilled substance. These cleanup supplies should include neutralizing agents (such as sodium carbonate or sodium bisulfate) and absorbents (such as vermiculite and sand). Paper towels and sponges may also be used as absorbent-type cleanup aids, although this should be done cautiously. For example, paper towels used to clean up a spilled oxidizer may later ignite, and appropriate gloves should be worn when wiping up highly toxic material with paper towels. Also, when a spilled flammable solvent is absorbed in vermiculite or sand, the resultant solid is highly flammable and gives off flammable vapors and, thus, must be properly contained or removed to a safe place. If you have questions regarding spill clean up requirements please contact EHSO at x63198.

VI. EXPOSURE MONITORING

Exposure monitoring shall be performed when there is reason to believe that exposures are in excess of the AL or the PEL. Materials which require monitoring under these conditions are listed in Appendix III. If an employee would like to have an exposure assessment conducted, the CHO should be contacted.

Documentation of exposure monitoring shall be kept and maintained as part of each employee's personnel record.

VII. MEDICAL CONSULTATIONS AND EXAMINATIONS

Employees shall be provided an opportunity to receive medical attention, including any related follow-up examinations, at the University's expense, under the following circumstances:

1. An individual develops signs or symptoms associated with exposure to hazardous chemicals in the laboratory.

2. Exposure monitoring reveals an exposure level routinely above the AL or PEL for a HIOSH regulated substance for which there are exposure monitoring and medical surveillance requirements.

3. An accident such as a spill, leak, equipment failure, or explosion results in possible over-exposure to hazardous chemicals.

The PI and department Personnel Offices are responsible for establishing and maintaining an accurate record of any medical consultations and examinations provided to an employee.

VIII. SELECT CARCINOGENS, REPRODUCTIVE TOXINS, HIGHLY ACUTE TOXINS

The procedures described in this section are mandatory when performing laboratory work with greater than 10 mg or 100 mL of any carcinogen, reproductive toxin, or substance that has a high degree of acute toxicity.

A. DEFINITIONS

1. Select carcinogens: any substance which meets one of the following criteria: (1) It is regulated by DOSH as a carcinogen; or (2) 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 (3) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or (4) 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.

2. Reproductive toxin: chemicals which affect reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogens).

3. Highly Acute Toxin is any substance for which:

   a. the median oral LD_{50} is less than or equal to 50 mg/kg when administered orally to albino rats, or

   b. the median inhalation lethal concentration, LC_{50}, value is less than or equal to 200 ppm by volume of gas or vapor, or 2 mg/liter or less of dust, mist, or fume when administered continuously for one hour or less to albino rats, or

c. the median LD_{50} is less than or equal to 200 mg/kg when administered by continuous contact for 24 hours or less with the bare skin of albino rabbits.

4. Designated area: a hood, glove box, portion of a laboratory, or an entire laboratory room, designated as the only area where work shall be conducted with quantities of select carcinogens, reproductive toxins, or highly acute toxins in excess of the limits specified above.

B. DESIGNATED AREA

Access to designated areas shall be restricted. Only trained employees will be allowed to work with chemicals in the designated area. All such persons will:

1. Use the smallest amount of chemical that is consistent with the requirement of the work to be done.

2. Always use these chemicals in a hood with adequate air flow (face velocity between 80 and 120 feet per minute with the sash 18 inches t from the floor of the hood) or other containment device for procedures which may result in the generation of aerosols or vapors containing the substance.

3. Use high-efficiency particulate air (HEPA) filters or high-efficiency scrubber systems to protect vacuum lines and pumps.

4. Contact the Chemical Hygiene Officer at x 65180 for more information about reproductive toxins. A partial list of reproductive toxins is listed in Appendix IX.

5. Decontaminate designated areas before normal work is resumed there. This includes contaminated equipment.

6. Remove any protective apparel, place it in an appropriately labeled container, thoroughly wash hands, forearms, face, and neck on leaving a designated area.

7. Prepare wastes for disposal in accordance with the UHM Hazardous Material Management Program (Appendix IV).

8. Do not wear jewelry when working in designated areas since decontamination of jewelry may be difficult or impossible.

APPENDIX I

EMERGENCY TELEPHONE NUMBERS
and
WORK COORDINATION

EMERGENCY TELEPHONE NUMBERS

CAMPUS EMERGENCY (24 Hours)	X 66911
POISON CENTER	941-4411

ENVIRONMENTAL HEALTH & SAFETY OFFICE (EHSO) RESOURCES

Laboratory Safety Chad C. Gushikuma, Chemical Hygiene Officer	x 65097
Radiation Safety Irene Sakimoto, Radiation Safety Officer	x 66475
Occupational Health and Safety Emma Kennedy, Industrial Hygienist	x 63204
Hazardous Material Management Tim O'Callaghan, Hazardous Material Management Officer	x 63198
EHSO Training Hans Nielsen, EHSO Training Coordinator	x 65180
Diving Safety Dave Pence, Diving Safety Officer	x 66420
Fire Safety Mike “Richard Merrell, Fire Safety Officer	x 64953
Environmental Compliance Tavia Oshiro, Environmental Compliance Officer	x 69173

OFFICE OF FACILITIES AND GROUNDS (OFG)

Work Coordination	x 67134

OFFICE OF RESEARCH COMPLIANCE, BIOSAFETY PROGRAM

BIOSAFETY COMPLIANCE PROGRAM	x 60347

APPENDIX II

LABORATORY INSPECTION CHECKLIST

UH MANOA LAB SAFETY INSPECTION CHECKLIST

Principal Investigator:	Department:
Building / Lab Room #:	Date of Inspection:
Inspector(s):	Escorted By:

1	WORK ENVIRONMENT/GENERAL SAFETY	Y	N	N/A	Inspector Comments	PI Comments/ Corrected
1.1	Is the laboratory locked when not in use?					
1.2	Are emergency eye washes and showers available, unobstructed and inspected every semester?					
1.3	Are disposable containers for broken glass provided and specifically labeled for glass disposal (“Broken Glass”)?					
1.4	Is protective clothing, goggles, face shields, gloves, closed-toe shoes and other PPE available and used?					
1.5	Have all chemical fume hoods passed inspection within the past 12 months?					
1.6	Are chemical fume hoods free from excessive storage?					
1.7	Are chemical fume hood sashes closed when not in use?					
1.8	Is housekeeping maintained?					
1.9	Are all floors kept clean and dry and in good repair?					
1.10	Are food and beverages prepared and consumed in areas separate from chemicals?					
1.11	Are fire extinguisher(s) readily accessible?					
1.12	Are fire-rated doors not propped open?					
1.13	Are glass containers not stored on the floor?					
1.14	Are exits free of any trip hazards or obstruction? (minimum 28 inches clearance in aisles)					
1.15	Is storage at least 18 inches below the ceiling/sprinkler heads?					
1.16	Are safety guards in place for equipment with moving parts (belts, blades, fans, etc)?					
1.17	Is there a first aid kit in the lab and is it adequately stocked?					
1.18	Do refrigerators, freezers, microwaves, and ice machines have proper “No Food/Drink” signage?					

2	CHEMICAL SAFETY	Y	N	N/A	Inspector Comments	PI Comment Corrected
2.1	Are all highly flammable and toxic procedures performed in a fume hood?					
2.2	Are approved spark-proof refrigerators used for cold storage of flammable liquids?					
2.3	Are flammable chemicals stored in a safe manner (more than 10 gallons stored in an approved flammable storage cabinet)?					
2.4	Are incompatible chemicals segregated in storage? (flammables and oxidizers; nitric acid/acids; acids and bases)					
2.5	Are all chemicals properly labeled, including hazard identification, and percentages of mixtures?					
2.6	Are air and water reactive chemicals properly stored?					
2.7	Does the laboratory test peroxide-forming chemicals?					
2.8	Are chemical storage areas identified with signs (e.g., flammables, corrosives, carcinogens, poisons, etc.)?					
2.9	Is a chemical spill kit available (with posted procedures)?					
2.10	Is mercury containing equipment being used in the laboratory? If yes, is a Hg spill kit available?					

3	COMPRESSED GAS CYLINDERS	Y	N	N/A	Inspector Comments	PI Comments Corrected
3.1	Are incompatible gases properly segregated when not in use?					
3.2	Are cylinders secured properly and protective caps in place when not in use?					

4	ELECTRICAL	Y	N	N/A	Inspector Comments	PI Comments Corrected
4.1	Are the cords of all electrical equipment in good condition?					
4.2	Are cords used properly (e.g., no piggy-backing of surge protectors; clear of burners, sinks, aisles; no use of extension cords)					

5	DOCUMENTATION	Y	N	N/A	Inspector Comments	PI Comments Corrected
5.1	Is a current Chemical Hygiene Plan available?					
5.2	Are Standard Operating Procedures available for experiments posing an					

	increased hazard?					
5.3	Does the lab have a written (annually updated) chemical inventory?					
5.4	Are MSDS's available for all chemicals in the lab (hardcopy or accessible online by all lab members)?					
5.5	Have personnel attended initial Lab Safety Training?					
5.6	Is refresher lab safety training conducted annually with all staff?					
5.7	Are emergency notification procedures, contacts with current phone numbers, and hazardous warning signs posted at the entry to the lab?					

6	**HAZARDOUS WASTE AUDIT CHECKLIST**	**Y**	**N**	**N/A**	**Inspector Comments**	**PI Comments/ Corrected**
6.1	Is any hazardous waste generated in the laboratory?					
6.2	Is any non-hazardous chemical waste disposed of in the laboratory?					
6.3	Does the satellite accumulation area store less than 55 gallons of all hazardous waste and less that one quart of P waste?					
6.4	Is the satellite accumulation area in the same laboratory where the waste is generated?					
6.5	Is the satellite accumulation area kept in good housekeeping condition?					
6.6	Are waste containers separated by hazard class to avoid incompatible storage?					
6.7	Are all the waste containers in good condition (e.g., not corroded or leaking, and properly sealed or closed)?					
6.8	Are all waste containers properly labeled as to their contents (correct chemicals names, readable labels, and percentages of individual components for mixtures)?					
6.9	Are secondary containers used when required?					
6.10	Is there at least one person in the laboratory who has attended the EHSO training for Hazardous Waste Generators?					
6.11	Is the satellite accumulation area identified by a posted sign?					
6.12	Are all hazardous waste containers closed except when waste is being added?					
6.13	When a waste container is attached to equipment generating waste, is the container closed when the equipment is not in use?					

ADDITIONAL INSPECTOR COMMENTS/ISSUES:

Once each identified problem has been corrected, fill out the "PI comments/Date corrected" column. The PI/Lab manager has 30 days upon receipt of this checklist to respond (e-mail back this form) with corrective action(s). A follow-up inspection may be conducted to ensure corrections were made.

By typing in my name I agree that it is equivalent to my handwritten signature.

I certify that the information submitted is, to the best of my knowledge, true and accurate.

Lab Manager/PI: _____ Date: _____

Print Name

*Revised 10/1/15

APPENDIX III

"LIMITS FOR AIR CONTAMINANTS"
STATE OF HAWAII OCCUPATIONAL SAFETY & HEALTH STANDARDS

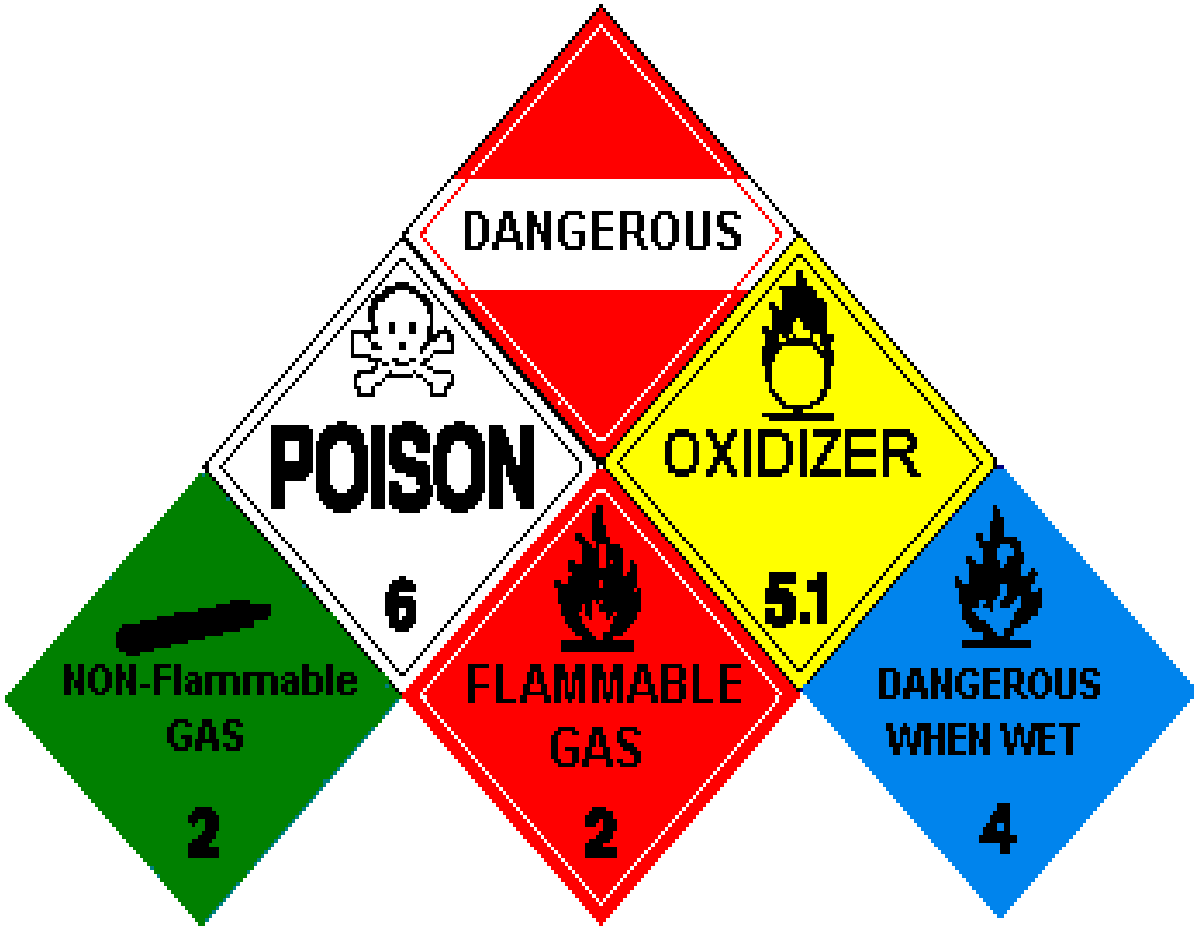
The” limits for air contaminants” can be found at HAR 12-60-50, exhibit B, at the following link:

http://labor.hawaii.gov/hiosh/files/2012/12/12-60-General-Safety-Health-Requirements.pdf

APPENDIX IV

HAZARDOUS MATERIAL MANAGEMENT PROGRAM

UNIVERSITY OF HAWAII AT MANOA



Hazardous Material Management Program

July 2016

UNIVERSITY of HAWAI'I®
MĀNOA

Office of the Chancellor

July 25, 2012

Dear Colleagues:

Providing a safe and healthy environment in which the faculty, staff and students work and study is a matter of the highest priority on the Manoa campus. Our students and employees should be able to go about their daily activities knowing that hazardous materials in our laboratories are handled safely, with competence, and with utmost concern for our health and a commitment to protect our environment.

We are obligated to comply with the applicable federal, state and local regulations that govern the use of hazardous materials and the disposal of hazardous wastes. To assist us in following all applicable rules, the manual detailing the Manoa campus Hazardous Material Management Program (HMMP) has been revised and is being distributed for immediate implementation.

The manual is a definitive guide to handling hazardous materials and disposing of hazardous wastes. This is not only a matter of complying with the law-it is a matter of ensuring the personal health and safety of everyone on campus and making sure that we do whatever is necessary to maintain a safe and secure workplace and to protect our environment.

We all need to be aware of our responsibilities in this area, and the HMMP has been prepared with everyone's safety in mind.

Sincerely,

Tom Apple
Chancellor

2500 Campus Road, Hawai'i Hall 202
Honolulu, Hawai'i 96822
Telephone: (808) 956-7651
Fax: (808) 956-4153

TABLE OF CONTENTS

ATTACHMENTS

HAZARDOUS MATERIAL MANAGEMENT PROGRAM

I. INTRODUCTION.

This manual provides information on requirements for the management of hazardous materials, including the disposal of hazardous waste. These requirements are based on Federal and State of Hawaii regulations. Failure to comply with these requirements may subject the University and/or individuals to fines, and civil or criminal prosecution. In addition, the proper management of hazardous materials is necessary to reduce disposal costs. While the disposal of all material as hazardous waste is expensive, there are certain materials that require special attention to minimize the difficulty and expense of their disposal. A copy of this Hazardous Material Management Program along with other useful information is available online at the University's web-site (http://www.hawaii.edu/ehso/hazmat).

II. MANAGEMENT OF HAZARDOUS MATERIAL.

Compliance with the following requirements will assist the University's Environmental Health and Safety Office (EHSO) in ensuring the proper management of certain types of hazardous chemicals. Our hazardous material management strategy is divided into four parts: Approval to purchase, safety in use, inventory control, and audits.

A. Approval to Purchase Certain Hazardous Chemicals. EHSO approval is required for the purchase or requisition of the specific chemicals on the list provided on the Procurement Authorization for Hazardous Material Form, Attachment (1). This form must be filled out and submitted to EHSO for approval prior to initiating a purchase order for any of the materials on the list. If approved, a copy of the form will be provided to you for attachment to your purchase order or requisition. The purpose of EHSO approval is to enable us to assist you in ensuring the safe storage, handling and disposal of the material while minimizing cost to the University.

B. Safety in Use. Certain hazardous materials require Standard Operating Procedures (SOPs) to ensure the safe use and storage of these materials. The University Chemical Hygiene Plan (CHP) provides requirements for SOPs and describes the specific types of material covered. Attachment (2), Agreement for Use of Hazardous Material is being deleted by this revision to the HMMP since its purpose is being accomplished by the requirements cited above.

C. Inventory of Hazardous Material. The previous hazardous material inventory form, Attachment (3), has been deleted because of the requirement for a total chemical inventory has been incorporated into the University Chemical Hygiene Plan (CHP). The CHP chemical inventory will be used to provide EHSO with the information previously provided by Attachment (3). A copy of the inventory must be available at the laboratory/facility for review, but a copy does not have to be submitted to EHSO unless specifically requested.

D. Audit Program. EHSO has established an audit program to assist in maintaining laboratories and facilities that are safe and protective of the environment. EHSO personnel will periodically visit laboratories and facilities to review the implementation of applicable safety, health and environmental policies and requirements. Specifically, the following items will normally be covered: Use of personal protective equipment, emergency eyewashes and showers, laboratory chemical hoods, hazardous material storage, survey for highly hazardous materials or acutely hazardous waste, Material Safety Data Sheet availability, hazardous waste accumulation areas, and emergency plans. A report indicating any corrective actions that are necessary and suggesting any improvements will be provided.

III. HAZARDOUS WASTE DISPOSAL REQUIREMENTS. The following requirements apply to all generators of hazardous waste.

A. Mandatory Training: Initial and annual refresher training is required for hazardous waste generators. The purpose of the training is to familiarize waste generators with EPA requirements and University policies and procedures. The EHSO Training Coordinator can be contacted at 956-5180 to schedule training. Principal Investigators have the primary responsibility for the storage and disposal of excess hazardous material and waste in the laboratories. They can choose to train all of the workers in the laboratory as hazardous waste generators or they can designate an individual or individuals as the trained hazardous waste generator(s) for the laboratory. At least one person in each laboratory must have current hazardous waste generator training. In addition all persons who generate waste in the laboratory must know who the designated trained hazardous waste generator is and the basic requirements for waste disposal (i.e. hazardous waste must be labeled and stored in the satellite accumulation area in a closed container and non-hazardous waste must be appropriately disposed). The Principal Investigator has the responsibility to ensure that all persons who generate waste know the basic requirements for waste disposal and that the satellite accumulation area is periodically monitored to verify that requirements are met. **EHSO will NOT pick up any hazardous material or hazardous waste unless the person who signs the material/waste turn-in form has been trained.**

B. Waste Generator Responsibilities: The following outlines waste generator responsibilities.

1. Become familiar with the hazardous materials you use and the University policies on hazardous materials and hazardous waste management.

2. Obtain initial waste generator training.

3. Comply with waste requirements. Store and label waste properly, complete the waste turn-in form correctly.

4. Complete annual waste generator training, available online from the EHSO web-site.

5. Contact EHSO, if in doubt about the requirements or how to properly dispose of waste.

C. Establishment of a Satellite Accumulation Area (SAA): Each generator shall establish an identifiable area, with a posted sign for the collection of waste. The area must be at or near the point of generation of the waste (i.e., in the same room or in a connecting room where the waste is being generated). Up to 55 gallons of ordinary waste or one quart of Acutely Hazardous (P-coded) Waste may be accumulated over an indefinite period of time. A list of Acutely Hazardous Wastes is provided in Attachment (4). The containers must be labeled and must be closed except when waste is being added to them. If the 55 gallon or one quart limit is reached, you must contact EHSO immediately. The SAA should be neat and orderly, containers should not be stacked upon one another or containers of liquid should not be stored on their side. The SAA must be clearly defined and material that is not waste cannot be in the SAA.

D. Waste Containers: Containers used for wastes must be in good condition (i.e. not rusting, without cracks or structural defects). If a container is broken or begins to leak, the material must be transferred to a container in good condition. The material composition must be compatible with the material to be stored and incompatible materials must not be stored in the same container. Containers must have a secure closure (e.g., screw cap). Parafilm, glass or rubber stoppers are not considered secure closures. Containers of liquid waste must not be “overfilled”. The maximum amount of liquid in the container must not exceed 90% of its capacity.

E. Labeling: Normally all waste material shall be labeled with the word "waste" and the chemical name(s) of the waste (e.g., "waste methyl alcohol" or "waste ethidium bromide"). Generic names can be used if a separate list is maintained to indicate the chemical names and the approximate amounts (e.g., "waste chlorinated solvent bottle no 1" with a separate list "Bottle no. 1 Chloroform 50%, Methyl Chloroform 40%, Methylene Chloride 10%"). Chemicals which are unused or only partially used, in original containers , do not have to be labeled as waste if the manufacturers label provides the chemical name and specific hazards (e.g., flammable, corrosive or poison) associated with the material. The name of the chemical and other required data are entered on the Hazardous Material and Hazardous Waste Turn-in Form.

F. Secondary Containments. Secondary containments are required for containers of liquid waste under the following circumstances:

1. When the waste is stored in 55-gallon drums.

2. When the waste is stored on the floor.

3. When the waste is stored in a hood which has a drain.

4. When the waste is stored within four (4) feet of a sink.

5. When necessary to separate incompatible or high hazard wastes.

   Plastic tubs can be used as secondary containments. EHSO should be consulted about secondary containments for 55-gallon drums.

G. Hazardous Material and Hazardous Waste Turn In Form. This form, Attachment (5), is necessary to comply with EPA regulations. It will provide the University with a permanent auditable record of the excess material and hazardous waste generated. Instructions for completing the form and an explanation of the entries are also provided in Attachment (5).

H. Hazardous Waste Disposal Costs. The cost of hazardous waste disposal for the Manoa Campus is borne by the Environmental Health and Safety Office with no charge to the generator of the waste, except for the following:

   1. **Unknown Waste**. A charge of $70 for each container of unknown waste is made to cover the cost of analysis. Waste cannot be legally disposed of unless it has been identified.

   2. **Radioactive Mixed Waste**. Wastes which are both naturally radioactive (e.g., Uranium or Thorium compounds) and a regulated waste (e.g., nitrates or flammable solvents), are very expensive to dispose. In the past the cost of 10 pounds of radioactive mixed waste was $30,000. Reimbursement of EHSO disposal costs will be charged to the department generating the waste.

   3. **Compressed Gas Cylinders**. Compressed gas cylinders that are not empty, have frozen valves or which contain unknown gases present difficult and expensive disposal problems. One lecture bottle sized cylinder can cost from $500 to $6,000 dispose and cylinders whose contents are unknown can cost $10,000 or more for disposal. Reimbursement of EHSO disposal costs will be charged to the department generating the waste. There is no charge for the disposal of empty cylinders, but cylinders with frozen or non-operational valves cannot be considered empty. We dispose of empty cylinders by removing the valve and must be able to verify that the cylinder is truly empty before attempting to remove the valve or it would expose our technicians to an unacceptable safety risk. Once the valve has been removed the cylinders are disposed as scrap metal.

   4. **Dioxin or Dioxin Contaminated Materials**. Materials containing Dioxin (dibenzodioxins or dibenzofurans) must be disposed at one approved site on the Mainland which is only infrequently open or exported to a disposal site in Canada. This involves substantial cost, approximately $1,000 per pound and special permits. Reimbursement of EHSO disposal costs will be charged to the department generating the waste.

I. Emergency Plans for Spills. A specific plan and training in the plan is needed for the chemicals you will be using. Emergency procedures and emergency phone numbers should be posted in the work area. Personnel working with hazardous chemicals should be able to answer the question: **"What would I do if this material spilled?"** Spill kits with instructions, adsorbents, reactants, and protective equipment should be available to clean up minor spills. A minor spill is one that does not spread rapidly, does not endanger people or property except by direct contact, does not endanger the environment, and the workers in the area are capable of handling safely without the assistance of safety and emergency personnel. All other chemical spills are considered major. The following are general procedures for the handling of spills.

1. Attend to anyone who may have been contaminated or hurt, if it can be done without endangering yourself.

2. Ensure that the fume hood(s) is on and open windows where it can be done without endangering yourself. If flammable materials are spilled, de-energize electrical devices if it can be done without endangering yourself.

3. If the spill is major, contact Campus Security (x66911) and the EHSO (x63198). If the spill is minor, clean up can be performed as follows:

    a. Ensure protective apparel is resistant to the spilled material. Neutralize acids and bases, if possible using neutralizing agents such as sodium carbonate or sodium bisulfate.

    b. Control the spread of liquids by containing the spill.

    c. Absorb liquids by adding appropriate absorbent materials, such as vermiculite or sand, from the spill's outer edges toward the center. Paper towels and sponges may also be used as absorbent material, but this should be done cautiously considering the character of the spilled material. If you have any questions regarding spill clean up requirements, please contact EHSO at x63198.

    d. Collect and contain the cleanup residues by scooping it into a plastic bucket or other appropriate container and properly dispose of the waste as hazardous waste.

    e. Decontaminate the area and affected equipment. Ventilating the spill area may be necessary.

    f. Document what happened, why, what was done, and what was learned. Such documentation can be used to avoid similar instances in the future. Major incidents are almost always preceded by numerous near misses.

J. Specific Information on the Disposal of Various Materials. The individual possessing or generating the material retains the primary legal responsibility for the material. EHSO provides information on requirements and assistance in handling the materials. Specific information on various types of materials is given below.

1. **AEROSOL CANS:** Aerosol cans (e.g., paint cans, WD-40, or other aerosol products) whether full or empty shall be turned in to EHSO for disposal.

2. **BATTERIES:**
   a. Lithium, nickel-cadmium, silver or mercury batteries will be accepted by EHSO for disposal.

   b. Alkaline and Carbon Zinc batteries will NOT be accepted by EHSO for disposal. Under current Honolulu City and County regulations Alkaline or Carbon Zinc batteries can be disposed of as ordinary trash.

   c. Lead acid batteries are handled as follows. Lead acid batteries in computer equipment (i.e., UPS back-up power supplies) are e-waste and can be disposed of through the Quarterly University of Hawaii e-Waste Pick-up program (see UH website http://manoa.hawaii.edu/landscaping/landscapingpage/ewaste.php). Lead acid Vehicle batteries are recyclable and arrangements with local vendors can be made (e.g., Interstate Battery Systems of Hawaii, 94-120 Leokane St., 676-6000 or Battery Bill, 550 N. Nimitz Hwy, 536-4017). They accept car and other lead batteries for disposal/recycling. The disposal of batteries from University vehicles are handled by Transportation Services. The disposal of other lead acid batteries used in research will be handled on a case by case basis, contact EHSO (956-3198).

3. **BIOLOGICAL MATERIALS**: For biohazardous wastes, refer to the published University biohazardous waste disposal guidelines or contact the Biosafety Program (x68009) for information concerning the handling and disposal of biological materials.

4. **COMPRESSED GASES**: Compressed gas cylinders should be returned to the vendor. A return agreement with the vendor should be included in the contract. Without such an agreement the return or disposal of the cylinders is difficult and very costly.

5. **CONTROLLED SUBSTANCE**S: The handling and disposal of controlled substances (i.e. drugs and other substances listed in 21 CFR 1308) are the responsibility of the permit holder. EHSO cannot accept controlled substances for disposal.

6. **FLUORESCENT LIGHT BALLASTS**: The Office of Facilities & Grounds (OFG) removes non-leaking ballasts. Ballasts that contained PCBs are believed to have already been removed from University light fixtures. Contact EHSO (x63198) for assistance concerning leaking ballasts or any known to contain PCBs.

7. **FLUORESCENT LIGHT TUBES**: OFG removes and disposes of fluorescent light tubes. Contact Work Coordination (x67134) for assistance. Specialty lamps used in research (e.g., UV lamps, Halogen lamps, Atomic Absorption spectral lamps) can be submitted to EHSO for disposal.

8. **HAZARDOUS CHEMICALS AND HAZARDOUS WASTE**: EHSO will pick- up excess hazardous chemicals and hazardous chemical waste. Efforts should be made to determine if excess hazardous chemicals can be used by others in the department or facility prior to contacting EHSO for pickup. Chemicals considered non-hazardous waste can be disposed of in the municipal sanitary landfill or sanitary sewer under certain conditions (see "Non-Hazardous Waste" below). The completion of a hazardous material and hazardous waste turn in form is required for material/waste pickup by EHSO. A copy of this form is included as Attachment (5). The following rules must be complied with for us to pick up your material.

    a. YOU MUST HAVE ATTENDED THE HAZARDOUS WASTE GENERATOR CLASS (initial and annual refresher). We cannot pickup waste from persons who do not have current training.

    b. YOU MUST HAVE SUBMITTED A COPY OF A “HAZARDOUS MATERIAL & HAZARDOUS WASTE TURN-IN FORM” IN ADVANCE TO EHSO FOR OUR REVIEW AND APPROVAL. Fill in the form online and e-mail it to hazwaste@hawaii.edu. Upon approval, a mutually convenient time for pickup will be arranged.

    c. BE SURE EACH CHEMICAL CONTAINER IS PROPERLY LABELED Labels should clearly identify contents with a chemical name (i.e. no abbreviations or chemical formulas).

    d. PACKAGE MATERIALS IN STURDY CARDBOARD BOXES OR PLASTIC WASTE CONTAINERS, AVAILABLE FROM EHSO. ORIGINAL CONTAINERS FOR QUANTITIES GREATER THAN 5 GALLONS OR 55-GALLON WASTE DRUMS ARE ACCEPTABLE. Cushion the material in the containers to prevent breakage. If cardboard boxes are used which originally held chemicals, the name of the chemical must be covered over or defaced. Failure to do so constitutes improper marking as to contents and is an EPA regulation violation.

    e. REPACKAGE BROKEN OR LEAKING CONTAINERS INTO NON-LEAKING CONTAINERS PRIOR TO PICKUP.

    f. SEPARATE INCOMPATIBLE MATERIALS. Incompatible materials shall be segregated in separate boxes. Examples of incompatible materials are: acids/bases, organics/oxidizers, and flammable liquids/oxidizers. Unknowns and high hazard materials such as cyanides, organic peroxides, pyrophorics,

water reactives and explosives shall be packaged separately regardless of quantity.

If you have any questions on the proper disposal of hazardous materials or wastes, contact EHSO at (x63198).

9. **MERCURY**: EHSO will accept for disposal items containing functional mercury (e.g. light switches, barometers and thermometers).

10. **MIXED WASTE**: Mixed waste is defined as materials that possess a radioactive or biological hazard as well as an unrelated chemical hazard (e.g., acetone with carbon-14, is both flammable and radioactive). Contact the Radiation Safety Program (x68591) or Biosafety Program (x68009) as applicable for assistance in the proper disposal of these materials.

11. **NON-HAZARDOUS WASTE**: Listed in Table 1 below are typical laboratory chemicals which are not considered hazardous wastes by the U.S. Environmental Protection Agency. If solid and in plastic containers, they may be disposed of as ordinary trash. The container must have the chemical name on it and it should be marked "non-hazardous" to mitigate any concern by the refuse collectors. If solid and in glass or metal containers the material would have to be transferred to plastic containers, labeled and marked "non-hazardous". This is necessary as the refuse contract does not permit the collection of metal or glass containers unless they are empty. As an alternative, all non-hazardous solid chemicals can be turned in to EHSO for disposal using the turn-in form. Liquid chemicals or chemical solutions can only be disposed of to the sanitary sewer (i.e. "down the drain") if they are within the scope of the University's Industrial Wastewater Discharge Permit. The paragraph below provides general requirements and Table 2 below provides a list of materials that can be disposed of to the sanitary sewer. Contact EHSO (X63198) if you have chemicals that you believe may be non-hazardous for a written determination as to whether they must be turned in to EHSO for disposal or may be disposed of as ordinary trash or in the sanitary sewer in small amounts.

TABLE 1: Non-Hazardous Waste

Sugars (e.g., sucrose, glucose, mannose)	Silica Gel
Starch	Alumina (aluminum oxide)
Naturally occurring Amino Acids	Calcium Fluoride
Citric Acid and its Sodium, Potassium, Magnesium, Calcium and Ammonium Salts.	Lactic Acid and its Sodium, Potassium, Magnesium, Calcium and Ammonium, Salts

Sodium, Potassium, Calcium, Strontium, and Ammonium Sulfates	Sodium, Potassium, Calcium, Magnesium, Strontium and Ammonium Phosphates
Sodium, Potassium, Magnesium and Ammonium Chlorides	Sodium, Potassium, Magnesium, and Calcium Borates
Silicon Dioxide	Sodium, Potassium, Ammonium Acetates
Boron, Magnesium, Copper Oxides	Sodium, Potassium, Magnesium, Calcium , and Ammonium Carbonates

The following general requirements must be met for all waste to be disposed of in the sanitary sewer. The waste must meet both the general requirements and be listed in Table 2 or have specific written permission from EHSO (Hazardous Material Management Officer). The solution must have a pH between 5.5 and 9.5. No viscous solutions or solutions containing oil are permitted. No solutions at a temperature of greater than 40 degrees Centigrade are permitted. No solutions containing ashes, cinders, sand, mud, straw, shavings, metal powder, glass, rags, feathers, tar, plastics, wood, or paper are permitted.

TABLE 2: Drain Disposal Restrictions

Ethidium Bromide Solutions: <0.01% by weight and < 2 quarts per day per laboratory.
Phosphate Buffer Solutions: <10% by weight and < 1 quart per day per laboratory
Salt Solutions: <10% by weight (sodium, potassium, lithium, ammonium: chlorides, carbonates, phosphates, sulfates, or acetates) < 2 quarts per day per laboratory.
Dyes or Stains: Small amounts of from slides as part of laboratory experiments.
Alcohol Solutions (methyl, ethyl, isopropyl only): < 10% by volume and < 1 quart per day per laboratory.
Dilute formaldehyde Solutions: < 3% by weight and < 1 quart per day per laboratory.
Sugar Solutions: < 10% by weight and <2 quarts per day per laboratory
Amino Acids and their Salts in solution: <10% by weight and <2 quarts per day per laboratory.

Citric and Lactic Acids and their Salts in solution: <10% by weight and <1 quart per day per laboratory.

NOTE: The percentage by weight or volume refers to a total of the items in any category. For example a solution of 5 % sodium chloride and 5 % potassium chloride would meet the limit while a solution of 10% sodium chloride and 5 % potassium chloride would not. Similarly, a solution of 10% ethyl alcohol and 5% methyl alcohol would not meet the criteria for drain disposal. A solution of 10% ethyl alcohol and 10% sodium chloride would meet the criteria as they are in different categories, but the volume permitted per day would be the lower of the two.

12. **OILS AND TRANSFORMER FLUID**: EHSO will accept waste pump oil. EHSO will NOT accept used motor oil, unless it was used in research. Used motor oil is recyclable through local vendors. Used motor oil from University vehicles is handled by Transportation Services. Transformer fluid will be handled on a case by case basis, contact EHSO (x63198) for assistance.

13. **RADIOACTIVE MATERIALS**: Refer to the University Radiation Safety Manual or contact the EHSO Radiation Safety Program (x68591) for information concerning the proper handling and disposal of radioactive material.

14. **SHARPS.** Sharps are defined as: Any material or object that can puncture or cut the skin and cause injury. These include, but are not limited to: needles syringes, razors, scapels, lancets, and pipet tips.

    a. Metal sharps contaminated with hazardous chemicals. For metal sharps contaminated with hazardous chemicals (e.g., hypodermic needles, razors, scalpels or knife blades),rinse to decontaminate them and dispose of them in a sharps container, but do not use a red sharps container. Contact the Biosafety Program(x68009) for disposal of the sharps container.

    b. Glass or plastic sharps contaminated with hazardous chemicals. For glass or plastic sharps contaminated with hazardous chemicals (e.g., pipet tips), turn them in to EHSO as excess hazardous material/hazardous waste and include the name of the chemical (e.g., pipet tips contaminated with: phenol, ethidium bromide, or mercury).

    c. Sharps contaminated with radioactive material. Refer to the University Radiation Safety Manual or contact the Radiation Safety Program (x68591) for information on the proper handling and disposal of sharps contaminated with radioactive material.

    d. Sharps contaminated with biological or infectious material. Refer to the published biohazardous waste guidelines or contact the Biosafety

Program (x68009) for information concerning the proper handling and disposal of sharps contaminated with biological or infectious material.

15. **GLASSWARE.**

a. Glassware not contaminated with radiological, biological or hazardous chemicals shall be placed in a puncture resistant container, labeled “glass or broken glass”. It will be picked up by the custodial staff and disposed of.

b. Glassware contaminated with visible residual amounts (e.g., < 1gram or 1ml) of hazardous chemicals, except for “P” listed chemicals or insoluble materials, shall be rinsed to decontaminate them and the rinsate disposed down the drain. Glassware without any visible residual chemicals should be disposed of as ordinary glassware. Glassware contaminated with “P” listed chemicals or insoluble materials shall be turned in to EHSO for disposal as hazardous chemical waste.

c. Broken glassware contaminated with hazardous chemicals should be placed in a puncture resistant container (e.g., bottle, plastic container or metal can overpack with a secure lid), labeled with the name of the chemical and turned in to EHSO for disposal as hazardous chemical waste.

d. For information on the proper disposal of glassware contaminated with biological material, contact the Biosafety program (x68009). For information on glassware contaminated with radioactive material contact the Radiation Safety Program (x68591).

K. Abandoned Waste. Abandoned waste should not occur, as the abandonment of waste is a violation of the HMMP. In the event that abandoned waste is discovered, the following policy will be implemented.

1. If the waste material is in a building or adjacent to a building such that it can be assumed that the waste came from the building, then the Department/School/College occupying the building is responsible for the disposal of the waste material in accordance with the HMMP.

2. If the waste material is in an area such that it is not easily identifiable as having come from a building (e.g., the material is in a dumpster or parking lot), or if a chemical spill is involved, then EHSO will respond and dispose of the material as abandoned waste in accordance with the HMMP.

IV. HAZARDOUS WASTE MINIMIZATION

A. Buying Chemicals in Smaller Amounts. The "large economy size" may cost less to buy, but disposal costs, in most cases, are several times the initial cost of the material. Many of the bottles of excess or waste chemicals turned in are full or 3/4 full. Everyone needs to accurately estimate the amount of chemicals they expect to use.

B. Recycling and Redistribution. As described in the hazardous material control and hazardous waste program above, efforts are to be made to find someone in the laboratory or department who could use the hazardous material before it is turned in to EHSO as excess or waste. EHSO encourages the redistribution and exchange of surplus chemical products within the UH system as an alternative to disposal as waste. Information on the chemical exchange program and the UH electronic swap meet can be found online at www.hawaii.edu/ehso/hazmat and www.hawaii.edu/swapmeet. If no qualified user can be found then the material will be disposed of as hazardous waste. This program will reduce waste generation and save the University waste disposal costs.

C. Use of Less Hazardous or Non-hazardous Materials. The following provides some examples of the use of less hazardous or non-hazardous materials; everyone is encouraged to seek other alternatives to hazardous materials that may be applicable to their research or instructional materials.

1. Cleaning Solutions: Chromerge, chromic acid and dichromate cleaning solutions are not desirable from a waste disposal prospective as they cannot be made non-hazardous and are expensive to dispose of. There are many non-toxic biodegradable-cleaning solutions that can be used instead of chromic acid. For extremely dirty glassware a product called Nochromix, which uses sulfuric acid and an organic oxidizer in place of chromium can be used. While this requires neutralization of the acid for ordinary disposal, it is far less costly to dispose of than chromium solutions. A number of alternative cleaning solutions are listed below. These are all available from Fisher Scientific, who has the University contract for laboratory supplies. NoChromix, Alconox, Liquinox liquid detergent, Citranox, Fisherbrand sparkleen, and FL-70 Concentrate.

2. Drying Agents: The safest common drying agents are calcium chloride, silica gel, molecular sieves and calcium sulfate (Drierite). These are recommended because of their low toxicity and stability. Drying agents that pose varying degrees of hazard and disposal problems include:

    a. Phosphorus pentoxide, which generates highly corrosive phosphoric acid and heat on contact with water. This material also has to be disposed of as a hazardous waste unless it can be reacted and neutralized.

    b. Magnesium perchlorate (Dehydrite), which is a strong oxidizer and may

cause fires or explosions on contact with organic materials. This material has to be disposed of as a hazardous waste.

c. Water Reactive Chemicals, (materials such as sodium metal, potassium metal, calcium metal, calcium carbide, calcium hydride, lithium hydride, lithium aluminum hydride, sodium hydride and potassium hydride) are not recommended for use as general purpose drying agents because they form flammable gases on contact with water and are both dangerous and expensive to dispose of. Small amounts of these materials can be safely disposed of by reacting them with water under controlled conditions by knowledgeable personnel to create non-hazardous or less hazardous materials. If a bottle of solvent contains a water reactive drying agent, this information must be clearly marked on the bottle. This is necessary for the safety of personnel handling the material during disposal.

3. Thermometers: Mercury thermometers should be replaced with non-mercury thermometers whenever possible. Broken mercury thermometers create spills that are a potential health hazard, time consuming to clean up, and are one of the most expensive hazardous wastes we handle. Non mercury thermometers with equivalent accuracy are available for temperature ranges of -20 to 250 degrees Centigrade. Contact EHSO or check your laboratory supply catalog for more information. If mercury-containing equipment is used, then a mercury spill kit and personnel knowledgeable in its use is required in the laboratory or facility.

D. Conversion to Non-hazardous Material. As part of instruction or research operations, hazardous materials can be converted into non-hazardous wastes The neutralization of acids or bases is an example of this. Experiments can be designed to convert residual or produced hazardous materials into non-hazardous wastes. In some cases this can have instructional value as well as reducing the amount of hazardous waste and its disposal cost.

UNIVERSITY OF HAWAII AT MANOA
PROCUREMENT AUTHORIZATION FOR HAZARDOUS MATERIALS

An approved (signed) copy of this form must accompany any purchase order or requisition for the procurement of the hazardous materials listed on page two of this form.

****

NAME: _____
(Principal Investigator)

DEPARTMENT: _____ **PHONE NO., EXT**.: _____

LOCATION: _____
(Where chemical will be used)

Chemical Name	Solid/liquid/gas	Amount

Signature of Principal Investigator:_____ **Date**:_____

PLEASE SEND THE COMPLETED FORM TO: EHSO, 2040 East-West Road, Attention: Hazardous Materials Management Officer. The Hazardous Materials Management Officer may be contacted at 956-3198 or FAX 956-3205, if you have questions.

****

FOR EHSO USE ONLY

EHSO APPROVAL:_____ Date:_____
(Hazardous Materials Management Officer)

APPROVAL NO._____

9/19/02

LIST OF CHEMICALS REQUIRING ENVIRONMENTAL HEALTH & SAFETY OFFICE (EHSO) APPROVAL TO PURCHASE

Because the following chemicals are highly toxic, explosive, water reactive or for other reasons very difficult and expensive to dispose of (disposal costs can be more than $1000 per container) their use needs to be minimized and monitored. Contact Tim O'Callaghan, at EHSO (956-3198) for further information.

Arsine
Boron Trichloride
Boron Trifluoride
Bromine Chloride
Butyl Lithium
Carbon Monoxide
Carbonyl Sulfide
Cesium
Calcium Hydride
Chlorine
Chlorine Trifluoride
Chloropicrin
Cyanogen
Cyanogen Chloride
Diborane
3,5-Dinitrophenol
2,4-Dinitrophenylhydrazine
3,5-Dinitrosalicylic Acid
Ethylene Oxide
Fluorine
Hydrogen Bromide
Hydrogen Chloride
Hydrogen Cyanide
Hydrogen Fluoride
Hydrogen Sulfide
Lithium
Lithium Aluminum Hydride
Lithium Hydride
Methyl Amine
Methyl Bromide
Methyl Chloride
Methyl Lithium
Nitric Acid - concentrated only (≥ 68%)
Nitric Oxide
Nitrogen Dioxide
Nitrogen Trifluoride
Phosgene
Phosphine
Phosphorus
Picfume
Picric Acid
Picryl Sulfonic Acid
Picramide
Potassium
Rubidium
Silane
Silane Dichloride
Sodium
Sulfur Dioxide
Thorium Compounds
Trinitroaniline
Trinitrobenzene
Trinitrocresol
Trinitronapthalene
Trinitrophenol
Trinitrotoluene
Uranium Compounds
Urea Nitrate
Vinyl Chloride

UNIVERSITY OF HAWAII AT MANOA
AGREEMENT FOR THE USE OF HAZARDOUS MATERIAL

DELETED

Attachment 2

ATTACHMENT 3

SAMPLE CHEMICAL INVENTORY FORMAT

Lab Room Number :

PI's Name :_____ Date Completed:

FORM DELETED

Chemical Name	CAS #	AMOUNT	HAZARD CLASS	Location

ATTACHMENT 4

LIST OF ACUTELY HAZARDOUS WASTE (P-CODED WASTE)

The following materials are hazardous wastes if and when they are intended to be discarded (40 CFR 261.33):

1. Any commercial chemical product or manufacturing chemical intermediate having the generic name listed below.

2. Any off-specification commercial chemical product or chemical intermediate having the generic name listed below.

3. Any visible residue remaining in a container of P-coded material

4. Any residue resulting from the clean-up of a spill of a P-coded waste.

5. The phrase "commercial chemical product or manufacturing chemical intermediate having a generic name listed below" refers to a chemical substance which is manufactured or formulated for commercial or manufacturing use which consists of the commercially pure grade of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient.

Hazardous Waste No.	Chemical Abstracts No.	Chemical Name
P023	107-20-0	Acetaldehyde, chloro-
P002	591-08-2	Acetamide, N-(aminothioxomethyl)-
P057	640-19-7	Acetamide, 2-fluoro-
P058	62-74-8	Acetic acid, fluoro-, sodium salt
P002	591-08-2	1-Acetyl-2-thiourea
P003	107-02-8	Acrolein
P070	116-06-3	Aldicarb
P203	1646-88-4	Aldicarb sulfone
P004	309-00-2	Aldrin
P005	107-18-6	Allyl alcohol
P006	20859-73-8	Aluminum phosphide
P007	2763-96-4	5-(Aminomethyl)-3-isoxazolol
P008	504-24-5	4-Aminopyridine
P009	131-74-8	Ammonium Picrate
P119	7803-55-6	Ammonium Vanadate

Hazardous Waste No.	Chemical Abstracts No.	Chemical Name
P099	506-61-6	Argintate (1-), bis(cyano-C-), potassium
P010	7778-39-4	Arsenic acid (H3AsO4)
P012	1327-53-3	Arsenic oxide (As2O3)
P011	1303-28-2	Arsenic oxide (As2O5)
P011	1303-28-2	Arsenic pentoxide
P012	1327-53-3	Arsenic trioxide
P038	692-42-2	Arsine, diethyl-
P036	696-28-8	Arsenous dichloride, phenyl-
P054	151-56-4	Aziridine
P067	75-55-8	Aziridine, 2-methyl-
P013	542-62-1	Barium cyanide
P024	106-47-8	Benzenamine, 4-chloro-
P077	100-01-6	Benzenamine, 4-nitro
P028	100-44-7	Benzene (chloromethyl)-
P042	51-43-4	1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-
P046	122-09-8	Benzeneethanamine, alpha,alpha-dimethyl-
P014	108-98-5	Benzenethiol
P127	1563-66-2	7-Benzofuranol, 2,3-dihydro-2-2-dimethyl-, methylcarbamate
P188	57-64-7	Benzoic acid, 2-hydroxy,compd, with (3aS-cis)-1,2,3,3a,8,8a-hexahydro-1,3a,8-trimethylpyrrolo [2,3-b]indol-5-yl methylcarbamate ester (1:1)
P001	81-81-2	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenylbutyl)-, & salts, when present at concentrations greater than 0.3%.
P028	100-44-7	Benzyl chloride
P015	7740-47-7	Beryllium powder
P017	598-31-2	Bromoacetone
P018	357-57-3	Brucine
P045	39196-18-4	2-Butanone, 3,3-dimethyl-1-(methylthio)-, o-[methylamino, carbonyl] oxime
P021	592-01-8	Calcium cyanide
P189	55285-14-8	Carbamic acid, [(dibutylamino)-thio]methyl-,2,3-dihydro-2,2-dimethyl-7-benzofuranyl ester
P191	644-64-4	Carbamic acid, dimethyl-, 1-[(diemthylamino)carbonyl]-5-methyl-1H-pyrazol-3-yl ester
P192	119-38-0	Carbamic acid, dimethyl-, 3-methyl-1-(1-methylethyl)-1H-pyrazol-5-yl ester
P190	1129-41-5	Carbamic acid, methyl-, 3-methylphenyl ester
P127	1563-66-2	Carbofuran

Hazardous Waste No.	Chemical Abstracts No.	Chemical Name
P022	75-15-0	Carbon disulfide
P095	75-44-5	Carbonic dichloride
P189	55285-14-8	Carbosulfan
P023	107-20-0	Chloroacetaldehyde
P024	106-47-8	p-Chloroaniline
P026	5344-82-1	1-(o-Chlorophenyl) thiourea
P027	542-76-7	3-Chloropropionitrile
P029	544-92-3	Copper cyanide (202CuCN)
P202	64-00-6	m-Cumenyl methylcarbamate
P030	----------	Cyanides (soluble cyanide salts) not otherwise specified
P031	460-19-5	Cyanogen
P033	506-77-4	Cyanogen chloride (CNCl)
P034	131-89-5	2-Cyclohexyl-4,6-dinitrophenol
P016	542-88-1	Dichloromethyl ether
P036	696-28-6	Dichlorophenylarsine
P037	60-57-1	Dieldrin
P038	692-42-2	Diethylarsine
P041	311-45-5	Diethyl-p-nitrophenyl phosphate
P040	297-97-2	O,O-Diethyl O-pyrazinyl phosphorothioate
P043	55-91-4	Diisopropylfluorophosphate (DFP)
P004	309-00-2	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa-chloro-1,4,4a,5,8,8a,-hexahydro-(1alpha,4alpha,4abeta,5alpha,8alpha,8abeta)-
P060	465-73-6	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa-chloro-1,4,4a,5,8,8a-hexahydro-, (1alpha,4alpha,4abeta,5beta,8beta,8abeta)-
P037	60-57-1	2,7:3,6-Dimethanonaphth[2,3-b] oxirene,3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-(1aalpha,2beta,2aalpha,3beta,6beta,6aalpha, 7beta,7aalpha)-
P051	72-20-8	2,7:3,6-Dimethanonaphth[2,3,-b] oxirene,3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-,(1aalpha,2beta,2abeta,3alpha,6alpha,6abeta,7 beta,7aalpha)-, & metabolites
P044	60-51-5	Dimethoate
P046	122-09-8	alpha,alpha-Dimethylphenethylamine
P191	644-64-4	Dimetilan

Hazardous Waste No.	Chemical Abstracts No.	Chemical Name
P047	534-52-1	4,6,Dinitro-o-cresol, & salts
P048	51-28-5	2,4,-Dinitrophenol
P020	88-85-7	Dinoseb
P085	152-16-9	Diphosphoramide, octamethyl-
P111	107-49-3	Diphosphoric acid, tetraethyl ester
P039	298-0404	Disulfoton
P049	541-53-7	Dithiobiuret
P185	26419-73-8	1,3-Dithiolane-2-carboxaldehyde, 2,4-dimethyl-,O-[(methylamino)-carbonyl] oxime
P050	115-29-7	Endosulfan
P088	145-73-3	Endothall
P051	72-20-8	Endrin, & metabolites
P042	51-43-4	Epinephrine
P031	460-19-5	Ethanedinitrile
P194	23135-22-0	Ethanimidothioc acid, 2-(dimethylamino)-N-{[(methylamino) carbonyl] oxy}-2-oxo-, methyl ester
P066	16752-77-5	Ethanimidothioic acid, N-{[(methylamino) carbonyl]oxy}-, methyl ester
P101	107-12-0	Ethyl cyanide
P054	151-56-4	Ethyleneimine
P097	52-85-7	Famphur
P056	7782-41-4	Fluorine
P057	640-19-7	Fluoroacetamide
P058	62-74-8	Fluoroacetic acid, sodium salt
P198	23422-53-9	Formetanate hydrochloride
P197	17702-57-7	Formparanate
P065	628-86-4	Fulminic acid, mercuric salt
P059	76-44-8	Heptachlor
P062	757-58-4	Hexaethyl tetraphosphate
P116	79-19-6	Hydrazinecarbothioamide
P068	60-34-4	Hydrazine, methyl-
P063	74-90-8	Hydrocyanic acid
P063	74-90-8	Hydrogen cyanide
P096	7803-51-2	Hydrogen phosphide
P060	465-73-6	Isodrin
P192	119-38-0	Isolan
P202	64-00-6	3-Isopropylphenyl N-methylcarbamate
P007	2763-96-4	3(2H)-Isoxazolone, 5-(aminomethyl)-
P196	15339-36-3	Manganese, bis(dimethylcarbamodithioato-S,S')-

Hazardous Waste No.	Chemical Abstracts No.	Chemical Name
P196	15339-36-3	Manganese dimethyldithiocarbamate
P092	62-38-4	Mercury, (acetato-O)phenyl-
P065	628-86-4	Mercury fulminate
P082	62-75-9	Methanamine, N-methyl-N-nitroso-
P064	624-83-9	Methane, isocyanato-
P016	542-88-1	Methane, oxybis(chloro-
P112	509-14-8	Methane, tetranitro-
P118	75-70-7	Methanethiol, trichloro-
P198	23422-53-9	Methanimidamide, N,N-diemthyl-N'-{3-[[(methylamino)-carbonyl]oxy]-phenyl}-, monohydrochloride
P197	17702-57-7	Methanimidamide, N,N-dimethyl-N'-{2-methyl-4-[[(methylamino) carbonyl]oxy]phenyl}-
P050	115-29-7	6,9,-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide
P059	76-44-8	4,7,-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-
P199	2032-65-7	Methiocarb
P066	16752-77-5	Methomyl
P068	60-34-4	Methyl hydrazine
P064	624-83-9	Methyl isocyanate
P069	75-86-5	2-Methyllactonitrile
P071	298-00-0	Methyl parathion
P190	1129-41-5	Metolcarb
P128	315-08-4	Mexacarbate
P072	86-88-4	alpha-Naphthylthiourea
P073	13463-39-3	Nickel carbonyl (NiCO)
P074	557-19-7	Nickel cyanide (NiCN)
P075	54-11-5	Nicotine & salts
P076	10102-43-9	Nitric oxide
P077	100-01-6	p-Nitroaniline
P078	10102-44-0	Nitrogen dioxide
P076	10102-43-9	Nitrogen oxide (NO)
P078	10102-44-0	Nitrogen oxide (NO2)
P081	55-63-0	Nitroglycerine
P082	62-75-9	N-Nitrosodimethylamine
P084	4549-40-0	N-Nitrosomethylvinylamine
P085	152-16-9	Octamethylpyrophosphoramide
P087	20816-12-0	Osmium Tetroxide (OsO4)

Hazardous Waste No.	Chemical Abstracts No.	Chemical Name
P088	145-73-3	7-Oxabicyclo(2.2.1)heptane-2,3-dicarboxylic acid
P194	23135-22-0	Oxamyl
P089	56-38-2	Parathion
P034	131-89-5	Phenol, 2-cyclohexyl-4,6-dinitro-
P048	51-28-5	Phenol, 2,4-dinitro
P047	534-52-1	Phenol, 2-methyl-4,6-dinitro- & salts
P020	88-85-7	Phenol, 2-(1-methylpropyl)-4,6-dinitro-
P009	131-74-8	Phenol, 2,4,6-trinitro-, ammonium salt
P128	315-18-4	Phenol, 4-(dimethylamino)-3,5-dimethyl-, methylcarbamate (ester)
P199	2032-65-7	Phenol, (3,5-dimethyl-4-(methylthio)-, methylcarbamate
P202	64-00-6	Phenol, 3-(1-methylethyl)-, methylcarbamate
P201	2631-37-0	Phenol, 3-methyl-5-(1-methylethyl)-, methylcarbamate
P092	62-38-4	Phenylmercury acetate
P093	103-85-5	Phenylthiourea
P094	298-02-2	Phorate
P095	75-44-5	Phosgene
P096	7803-51-2	Phosphine
P041	311-45-5	Phosphoric acid, diethyl 4-nitrophenyl ester
P039	298-04-4	Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester
P094	298-02-2	Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester
P044	60-51-5	Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] ester
P043	55-91-4	Phosphorofluoridic acid, bis(1-methylethyl) ester
P089	56-38-2	Phosphorothioic acid, O,O-diethyl O-(4-nitrophenyl) ester
P040	297-97-2	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester
P097	52-85-7	Phosphorothioic acid, O-{4-[(dimethylamino)sulfonyl] phenyl} O,O-dimethyl ester
P071	298-00-0	Phosphorothioic acid, O,O-dimethyl O-(4-nitrophenyl) ester
P204	57-47-6	Physostigmine
P188	57-64-7	Physostigmine salicylate
P110	78-00-2	Plumbane, tetraethyl-
P098	151-50-8	Potassium cyanide (KCN)

Hazardous Waste No.	Chemical Abstracts No.	Chemical Name
P099	506-61-6	Potassium silver cyanide
P201	2631-37-0	Promecarb
P070	116-06-3	Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino)carbonyl] oxime
P203	1646-88-4	Propanal, 2-methyl-2-(methyl-sulfonyl)-, O-[(methylamino) carbonyl] oxime
P101	107-12-0	Propanenitrile
P027	542-76-7	Propanenitrile, 3-chloro-
P069	75-86-5	Propanenitrile, 2-hydroxy-2-methyl-
P081	55-63-0	1,2,3,-Propanetriol, trinitrate
P017	598-31-2	2-Propanone, 1-bromo-
P102	107-19-7	Propargyl alcohol
P003	107-02-8	2-Propenal
P005	107-18-6	2-Propen-1-ol
P067	75-55-8	1,2-Propylenimine
P102	107-19-7	2-Propyn-1-ol
P008	504-24-5	4-Pyridinamine
P075	54-11-5	Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-, & salts
P204	57-47-6	Pyrrolo[2,3-b]indol-5-ol, 1,2,3,3a,8,8a-hexahydro-1,3a,8-trimethyl-, methylcarbamate (ester, (3aS-cis)-
P114	12039-52-0	Selenious acid, dithallium (thallous) salt
P103	630-10-4	Selenourea
P104	506-64-9	Silver cyanide (AgCN)
P105	26628-22-8	Sodium azide
P106	143-33-9	Sodium cyanide (NaCN)
P108	57-24-9	Strychnidin-10-one, & salts
P018	357-57-3	Strychnidin-10-one, 2,3-dimethoxy-
P108	57-24-5	Strychnine & salts
P115	7446-18-6	Sulfuric acid, dithallium (thallous) salt
P109	3689-24-5	Tetraethyldithiopyrophosphate
P110	78-00-2	Tetraethyl lead
P111	107-49-3	Tetraethyl pyrophosphate
P112	509-14-8	Tetranitromethane
P062	757-58-4	Tetraphosphoric acid, hexaethyl ester
P113	1314-32-5	Thallic oxide
P113	1314-32-5	Thallium oxide (Tl2O3)
P114	12039-52-0	Thallium (I) selenite (thallous selenite)
P115	7446-18-6	Thallium (I) sulfate (thallous sulfate)

Hazardous Waste No.	Chemical Abstracts No.	Chemical Name
P109	3689-24-5	Thiodiphosphoric acid, tetraethyl ester
P045	39196-18-4	Thiofanox
P049	541-53-7	Thioimidodicarbonic diamide (H2NCS)2NH
P014	108-98-5	Thiophenol
P116	79-19-6	Thiosemicarbazide
P026	5344-82-1	Thiourea, (2-chlorophenyl)-
P072	86-88-4	Thiourea, 1-naphthalenyl-
P093	103-85-5	Thiourea, phenyl-
P185	26419-73-8	Tirpate
P123	8001-35-2	Toxaphene
P118	75-70-7	Trichloromethanethiol
P119	7803-55-6	Vanadic acid, ammonium salt
P120	1314-62-1	Vanadium Oxide (V2O5) vanadium pentoxide
P084	4549-40-0	Vinylamine, N-methyl-N-nitroso-
P001	81-81-2	Warfarin, & salts, when present at concentrations greater than 0.3%
P205	137-30-4	Zinc, bis(dimethylcarbamodithioato-S,S')-,
P121	557-21-1	Zinc cyanide [Zn (CN)2]
P122	1314-84-7	Zinc phosphide (Zn3P2) when in concentrations greater than 10%
P205	137-30-4	Ziram

RESET FORM

Excess Hazardous Materials and Hazardous Waste Turn in Form

This form is to be used for the turn in of excess hazardous materials or hazardous waste to the Environmental Health and Safety Office (EHSO) for reuse or disposal. Please refer to the Hazardous Materials Management Program requirements for information on the types of materials accepted and the proper disposition of other materials. See the attached sheet for information on completing the form. The form must be completed online and e-mailed as an attachment to hazwaste@hawaii.edu.
*** NOTE: Please use Adobe Reader/Acrobat and NOT a "Preview" app or view to fill out this form. ***

Dept/Org: _____ Date: _____

Name: _____ Phone: _____

Location: _____ Page: _____ of _____

List of Materials:

* Item No#	Chemical Name	Quantity	** Physical State	For EHSO Use

* Item No# = List the Item Number and mark the individual containers with the same Item Number.
** Physical state = S (Solid), L (Liquid), G (Gas/Aerosol). Quantity is to be specified in pounds (lbs) for solids and gallons (gal) for liquids. See the conversion list if necessary. For gases and aerosols see Instructions.

* Item No#	Chemical Name	Quantity	** Physical State	For EHSO Use

Generator Certification: I certify that the information provided is complete and accurately describes, to the best of my knowledge, the material to be turned in.
Note: You have to have current training as a hazardous waste generator to sign this form.
By typing in my name I agree that it is equivalent to my handwritten signature.

_____ _____
Signature Date

EHSO Approval:_____ _____
Hazardous Materials Management Officer Date

Material Acceptance: The material submitted for turn in has been inspected and determined to match the list above and is labeled and packed in accordance with University Hazardous Materials Control and Hazardous Waste Disposal requirements.

_____ _____
EHSO Representative Date

SUBMIT FORM TO EHSO

PRINT FORM

EXCESS HAZARDOUS MATERIAL AND HAZARDOUS WASTE TURN IN FORM

Name:_____**Page**:_____**of**____

* Item No#	CHEMICAL NAME	Quantity	** Physical State	For EHSO Use

*Item No# = List the Item Number and mark the individual containers with the same Item Number.
**Physical State = S (Solid), L (Liquid), G (Gas/Aerosol)

10/20/2009

LINE BY LINE INSTRUCTIONS FOR FILLING OUT THE EHSO EXCESS HAZARDOUS MATERIAL AND HAZARDOUS WASTE TURN IN FORM

Department/Organization: The source of the material (e.g. Chemistry, Engineering, Botany, Hawaii Natural Energy Institute)

Date: Today's date.

Name: Name of the generator who signs the form must appear here. Additional names can be listed as necessary. For example, John Smith, contact Harry Brown for Pick-up.

Phone No: Telephone number of contact person.

Location: Location where material can be picked up (e.g. Bilger 214 or Biomed T 411)

List of Materials: Each material is to be listed on a separate line. This information is critical for us to properly handle and dispose of the material. Unknowns are extremely difficult and expensive to dispose of. Try to identify the material in a broad category such as "unknown acid" or "unknown flammable solvent". If the material is truly unknown write "unknown" in the Chemical Name space on the form. Note; your department will be charged $70 for each container of unknown material.

Item No #: This is an identifying number for each item (e.g., 1, 2, 3, 4). This number must be marked on the containers, so that the containers can be matched with the items on the list and placed in the proper drums for their hazard class at our facility.

Chemical Name: This is the name on the container label. Do not use chemical formulas or abbreviations. If the material is not pure then the concentration should be given (e.g. 10% hydrogen peroxide solution, Acid waste: 2 Molar hydrochloric acid, waste solvent: 60% isopropyl alcohol, 40% acetone.) The more information that you can supply, the easier and less expensive it will be for us to handle the material. Also, when you list ten (10) or more items list each item with a number and also mark the corresponding number on the container. This will assist EHSO in matching the items to the list when we pickup the items and pack for disposal. When filling in the form online, if you have a large list of names as constituents for one line item, you can reduce the font size to 9 and this will enable you to get more items in one block on the form. You are limited to two lines of data for each block. If reducing the font size is not enough to list all of your constituents on two lines then you will have to use multiple blocks for the line item.

Quantity: Indicate the approximate amount in pounds for solids and gallons for liquids. For items less than 0.01 pound (4.5 grams) report 0.01 pounds. For items less than 0.01 gallons (40 ml or 1.3 ounces) report 0.01 gallons. For gases indicate the number of cylinders in the quantity block. For aerosols indicate the size and number of containers (e.g., 5 x 15 oz cans).

Physical State: This identifies the type of material (solid, liquid, gas/aerosol) and is important as the hazard class or EPA waste code may depend on the physical state of the material. Use "S" for solids, "L" for liquids and "G" for gases or aerosols.

For EHSO Use: EHSO uses this space to record the DOT hazard class and the EPA waste code for the material. Please do not write in the left margin on the form, as we use that space to enter the drum number for each item.

Generator Certification: A person currently trained as a hazardous waste generator must fill in the signature block on the form. Complete the signature block by typing in your name . This signature acknowledges your responsibility for the material. When you e-mail the form, you should receive an automatic e-mail response that your form has been received. If you do not receive an automatic response, contact EHSO as we may not have received your form.

EHSO Approval: The Hazardous Materials Management Officer (HMMO) will review the form for completeness and conformance with the regulations. If there are any problems or questions, the HMMO will contact the generator. Upon approval of the form by the HMMO the generator will be contacted and a mutually convenient time for pickup of the material will be arranged by EHSO.

Material Acceptance: EHSO personnel will inspect the material, prior to accepting it. Any material that does not match the material on the approved form or that does not conform to the requirements for labeling, packaging and container condition will not be accepted. The EHSO Representative signature verifies that the generator has complied with the applicable requirements.

If you have any questions on the proper disposal of materials or on the form, please contact EHSO (x 63198).

7/7/2016

Weight and Volume Conversion Table

The following tables are provided for convenience to those using the waste turn in form. Numbers are approximations and have been rounded off.

1. Weights: grams to pounds 1 gram = 0.0022 pounds

<5 grams.....0.01 pounds (per instructions all weights less than 5 grams or 0.01 pounds are to be reported as 0.01 pounds)

5	grams.....…0.01 lbs.	10	grams..... 0.02 lbs.
20	grams..... 0.04 lbs.	30	grams..... 0.07 lbs.
40	grams..... 0.09 lbs.	50	grams..... 0.11 lbs.
100	grams..... 0.22 lbs.	500	grams..... 1.10 lbs.

2. Volumes: liters to gallons 1 liter = 0.2642 gallons

≤ 40 ml.....… 0.01 (per instructions volumes ≤ 40 ml are reported as 0.01 gal.)

50	ml..... 0.01 gal	60	ml.....….... 0.02 gal
100	ml..... 0.03 gal	150	ml.…..... 0.04 gal
200	ml..... 0.05 gal	300	ml.....… 0.08 gal
400	ml ..... 0.11 gal	500	ml.....…. 0.13 gal
600	ml..... 0.16 gal	700	ml.....….. 0.18 gal
800	ml….....… 0.21 gal	900	ml.…..... 0.24 gal
1.0	liter.....……0.26 gal	1.5	liters.……0.40 gal
2.0	liters..……0.53 gal	2.5	liters.……0.66 gal
3.0	liters.……..0.79 gal	4.0	liters.....….1.06 gal

0.5 pints (8 oz)…..0.06 gallons

1.0 pint (16 oz)… 0.13 gallons

1.0 quart (32 oz)... 0.25 gallons

APPENDIX V

UHM EMERGENCY PROCEDURES DURING POWER OUTAGES

EMERGENCY PROCEDURES FOR LABORATORIES DURING POWER OUTAGES

It is important to remember that some equipment cannot be turned off and certain other pieces of equipment do not shut themselves off when there is a power outage. Pre-plan specific procedures for your laboratory while adhering to the following:

- Close chemical fume hood sashes. No work is allowed in fume hoods during a power outage.

- Ensure that all chemical containers are secured with caps, parafilm, etc.,

- All non-essential electrical devices should be turned off. Keep the doors of refrigerators and freezers closed. Check to ensure large lasers, radio frequency generators, etc. have been turned off.

- Turn off all gas cylinders at the tank valves. If a low flow of an inert gas is being used to "blanket" a reactive compound or mixture, it may be appropriate to leave the flow of gas on. The decision to do this should be part of the written SOP specific for each lab and included in this CHP.

- Check all cryogenic vacuum traps (N_2, CO_2 + solvent). The evaporation of trapped materials may cause dangerous conditions.

- Check all pressure, temperature, air, or moisture sensitive materials and equipment. This includes vacuum work, distillations, glove boxes used for airless/moistureless reactions, etc.

APPENDIX VI

UHM REQUIREMENTS FOR STORAGE AND HANDLING OF FLAMMABLE AND LIQUIDS

UNIVERSITY OF HAWAII AT MANOA

REQUIREMENTS FOR STORAGE AND HANDLING OF FLAMMABLE LIQUIDS

STORAGE REQUIREMENTS

1 Flammable liquids stored in the open in a laboratory work area or inside any building shall be kept to the minimum necessary for the work being done.

2 Maximum quantity permitted in labs and other areas of use is limited to a total of 10 gallons, all classifications combined, outside of a flammable storage cabinet or approved flammable storage room. Please refer to Table 1.

3 Quantities stored in flammable storage cabinets shall be limited to 60 gallons of category 1 and 2 or 3 and 4 liquids and the total of all liquids shall not exceed 120 gallons. Please refer to Table 1 for maximum allowable container size for each class. Not more than three cabinets shall be located in the same fire area.

4 Quantities exceeding the above must be stored in an approved flammable storage room meeting the requirements of the Uniform Building and Fire Codes.

5 Flammables shall not be stored near exit doorways, stairways, in exit corridors, or in a location that would impede egress from the building.

6 Materials which will react with water or other liquids to produce a hazard shall be segregated from flammable liquids.

7 Refrigerators, freezers, and other cooling equipment used for storing flammable liquids must be rated for storing such items and prominently labeled as such. Equipment that is IM or UL listed as “flammable storage” or “explosion proof” must be used for flammable or volatile liquid storage. “Flammable storage” indicates that flammable materials are isolated from sparks. “Explosion proof” indicates that the entire unit is sealed and can be used in explosive atmospheres.

HANDLING AND DISPENSING

1 Category 1 and 2 liquids shall not be transferred from one vessel to another in any exit passageway.

2 Transfer of flammable liquids from 5 gallon containers (or less) to smaller containers shall be done in a laboratory fume hood or in an approved flammable liquid storage room.

3 Empty containers shall be treated in the following manner:

a) For water soluble solvents ----→ rinse, deface label, and dispose with normal trash.

b) For non-water soluble solvents ----→ allow to evaporate to dryness in a hood, rinse, deface label, and dispose with normal trash.

TABLE 1

(Categories are per new Globally Harmonized System)

CATEGORY	1	2	3	4
Flash point	less than 73.4 F	less than 73.4 F	between 73.4 F and 140 F	between 140 F and 199.4 F
Boiling point	less than or equal to 95 F	greater than 95 F		
Flammability Potential	Extremely High	Very High	High	Moderate
EXAMPLES OF COMMONLY USED MATERIALS	acetaldehyde benzoyl peroxide ethyl ether pentane methyl formate	acetone ethanol butylamine gasoline methanol isopropanol	amyl acetate butanol chlorobenzene turpentine xylene	formaldehyde hydrazine kerosene
MAXIMUM CONTAINER SIZE Glass	1 pint (500 ml)	1 quart (1 liter)	1 gallon (4 liter)	1 gallon (4 liter)
Metal or approved plastic	1 gallon	5 gallon	5 gallon	5 gallon
Safety cans	2 gallon	5 gallon	5 gallon	5 gallon
Metal drums (DOT)	N/A	5 gallon	5 gallon	5 gallon

APPENDIX VII

SELECT CARCINOGENS

APPENDIX VIII

SELECT CARCINOGENS

Substances regulated as select carcinogens by OSHA include:

--Compounds regulated by Title 29, Code of Federal Regulations, Part 1910, Subpart Z - Toxic and Hazardous Substances(1).

--Compounds considered to be "Known Carcinogens" by the National Toxicology Program, (NTP)(2).

--Compounds designated as carcinogens and suspect carcinogens by the International Agency for Research on Cancer, (IARC)(3).

Those compounds included in the IARC lists are shown with their IARC Group; those from Subpart Z and the NTP lists are shown with the appropriate footnote. This list does not include industrial processes that have been identified to cause cancer.

Substance	IARC Group(4)
A-alpha-C(2-Amino-9H-pyrido(2,3,b)indole)	2B
Acetaldehyde	2B
Acetamide	2B
2-Acetylaminofluorene(1)	--
Acrylamide	2B
Acrylonitrile(1)	2A
Adriamycin	2A
AF-2(2-(2-Furyl)-3-(5-nitro-2-furyl)acrylamide)	2B
Aflatoxins	1
para-Aminoazobenzene	2B
ortho-Aminoazotoluene	2B
4-Aminobiphenyl(1,2)	1
2-Amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole	2B
Amitrole	2B
Analgesic mixtures containing phenacetin2	1
Androgenic steroids	2A
ortho-Anisidine	2B
AramiteTM	2B

Arsenic and arsenic compounds(1,2)	1
Asbestos(1,2)	1
Auramine, technical-grade	2B
Azaserine	2B
Azathioprine(2)	1
Benzene(1,2)	1
Benzidine(1,2)	1
Benzidine-based dyes	2A
Benzo(a)pyrene	2A
Benzo(b)fluoranthene	2B
Benzo(f)fluoranthene	2B
Benzo(k)fluoranthene	2B
Benzyl violet 4B	2B
Beryllium compounds	2A
Betel quid with tobacco	1
Bis(chloroethylnaphthyl)amine	1
Bis(chloroethyl) nitrosourea (BCNU)	2A
Bis(chloromethyl) ether(1,2)	1
Bitumens, extracts of steam-refined & air-refined	2B
Bleomycins	2B
Bracken fern: Toxic Component is shikimic acid	2B
1,3-Butadiene	2B
1,4-Butanediol dimethanesulfonate ("Myleran")(2)	1
Butylated hydroxyanisole (BHA)	2B
-Butyrolactone	2B
Cadmium compounds	2A
Carbon-black extracts	2B
Carbon tetrachloride	2B
Carrageenan, degraded	2B
Chlorambucil(2)	1
Chloramphenicol	2B
Chlordecone ("Kepone")	2B
alpha-Chlorinated toluenes	2B
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU)	2A
1-(2-Chloroethyl)-3-(methylcyclohexyl)-1-nitrosourea(Methyl-CCNU)	1
Chloroform	2B
Chlorophenols	2B
Chlorophenoxy herbicides	2B
4-Chloro-ortho-phenylenediamine	2B
para-Chloro-ortho-toluidine	2B
Chromium (VI) compounds(2)	1
Cisplatin	2A
Citrus Red No. 2	2B
Coal tar pitches1	1
Coal tars(1)	1
Cotton dusts(1)	--
Creosotes	2A
para-Cresidine	2B

Cycasin	2B
Cyclophosphamide(2)	1
Dacarbazine	2B
Daunomycin	2B
DDT	2B
N,N'-Diacetylbenzidine	2B
2,4-Diaminoanisole	2B
4,4'-Diaminodiphenyl ether	2B
2,4-Diaminotoluene	2B
Dibenz(a,h)acridine	2B
Dibenz(a,f)acridine	2B
7H-Dibenzo(c,g)carbazole	2B
Dibenz(a,h)anthracene	2A
Dibenzo(a,e)pyrene	2B
Dibenzo(a,h)pyrene	2B
Dibenzo(a,i)pyrene	2B
Dibenzo(a,l)pyrene	2B
1,2-Dibromo-3-chloropropane(1)	2B
para-Dichlorobenzene	2B
3,3'-Dichlorobenzidine(1)	2B
3,3'-Dichloro-4,4'-diaminodiphenyl ether	2B
1,2-Dichloroethane	2B
Dichloromethane	2B
1,3-Dichloropropene (technical-grade)	2B
Diepoxybutane	2B
Di(2-ethylhexyl)phthalate	2B
1,2-Diethylhydrazine	2B
Diethylstilbestrol(2)	1
Diethyl sulphate	2A
Diglycidyl resorcinol ether	2B
Dihydrosafrole	2B
3,3'-Dimethoxybenzidine (ortho-Dianisidine)	2B
para-Dimethylaminoazobenzene(1)	2B
trans-2((Dimethylamino)methylimino) -5-(2-(5-nitro-2-furyl)vinyl-1,3,4-oxadiazole	2B
3,3'-Dimethylbenzidine (ortho-Tolidine)	2B
1,1-Dimethylhydrazine	2B
1,2-Dimethylhydrazine	2B
Dimethylcarbamoyl chloride	2A
Dimethyl sulphate	2A
1,4-Dioxane	2B
Epichlorohydrin	2A
Erionite	1
Ethyl acrylate	2B
Ethylene dibromide	2A
Ethyleneimine1(aziridine)	--
Ethylene oxide1	2A
Ethylene thiourea	2B

Ethyl methanesulphonate	2B
N-Ethyl-N-nitrosourea	2A
Formaldehyde1	2A
2-(2-Formylhydrazino)-4-(5-nitro-2-furyl)thiazole	2B
Glu-P-1 (2-Amino-6-methyldipyrido(1,2-alpha:3',2'-d)imidazole)	2B
Glu-P-2 (2-Aminodipyrido(1,2-alpha:3',2'-d)imidazole)	2B
Glycidaldehyde	2B
Griseofulvin	2B
Hexachlorobenzene	2B
Hexachlorocyclohexanes	2B
Hexamethylphosphoramide	2B
Hydrazine	2B
Indeno(1,2,3-cd)pyrene	2B
IQ (2-Amino-3-methylimidazo(4,5-f)quinoline)	2B
Iron-dextran complex	2B
Iron and steel founding	1
Isopropyl alcohol manufacture, strong-acid process	1
Lasiocarpine	2B
Lead compounds (inorganic)(1)	2B
Magenta, manufacture of	1
MeA-alpha-C(2-Amino-3-methyl-9H-pyrido(2,3-b)indole)	2B
Methoxyprogesterone acetate	2B
Melphalan(2)	1
Merphalan	2B
5-Methoxypsoralen	2A
8-Methoxypsoralen & UV light(2)	1
2-Methylaziridine	2B
Methylazoxymethanol and its acetate	2B
Methyl chloromethyl ether(1)	1
5-Methylchrysene	2B
4,4'-Methylene bis(2-chloroaniline) (MOCA)	2A
4,4'-Methylene bis(2-methylaniline)	2B
4,4'-Methylenedianiline	2B
Methyl methanesulphonate	2B
2-Methyl-1-nitroanthraquinone	2B
N-Methyl-N-nitrosourethane	2B
N-Methyl-N'-nitro-N-nitrosoguanidine (MNNG)	2A
N-Methyl-N-nitrosourea	2A
Methylthiouracil	2B
Metronidazole	2B
Mineral oils	1
Mirex	2B
Mitomycin C	2B
Monocrotaline	2B
5-(Morpholinomethyl)-3-((5-nitrofurfurylidene)amino)-2-oxazolinone	2B
Mustard gas(2)	1
Nafenopin	2B

1-Naphthylamine(1)	3
2-Naphthylamine(1,2)	1
Nickel compounds	1
Niridazole	2B
5-Nitroacenaphthene	2B
4-Nitrobiphenyl(1)	3
Nitrofen (technical-grade)	2B
1-((5-Nitrofurfurylidene)amino)-2-imidazolidonone	2B
N-(4-(5-Nitro-2-furyl)-2-thiazolyl)acetamide	2B
Nitrogen mustard	2A
Nitrogen mustard N-oxide	2B
2-Nitropropane	2B
N-Nitrosodiethylamine	2A
N-Nitrosodimethylamine(1)	2A
N-Nitrosodi-n-butylamine	2B
N-Nitrosodi-ethanolamine	2B
N-Nitrosodi-n-propylamine	2B
3-(N-Nitrosomethylamino)propionitrile	2B
4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)	2B
N-Nitrosomethylethylamine	2B
N-Nitrosomethylvinylamine	2B
N-Nitrosomorpholine	2B
N-Nitrosonornicotine	2B
N-Nitrosopiperidine	2B
N-Nitrosopyrrolidine	2B
N-Nitrososarcosine	2B
Oestrogens, non-steroidal	1
Oestrogens, steroidal	1
Oil Orange SS	2B
Oral contraceptives, combined	1
Oral contraceptives, sequential	1
Panfuran S (containing dihydroxymethylfuratrizine)	2B
Phenacetin & analgesics	2A
Phenazopyridine hydrochloride	2B
Phenobarbital	2B
Phenoxybenzamine hydrochloride	2B
Phenytoin	2B
Polybrominated biphenyls	2B
Polychlorinated biphenyls	2A
Ponceau MX	2B
Ponceau 3R	2B
Potassium bromate	2B
Procarbazine hydrochloride	2A
Progestins	2B
1,3-Propane sultone	2B
-Propiolactone(1)	2B
Propylene oxide	2A
Propylthiouracil	2B

Saccharin	2B
Safrole	2B
Shale oils	1
Silica, crystalline	2A
Sodium ortho-phenylphenate	2B
Soots	1
Sterigmatocystin	2B
Streptozotocin	2B
Styrene	2B
Styrene oxide	2A
Sulfallate	2B
Talc containing asbestiform fibers	1
2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD)	2B
Tetrachloroethylene	2B
Thioacetamide	2B
4,4'-Thiodianiline	2B
Thiourea	2B
Thorium dioxide(2)	--
Tobacco products, smokeless	1
Tobacco smoke	1
Toluene diisocyanates	2B
ortho-Toluidine	2B
Toxaphene (polychlorinated camphenes)	2B
Treosulphan	1
Tris(1-aziridinyl)phosphine sulphide (Thiotepa)	2A
Tris(2,3-dibromopropyl) phosphate	2A
Trp-P-1 (3-Amino-1,4-dimethyl-5H-pyrido(4,3-b)indole)	2B
Trp-P-2 (3-Amino-1-methyl-5H-pyrido(4,3-b)indole)	2B
Trypan blue	2B
Uracil mustard	2B
Urethane	2B
Vinyl bromide	2A
Vinyl chloride(1,2)	1

References

1 Occupational Safety and Health Administration Standards, Title 29, Code of Federal Regulations, Part 1910, Subpart Z - Toxic and Hazardous Substances as of 19 January 1989.

2 Fifth Annual Report on Carcinogens, Substances "Known to be Carcinogenic," National Toxicology Program, Report NTP 89-239, 1989 (latest edition).

3 IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: Overall Evaluations of Carcinogenicity, Supplement 7, International Agency for Research on Cancer (IARC), Lyons,

France, 1987.

4 IARC Carcinogen Groups:
1 = known carcinogenicity;
2A =probable;
2B =possible;
3 = not classifiable due to insufficient or conflicting data.

APPENDIX VIII

REPRODUCTIVE TOXICANTS

UNIVERSITY OF HAWAII AT MANOA

REPRODUCTIVE TOXICANTS
CHEMICAL NAME and CAS NUMBER

Acetohydroxamic acid.....546883

Actinomycin D.....50760

All-trans retinoic acid.....302794

Alprazolamm.....8981977

Amikacin sulfate.....3983555

Aminoglutethimide.....125848

Aminoglyosides.....-----

Aminopterin.....54626

Angiotensin converting enzyme (ACE inhibitors).....-----

Anisindione.....117373

Aspirin.....50782

Barbiturates.....-----

Benomyl.....17804352

Benzphetamine hydorchloride.....5411223

Benzodiazepines.....-----

Bischloroethyl nitrosurea (BCNU) (carmustine).....154938

Bromoxynil.....1689845

Butabarbital sodium.....143817

1,4-Butanediol dimethylsulfonate (busulfan).....55981

Carbon disulfide.....75150

Carbon monoxide.....630080

Carboplatin.....41575944

Chenodiol.....474259

Chlorcyclizine hydrochloride.....1620219

Clorambucil.....305033

Chlordecone (kepone).....143500

Chlordiazepoxide.....58253

Chlordiazepoxide hydorchloride.....438415

1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU).....13010474

Clomiphene citrate.....50419

Chlorazepate dipotassium.....57109907

Cocaine.....50362

Colchicine.....64868

Conjugated estrogens.....-----

Cyanazine.....21715462

Cycloheximide.....66819

Cyclophosphamide (anhydrous).....50180

Cyclophosphamide (hydrated).....6055192

Cyhexatin.....13121705

Cytarabine.....147944

Danazol.....17230885

Daunorubicin hydrochloride.....23541506

Demeclocycline hydrochloride (internal use).....64733

Diazepam.....439145

Fluorouracil.....51218

Fluoxymesterone.....76437

Flurazepam hydorchloride.....1172185

Flutamide.....13311847

Halazepam.....23093173

Hexachlorobenzene.....118741

Ifosfamide.....3778732

Iodine-131.....24267569

Isotretinoin.....4759482

Lead.....-----

Lithium carbonate.....554132

Lithium citrate.....919164

Lorazapam.....846491

Lovastatin.....75330755

Medroxyprogesterone acetate.....71589

Megestrol acetate.....595335

Melphalan.....148823

Menotropins.....9002680

Meprobamate.....57534

Mercaptopurine.....6112761

Methacycline hydorchloride.....3963959

Methimazole.....60560

Methotrexate.....59052

Tethotrexate sodium.....15475566

Methyl bromide.....74839

Methyl mercury.....-----

Methyltestosterone.....58184

Midazolam hydrochlorid.....59467968

Minocycline hydrochloride (internal use).....13614987

Misoprostol.....62015398

Mitoxantrone hydrochloride.....70476823

Nafgarelin acetate.....86220420

Pipobroman.....54911

Plicamycin.....18378897

Polychlorinated biphenyls.....-----

Procarbazine hydrochloride.....366701

Propylthiouracil.....51525

Ribarvirin.....36791045

Secobarbital sodium.....309433

Streptomycin sulfate.....3810740

Tamoxifen citrate.....54965241

Temazepam.....846504

Testosterone cyoionate.....846504

Testosterone enanthate.....315377

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD).....1746016

Tetracycline (internal use).....-----

Thalidomide.....50351

Thioguanine.....154427

Tobacco smoke (primary).....-----

Tobramycin sulfate.....49842071

Toluene.....108883

Triazolam.....28911015

Trilostane.....13647353

Uracil mustard.....66751

Urofollitropin.....26995915

Valproate (valproic acid).....99661

FEMALE REPRODUCTIVE TOXICITY

Anabolic steroids.....-----

Carbon disulfide.....75150

Cocaine.....50362

Cyclophosphamide (anhydrous).....50180

Cyclophosphamide (hydrated).....6055192

Ethylene oxide.....75218

Lead.....-----

Tobacco smoke (primary).....-----

Uracil mustard.....66751

MALE REPRODUCTIVE TOXICITY

Benomyl.....17804352

Cardon disulfide.....75150

Colchicine.....64868

Cyclophosphamide (anyhdrous).....50180

Cyclophosphamide (hydrated).....6055192

1,2-Dibromo-3-chloropropane (DBCP).....96128

m-Dintrobenzene.....99650

o-Dintrobenzene.....528290

p-Dintrobenzene.....100254

Dinoseb.....88857

Ethylene glycol monoethyl ether.....110805

Ethylene glycol monomethyl ether.....109864

Lead.....-----

Nitrofurantoin.....67209

Tobacco smoke (primary).....-----

Uracil mustard.....66751

*CRC Handbook of Laboratory Safety, Keith A. Furr, 1995.

APPENDIX IX

GLOVE SELECTION GUIDE

GLOVE SELECTION GUIDANCE

Resistance to Chemicals of Common Glove Materials
(E=Excellent, G=Good, F=Fair, P=Poor)

Chemical	Natural Rubber	Neoprene	Nitrile	Vinyl	Chemical	Natural Rubber	Neoprene	Nitrile	Vinyl
Acetaldehyde	G	G	E	G	Formic Acid	G	E	E	E
Acetic Acid	E	E	E	E	Glycerol	G	G	E	E
Acetone	G	G	G	F	Hexane	P	E	-	P
Acrylonitrile	P	G	-	F	Hydrobromic acid (40%)	G	E	-	E
Ammonium Hydroxide	G	E	E	E	Hydrochloric acid (conc)	G	G	G	E
Aniline	F	G	E	G	Hydrofluoric acid (30%)	G	G	G	E
Benzaldehyde	F	F	E	G	Hydrogen Peroxide	G	G	G	E
Benzene	P	F	G	F	Iodine	G	G	-	G
Benzyl Chloride	F	P	G	P	Methylamine	G	G	E	E
Bromine	G	G	-	G	Methyl Cellosolve	F	E	-	P
Butane	P	E	-	P	Methyl Chloride	P	E	-	P
Calcium Hypochlorite	P	G	G	G	Methyl Ethyl Ketone	F	G	G	P
Carbon Disulfide	P	P	G	F	Methylene Chloride	F	F	G	F
Carbon Tetrachloride	P	F	G	F	Monoethanolamine	F	E	-	E
Chlorine	G	G	-	G	Morpholine	F	E	-	E
Chlorocetone	F	E	-	P	Naphthalene	G	G	E	G
Chloroform	P	F	G	P	Nitric Acid (conc)	P	P	P	G
Chromic Acid	P	F	F	E	Perchloric Acid	F	G	F	E
Cyclohexane	F	E	-	P	Phenol	G	E	-	E
Dibenzylether	F	G	-	P	Phosphoric Acid	G	E	-	E
Dibutyl Phthalate	F	G	-	P	Potassium Hydroxide (sat)	G	G	G	E
Diethanolamine	F	E	-	E	Propylene Dichloride	P	F	-	P
Diethyl Ether	F	G	E	P	Sodium Hydroxide	G	G	G	E
Dimethyl Sulfoxide	-	-	-	-	Sodium Hypochlorite	G	P	F	G
Ethyl Acetate	F	G	G	F	Sulfuric Acid (conc)	G	G	F	G
Ethylene Dichloride	P	F	G	P	Toluene	P	F	G	F
Ethylene Glycol	G	G	E	E	Trichloroethylene	P	F	G	F
Ethylene Trichloride	P	P	-	P	Tricresyl Phosphate	P	F	-	F
Fluorine	G	G	-	G	Triethanolamine	F	E	E	E
Formaldehyde	G	E	E	E	Trinitrotoluene	P	E	-	P

Aromatic and halogenated hydrocarbons will attack all types of natural and synthetic glove materials.

APPENDIX X

INVENTORY AND CHEMICAL STORAGE GUIDELINES

Chemical Inventory

Principal Investigator:________________________
Department:__________________________________
Laboratory room #s:___________________________
Updated/revised:______________________________

Chemical Name	Amount	Physical state	Location	Hazard Class

SUGGESTED SHELF STORAGE PATTERN - ORGANIC

Organic #2 Alcohols, Glycols, Amines, Amides, Imines, Imides (Store flammables in a dedicated cabinet.)		**Organic #8** Phenol, Cresols
Organic #3 Hydrocarbons, Esters, Aldehydes (Store flammables in a dedicated cabinet.)		**Organic #6** Peroxides, Azides, Hydroperoxides
Organic #4 Ethers, Ketones, Ketenes, Halogenated Hydrocarbons, Ethylene Oxide (Store flammables in a dedicated cabinet.)		**Organic #1** Acids, Anhydrides, Peracids (Store certain organic acids in acid cabinet.)
Organic #5 Epoxy Compounds, Isocyanates		**Organic #9** Dyes, Stains, Indicators (Store alcohol-based solutions in flammables cabinet.)
Organic #7 Sulfides, Polysulfides, etc.		**MISCELLANEOUS**

SUGGESTED SHELF STORAGE PATTERN - INORGANIC

Inorganic #10 Sulfur, Phosphorus, Arsenic, Phosphorus Pentoxide		**Inorganic #7** Arsenates, Cyanides, Cyanates (Store away from water)
Inorganic #2 Halides, Sulfates, Sulfites, Thiosulfates, Phosphates, Halogens, Acetates		**Inorganic #5** Sulfides, Selenides, Phosphides, Carbides, Nitrides
Inorganic #3 Amides, Nitrates (not Ammonium Nitrate), Nitrites, Azides (Store Ammonium nitrate away from all other substances-ISOLATE IT!)		**Inorganic #8** Borates, Chromates, Manganates, Permanganates
Inorganic #1 Metals & Hydrides (Store away from any water.) (Store flammable solids in flammables cabinet.		**Inorganic #9** Acids, except Nitric (Acids are best stored in dedicated cabinets.) **(**Store Nitric Acid away from other acids unless your acid cabinet provides a separate compartment for Nitric Acid.)
Inorganic #4 Hydroxides, Oxides, Silicates, Carbonates, Carbon		**Inorganic #6** Chlorates, Bromates, Iodates, Chlorites, Hypochlorites, Perchlorates, Perchloric Acid, Peroxides, Hydrogen Peroxide

COMMON LABORATORY CORROSIVES

ORGANIC ACIDS	**ORGANIC BASES**
Acetic Acid (Glacial)	Ethylenediamine
Acetic Anhydride	Ethylimine
Acetyl Bromide	Hexamethylenediamine
Acetyl Chloride	Hydroxylamine
Benzoyl Bromide	Phenylhydrazine
Benzoyl Chloride	Piperazine
Benzyl Bromide	Tetramethylammonium Hydroxide
Benzyl Chloride	Tetramethylethylenediamine
Butyric Acid	Triethylamine
Chloroacetic Acid	Trimethylamine (aqueous solution)
Chloroacetyl Chloride	
Chlorotrimethylsilane	**INORGANIC BASES**
Dichlorodimethylsilane	Ammonium Hydroxide
Dimethyl Sulfate	Ammonium Sulfide
Formic Acid	Calcium Hydride
Methyl Chloroformate	Calcium Hydroxide
Oxalic Acid	Calcium Oxide
Phenol	Hydrazine
Propionic Acid	Potassium Hydroxide
Propionyl Bromide	Sodium Hydride
Propionyl Chloride	Sodium Hydroxide
Salicylic Acid	
Trichloroacetic Acid	**OTHERS**
	Aluminum Trichloride
INORGANIC ACIDS	Ammonium Bifluoride
Bromine Pentafluoride	Antimony Trichloride
Chlorosulfonic Acid	Bromine (liquid)
Hydriodic Acid	Calcium Fluoride
Hydrobromic Acid	Chlorine (gas)
Hydrochloric Acid	Ferric Chloride
Hydrofluoric Acid	Fluorine (gas)
Nitric Acid	Iodine
Perchloric Acid	Phosphorus
Phosphoric Acid	Sodium Bisulfate
Phosphorus Pentachloride	Sodium Fluoride
Phosphorus Pentoxide	
Phosphorus Tribromide	
Phosphorus Trichloride	
Sulfuric Acid	
Sulfuryl Chloride	
Thionyl Chloride	
Tin Chloride	
Titanium Tetrachloride	

COMMON LABORATORY OXIDIZERS

Oxidizers react with other chemicals by giving off electrons and undergoing reduction. Uncontrolled reactions of oxidizers may result in a fire or an explosion, causing severe property damage or personal injury. Use oxidizers with extreme care and caution and follow all safe handling guidelines specified in the MSDS.

Bleach
Bromates
Bromine
Butadiene
Chlorates
Chloric Acid
Chlorine
Chlorite
Chromates
Chromic Acid
Dichromates
Fluorine
Haloate
Halogens
Hydrogen Peroxide
Hypochlorites
Iodates
Mineral Acid
Nitrates
Nitric Acid
Nitrites
Nitrites
Nitrous oxide
Ozanates
Oxides
Oxygen
Oxygen Difluoride
Ozone
Peracetic Acid
Perhaloate
Perborates
Percarbonates
Perchlorates
Perchloric Acid
Permanganates
Peroxides
Persulfate
Sodium Borate Perhydrate
Sulfuric Acid

APPENDIX XI

CLOSEOUT PROCEDURES AND CHECKLIST

CLOSE-OUT PROCEDURES FOR DEPARTING/RETIRING FACULTY AND STAFF

Proper disposal of all hazardous materials used in the workplace is the responsibility of the chemical user or supervisor/Principal Investigator (PI) to whom a chemical use room/laboratory is assigned. Enforcement of this policy is the responsibility of the supervisor/PI. Proper disposition of hazardous materials is required whenever a chemical user leaves the University or transfers to a different laboratory/chemical use room. This process should be started at least a month before departure from the chemical use room/laboratory to allow ample time to properly dispose all materials. Hazardous waste pickup should be completed before the chemical use room/laboratory is vacated. The disposal must be in compliance with the University's Hazardous Materials Management Plan. The following checklist should be completed prior to the chemical user's departure. Once completed, the checklist should be signed and submitted to the user's Dean or Director and to the Environmental Health and Safety Office (EHSO).

If periodic inspections by the EHSO reveal that proper close-out procedures have not been followed, the EHSO will oversee correction/remediation of any problems created by failure to follow those procedures, and the cost of correcting those problems will be charged to the budget of the level V unit within which the problems were identified by the EHSO.

Prepared by: Environmental Health and Safety Office
Date: March 18, 2011

UNIVERSITY OF HAWAIʻI AT MĀNOA
M2.400 LABORATORY DECOMMISSIONING POLICY

I. POLICY STATEMENT:

Prior to laboratories being vacated, all equipment, furniture, chemicals, radioactive and biological materials must be properly transferred, removed, or disposed.

II. PURPOSE:

This policy is to prevent and minimize risk to the campus community, including cleaning and maintenance staff, contractors, and new occupants who may enter vacated laboratories containing abandoned hazardous material.

III. APPLICABILITY/SCOPE:

This policy applies to all laboratories and auxiliary spaces serving laboratories and provides for the removal of potentially hazardous material from these spaces when the user is planning to vacate the space. This includes terminating affiliation with the University, relocating to another laboratory space, major laboratory renovation requiring relocation of hazardous materials, and retirement from research activities. This policy applies to all Mānoa units regardless of location on or off campus.

This policy does not apply to facilities such as computer labs and music labs.

IV. DEFINITIONS:

A. Decommissioning – the formal deactivation of a laboratory.
B. Laboratory – a facility where quantities of hazardous chemicals, biological, and radiological materials are used in a non-production basis, including research labs, student teaching labs, and clinical labs.
C. Principal Investigator (PI) – faculty, staff, or researcher responsible for supervising activities within a laboratory.

V. RESPONSIBILITIES:

A. Deans/Directors are responsible for ensuring that departments and units are aware of and follow the procedures contained in this policy.
B. Department Chairs/Unit Heads are responsible for the following:
    1. Verify that PIs in their department/unit have notified the appropriate campus units, such as Radiation Safety and Facilities Management, when vacating or relocating a laboratory.

2. Inform EHSO's various departments of new laboratory assignments.
3. Accountable for costs, deficiencies, or regulatory actions or fines resulting from improper management or disposal of regulated materials from laboratories that have not been properly decommissioned.

C. Principal Investigators (PIs) are responsible for the following:
1. Ensure enough lead time (at least one month) is given for proper management of materials. Required disposal time will vary depending on amount and type of materials involved.
2. Notify the appropriate departments (i.e., Radiation Safety, Hazardous Materials Management, Laboratory Safety, and Biosafety) when vacating or relocating a laboratory.
3. Complete the Laboratory Decommissioning Checklist (Attachment 1) and submit to the Environmental Health and Safety Office (EHSO) Laboratory Safety Program.
4. Take specific measures to transfer or dispose of hazardous, radioactive, and/or biological materials before vacating or relocating.
5. Ensure all equipment, such as fume hoods, biological safety cabinets, flammable or corrosive storage cabinets, freezers, incubators, scintillation counters, autoclaves, and centrifuges are emptied and decontaminated.
6. All research specific apparatus shall be dismantled, packaged, and removed.
7. All compressed gas cylinders shall be removed prior to closing of the laboratory.
8. All papers, books, rags, empty containers, boxes, bottles, glassware, plastic ware, etc., shall be properly disposed of prior to vacating the laboratory.
9. If a vacated laboratory does not undergo decommissioning and becomes occupied by a new PI, all materials found within the laboratory become the responsibility of the new PI.

VI. **PROCEDURES:** Refer to section **V. RESPONSIBILITIES** above.

VII. **REFERENCES:**
A. Laboratory Decommissioning Checklist – Attachment 1
B. General Waste Disposal Procedures (Equipment, Furniture, etc.) – Attachment 2
C. Hazardous Materials Disposal/Laboratory Close-out Procedures - Attachment 3
D. Biosafety Laboratories Close-Out Guidance Document- Attachment 4
E. Radioisotope Laboratories Close-out Procedures - Attachment 5

VIII. **HISTORY:** Guidelines and procedures on hazardous waste handling have been in existence as listed above in REFERENCES (see B, C, D, and E). However, an official policy is warranted to ensure the health and safety of the campus community.

Attachment 1

University of Hawai‘i at Mānoa
Laboratory Decommissioning Checklist

Principal Investigator:	Department:
Department Head/Chair:	Building:
Room Number:	Laboratory Closeout Date:

The purpose of this checklist is to assist Principal Investigators in safely removing hazardous materials from a laboratory and confirming that the area is free from contamination.

Chemicals	**Yes**	**No**	**N/A**
Refrigerators, areas under sinks, fume hoods, cabinets and shelves, and bench tops have been checked for storage of hazardous materials (including shared spaces).			
All chemical containers have been labeled and ready for disposal, transfer, or recycling in accordance with the University of Hawai‘i Hazardous Materials Management & Disposal Guidelines.			
Refrigerators have been emptied, defrosted, and cleaned.			
Storage areas have been cleaned: chemical residues, drips, and spills are appropriately decontaminated and cleaned up.			
All bench tops have had disposable liners/covers removed from the work surface and surfaces have been cleaned.			
All keys to lockable chemical storage cabinets have been returned to the department.			
Controlled Substances	**Yes**	**No**	**N/A**
All storage areas are free of controlled substances.			
All controlled substances have been disposed of or transferred according to U.S. Drug Enforcement Agency regulations and requirements.			

Compressed Gas Cylinders	**Yes**	**No**	**N/A**
Cylinders have been properly labeled and secured.			
Cylinders not in use have been disconnected and capped**.**			
Arrangements have been made for returning empty cylinders to vendors.			
All cylinders have been labeled and ready for disposal, transfer, or recycling in accordance with the University of Hawaii Hazardous Materials Management and Disposal Guidelines.			
Radioactive Materials	**Yes**	**No**	**N/A**
Radioactive waste materials have been handled in accordance with the University of Hawaii Radioactive Waste Disposal Procedures.			
The removal of radioactive materials and termination surveys has been coordinated with the Radiation Safety Officer in accordance with the guidelines in the University of Hawaii Radiation Safety Manual.			
Biological Materials	**Yes**	**No**	**N/A**
All work surfaces and storage areas, including walk-in coolers, freezers, refrigerators and incubators, have been decontaminated.			
All inside working surfaces of the biological safety cabinets have been decontaminated.			
Certification of the biological safety cabinet is current.			
Arrangements have been made for the decontamination and replacement of the HEPA filter in the biological safety cabinet, if required.			
All sharps have been properly disinfected and placed in puncture resistant containers for disposal.			
All biological waste has been autoclaved and properly disposed of.			
Are there biological materials that need to be transferred to another location? If yes, contact Environmental Health and Safety Office for transport information.			
Has the Responsible Official (Research Office) been contacted to advise that experiments using a Select Agents and/or Toxins will be terminated and the Select Agents and/or Toxins will be destroyed?			
Equipment	**Yes**	**No**	**N/A**
All equipment has been disinfected and decontaminated.			
Is any equipment going to be transferred to surplus? If yes, then equipment must be inspected by EHSO prior to transfer to surplus.			
Is any equipment connected to permanent building systems being removed for transfer with the exiting investigator? If yes, contact Facilities Management.			
Has all broken glass been placed in a rigid, puncture resistant container and sealed in preparation for disposal by Buildings and Grounds Services?			

Records	**Yes**	**No**	**N/A**
Has a copy of the last current lab/chemical inventory been provided to the department head?			

I have, to the best of my knowledge, complied with the requirements of the University of Hawai‘i at Mānoa Laboratory Decommissioning Checklist and am not aware of any other items or special circumstances that are not listed on this form.

Principal Investigator: _____ Date:_____

Department Chair: _____ Date:_____

Final Inspection Sign-Off

Laboratory Safety Officer: _____ Date:_____

Biological Safety Officer: _____ Date:_____

Radiation Safety Officer: _____ Date:_____

Attachment 2

Waste Disposal Procedures for the University of Hawaii at Manoa

This guide was developed to assist campus departments in disposing of waste materials generated by official University operations. These procedures do not apply to the disposal of personal or household wastes. Personal property should not be brought on campus for disposal since the University must pay for all wastes that are disposed of. The University is subject to very strict regulations regarding the disposal of almost anything. The U.S. Environmental Protection Agency, State of Hawaii Department o f Health, City and County of Honolulu, and private landfills all have their own rules and regulations that apply to various types of waste material and these rules change frequently. As an example, the City and County has banned all ferrous metals, glass , and appliances from its landfills and H-Power plant. In addition, cardboard and green waste is limited to ten percent (10%) of each load. Potential penalties include fines, rejection of entire loads and denial of access to the disposal facilities. Al l the trash from the campus' building dumpsters is taken to the H-Power plant, therefore each department must assist in assuring that wastes are properly segregated and disposed of appropriately.

The University has its own garbage truck and refuse crew. Contents from refuse dumpsters are loaded into the garbage truck and the loads are compacted (crushed) inside the truck. This is why the following materials ***should not*** be placed in the refuse dumpsters:

1. **Lumber / Metal** - even a short piece can cause the compactor blade in the truck to jam.
2. **Wet / Liquid wastes** - containers containing liquids are often broken during the compacting process and leak out of the truck or splash onto our refuse workers.
3. **Unpackaged glass** - the glass may shatter during compaction posing a hazard to our refuse crew.
4. **Powdery material** - such as sawdust, ash, etc. should be double bagged to prevent release in truck during compaction.
5. **Regulated Waste (hazardous, biological, radioactive)** - it is illegal to dispose of regulated waste in the municipal waste stream.

For more detailed waste disposal procedures, please refer to the specific **Waste Categories**.

Environmental Compliance | EHSO Main Page

Last Updated 21 August 2001

WASTE CATEGORIES

ANIMAL CARCASSES

Non-laboratory carcass	Call Building and Grounds Management (x6-8686) for disposal.
Chemically Preserved Animal Carcasses and Tissues (Vertebrate and Invertebrate)	1. Tissues, body parts and carcasses must be separated from any liquids. Liquid preservatives (i.e. Formalin) should be screened to eliminate all solid material and may be regulated as a hazardous waste, please contact the Hazardous Materials Management Program (HMMP) at x63198 for proper disposal procedure for these liquids. 2. Preserved tissues must first be thoroughly rinsed and dried prior to wrapping. Wrap tissues/carcasses in newspaper or other absorbent material. 3. Wrapped tissues (10 lbs. or less) should be double bagged and sealed in plastic. No free liquid should be present in the bags. Larger quantities (more than 10 lbs.) will necessitate different procedures. Please call Buildings and Grounds Management Office for evaluation and recommendations on your particular situation. 4. Identify bags with: P.I. name, location (department), and emergency

	phone number, weight and a label indicating contents. 5. Contact the University's Buildings and Grounds Management Office for drop off procedures and locations.
Unpreserved Animal Carcasses and Tissues (Vertebrate and Invertebrate)	1. Tissues, body parts and carcasses must be separated from any liquids. Liquid should be screened to eliminate all solid material. Unpreserved liquids can be discarded down the drain. 2. Wrap tissues/carcasses in newspaper or other absorbent material. 3. Wrapped tissues (10 lbs. or less) should be double bagged and sealed in plastic. No free liquid should be present in the bags. Larger quantities (more than 10 lbs.) will necessitate different procedures. Please call Buildings and Grounds Management Office for evaluation and recommendations on your particular situation. 4. Identify bags with: P.I. name, location (department), and emergency phone number, weight and a label indicating contents. 5. Contact the University's Biological Safety Program (x63197) for specifics on procedures and drop off locations or contact the University's Laboratory Animal Service (x68770) (there may be a fee for the disposal for Non-LAS users).

BATTERIES

Household type (alkaline or carbon-zinc)	Dispose in regular trash
Lead-Acid Nickel-Cadmium (Ni-Cad) Lithium containing Mercury containing	Submit to EHSO for disposal (See *HMMP*) *(NOTE: Batteries must be removed from equipment prior to submission to EHSO)*

BIOLOGICAL WASTES

See *Biohazardous Waste Disposal Guidelines*

CARDBOARD

Flatten boxes, bundle (tie) together and place near *paper recycling bin.*

CHEMICALS

Before disposing as waste, offer your unused chemicals to other UH staff who may be able to use it through the UH Electronic Swap Meet (http://www.hawaii.edu/swap meet/). For disposal instructions, refer to the *Hazardous Materials Management Program (HMMP).*

OFFICE EQUIPMENT & FURNITURE (including COMPUTERS)

Offer your excess furniture and office equipment to other UH staff who may be able to use it through the UH Electronic Swap Meet (http://www.hawaii.edu/swapmeet/) or call the FPMO Surplus Warehouse (6-8887) to see if it can be reused. If not, submit proper forms to take equipment off of your inventory. Submit a work request to FPMO (6-7134) for pick-up of the equipment and attach a copy of the approved disposal form to the work request form.

COMPUTERS: See also the ITS Disposal Guidelines for Obsolete Computer Equipment.

SCIENTIFIC EQUIPMENT

Remove and properly dispose of any potentially hazardous components (radiation sources, PCB containing transformers, lead-acid/Ni-Cad batteries, etc.). Contact EHSO with any questions regarding the hazardous components. Submit a work request to FPMO (6-7134) for pick-up of the equipment. If the item is on UH inventory, attach the approved disposal form to the work request.

FREON CONTAINING EQUIPMENT (Refrigerators, Air-conditioners, etc.)

Submit forms to take equipment off your inventory (if necessary). Contact a properly trained and certified vendor (e.g., Refrigerant Recycling Inc.) directly for disposal. Freon containing equipment must be disposed of by a company licensed to handle this type of material.

GAS CYLINDERS

Cylinders should be returned to vendor. See *HMMP*.

GLASS

See *Glass Recycling*. Departments requiring assistance in transporting large quantities of glass items may submit a work request form to FPMO (6-7134).

GREEN WASTE

Bag, label as "GREEN WASTE" and place next to refuse dumpster.

LIGHT BULBS

Regular incandescent bulbs	Dispose of in regular trash. Package to prevent glass hazard.
Fluorescent bulbs (black end caps)	Various campus units collect and recycle older type bulbs. See *fluorescent bulb disposal procedure*.
Fluorescent bulbs (green end caps)	Dispose of in regular trash. Package to prevent broken glass hazard.

METALS

Call Landscaping (67922) for special pick-up.

OIL

Call EHSO for special instructions (*HMMP*).

PAINTS

Latex (or Water-Based)

Latex (or water-based) paint is typically a non-regulated substance. However, some latex paints are regulated if they contain EPA-listed metals, such as arsenic, barium, cadmium, chromium, lead, mercury, selenium, or silver.

Reading the label is the easiest way to determine whether or not a latex paint contains any of the above metals, and is therefore a regulated substance. If the label is missing or unreadable, the paint should be considered regulated.

Regulated paints may still be used for their intended purposes. Just ensure required paints are properly stored for future use; and, unwanted ones are turned into EHSO for proper disposal. Never place regulated paints in the trash!

Non-regulated paints may be disposed of in the regular trash; but, only after they are completely dried (never place liquid paint into the trash). Apply the following guidelines prior to trash disposal:

- Containers with small paint quantities (approximately less than one inch) can be placed without their lids, in a well-ventilated, covered area until dry.
- Containers with large quantities (approximately more than one inch) can be absorbed on to materials such as: clay-based kitty litter, saw dust, or shredded paper.

Recycle empty/dry, non-regulated metal paint containers by submitting a

work request for a scrap metal pickup.

Oil-based — Oil-based paints are regulated substances. Submit to EHSO for disposal (see *HMMP*). Never place oil-based paints in the trash!

PAINTING EQUIPMENT

Includes any item used in painting activities, such as: paint brushes, rollers, roller pans, rags, paper, buckets, scrapers, paint stirrers, and drop cloths (plastic or canvas).

Disposal of these items depends on the type of paint used (refer to "Paints" section above).

- Regulated (e.g., oil-based or latex with EPA-listed metals): Turn all equipment into EHSO for disposal. Do not place items in trash!
- Non-Regulated (e.g., latex with no EPA-listed metals): Let equipment completely dry before placing in trash.

PAPER

See *Paper Recycling*

RADIOACTIVE WASTES

See *Procedures for Isotope Shipments and Waste Disposal*

SOIL (UNCONTAMINATED)

Bag, label as "Soil" and place next to refuse dumpster. Call Landscaping (67922) for pick-up of large quantities. For contaminated soil, call EHSO for special instructions.

THERMOMETERS (MERCURY)

Submit to EHSO for disposal. See *HMMP*.

WOOD / LUMBER

Call Landscaping for special pick-up. DO NOT PUT LARGE PIECES IN DUMPSTER! May cause damage to refuse truck.

Sawdust should be double bagged, tied, and put into dumpster.

Environmental Compliance | EHSO Main Page

Last Updated 05 October 2010

CLOSE-OUT PROCEDURES FOR DEPARTING/RETIRING FACULTY AND STAFF

Proper disposition of all hazardous materials used in the workplace is the responsibility of the chemical user or supervisor/Principal Investigator (PI) to whom a chemical use room/laboratory is assigned. Enforcement of this policy is the responsibility of the supervisor/PI. Proper disposition of hazardous materials is required whenever a chemical user leaves the University or transfers to a different laboratory/chemical use room. This process should be started at least a month before departure from the chemical use room/laboratory to allow ample time to properly dispose all materials. Hazardous waste pickup should be completed before the chemical use room/laboratory is vacated. The disposal must be in compliance with the University's Hazardous Materials Management Plan. The following checklist should be completed prior to the chemical user's departure. Once completed, the checklist should be signed and submitted to the user's Dean or Director and to the Environmental Health and Safety Office (EHSO).

If periodic inspections by the EHSO reveal that proper close-out procedures have not been followed, the EHSO will oversee correction/remediation of any problems created by failure to follow those procedures, and the cost of correcting those problems will be charged to the budget of the level V unit within which the problems were identified by the EHSO.

CHEMICAL USER CLOSE-OUT CHECKLIST

DATE:_____ SUPV/PI:_____
BLDG:_____ DEPT:_____
ROOM(S):_____

REQUIREMENT	YES	NO	COMMENTS
1. Have shared storage units such as refrigerators, freezers, cold rooms, stock rooms, etc. been properly surveyed in order to locate and appropriately dispose/designate remaining chemicals?			
2. Are all chemical containers labeled and/or listed in a logbook or inventory with the name and hazard?			
3. Are all containers securely closed and in good condition?			
4. Have beakers, flasks, vials, evaporating dishes, etc. been emptied and the contents properly disposed? Remember to check refrigerators, freezers, cold rooms, fume hoods, biological safety cabinets, bench tops, storage cabinets, stock rooms, etc.			
5. Have you determined which chemicals and compressed gas cylinders are usable and transferred responsibility for those materials to another party who is willing to take charge of them? If a new user cannot be found, the materials must be disposed.			
6. Were controlled substances disposed of as specified by the Drug Enforcement Agency (DEA) permit under which they were held? Abandonment of a controlled substance is a violation of the DEA requirements.			
7. Was permission received from the DEA to transfer ownership of a controlled substance to another individual?			
8. Were non-transferable compressed gas cylinder connections removed, cylinder caps replaced, and cylinders returned to suppliers? If cylinders are non-returnable, contact the Hazardous Material Management Program at x63198.			
9. Has all laboratory equipment been cleaned or decontaminated? Were fume hood surfaces and bench tops washed?			

10. If laboratory equipment will be discarded, have the following items been removed prior to disposal: capacitors? transformers? mercury switches and thermometers? refrigerant fluids containing chlorofluorocarbons? radioactive sources and chemicals? Contact the Environmental Health and Safety office (EHSO) for assistance.	___ ___ ___ ___ ___	___ ___ ___ ___ ___	
11. Were chemicals targeted for hazardous waste disposal prepared by following procedures in the Hazardous Materials Management Program?			
12. Did you leave a copy of your lab notebook in the lab? Its care has been transferred to _____.			
13. Have you submitted the completed checklist to your Dean or Director and the EHSO? **EHSO Fax:** 63205 **Email:** labsafe@hawaii.edu			

NOTE: If any radioactive material or biological commodities were used in the lab, please contact the Radiation Safety Officer (66475) and/or the Biological Safety Officer (63197) at the EHSO.

REQUIRED SIGNATURES:

_____	_____	_____
Chemical User	Supervisor/PI	Department Head*

*By signing this checklist, you as Department Head are declaring that items 1 through 13 have been addressed. No signature would mean that the lab has not been closed-out properly. Therefore, the transfer of lab equipment to departing staff will be delayed.

Guidance Document: Biosafety Facilities Close-Out

A. Documentation (Close-Out/Moving)

1. Provide a complete inventory of all biological commodities.
2. Submit inventory with a completed and signed BSP-2 form.
3. Attached copies personal acquired federal and state permits and authorizations. (All federal and state agencies must be notified prior to move).
4. Follow close-out procedures.
5. May require current Biological Shipping and Receiving training.

Assess all biological materials (recombinant DNA materials, microorganisms, cells and cell lines, tissues, organs, body fluids, and biologically-derived or -contaminated media) and determine which materials will be moved to your new laboratory, transferred to another investigator or disposed.

Dispose of the remaining materials as you would have during the course of experimentation. For example, solid materials (including Petri dishes and microfuge tubes) should be autoclaved and disposed as biological contaminated waste.

B. Moving Biological Commodities from Lab

Many laboratory materials, including biological commodities are regulated. Regulated biological commodities include all microorganisms: bacteria, fungi, virus, animals (vertebrate and invertebrate), plants plant parts and seeds, human tissue, blood or body fluids, biological derived toxins and drugs, etc. Federal permits from USDA, CDC, DEA EPA, Commerce, Customs and DOT, as well as, State HDOA and HDOH permits may be required prior to transport, transfer or destruction.

1. Cultures and Stocks of microorganisms

Microorganisms are subject to the requirements of the U.S. DOT when being moved or shipped (Risk Group 2 or greater). HDOA must be notified if the microorganisms have an import or possession permit. Federal agencies may require notification.

2. Human and Animal Materials (Blood, body fluids, cell line, organs)

We strongly encourage all laboratories working with human or animal materials (blood, sera, cell, tissue) to plan for the movement of these materials, whether at ambient temperatures or frozen. This will allow

appropriate time to clean incubators and other equipment, and go through the other requisite steps for the move.

3. Preserved Tissue and Specimens

Any tissue or biological specimen preserved in formaldehyde, mercuric chloride, 70% ethanol, glutaraldehyde, DMSO, or other preservatives should be included in your chemical inventory, using the preservative name and volume. These containers MUST be shipped as hazardous materials. All containers MUST be PROPERLY SEALED (so they cannot leak) and labeled with the full chemical name to be lab-packed and moved. Check directly with EHSO Hazardous Materials Management Program, if disposing.

3. Biological Contaminated Wastes

Decontaminate **all** wastes. Biological waste must not be transported. All sharps containers in use, whether or not they are full, must be disposed of as biological waste prior to the move. See biological wastes procedures.

4. Select Agents and Toxins

Any Select Agents or toxins must not be moved by any outside contractors. All necessary federal requirements must be adhered with including notification to USDA and proper forms completed. Call for OVCRGE Compliance for further information.

5. Biological Derived Toxins and Drugs

If they are controlled under Federal/State Drug Enforcement Agencies, prior to movement or disposal they must be notified.

Disposal of biological toxins and drugs must be through an approved disposal method either autoclaving or neutralization.

6. Animals

The transport of any live vertebrate animals used in teaching or research must be approved by and coordinated through the Laboratory Animal Services (LAS) and IACUC

Invertebrates under permits from the NFWS or DLNR must be notified.

C. Moving Equipment

All equipment, apparatus, and fixed structure must be cleaned and decontaminated as necessary. Once decontamination is done, any work that can re-contaminate the premises must be prohibited.

Decontaminate all surfaces (interior and exterior), first with soapy water and then secondly with an appropriate working dilution of an appropriate disinfectant. Remember: Contact time of at least 10-15 minutes. Rinse with fresh water as some disinfectants are corrosive.

Tag equipment, instruments, apparatus as cleaned and decontaminated (see attached "Equipment Owner Declaration tag). Tag must be secured to the face of the equipment. Remove any universal biohazard symbol.

1. **Equipment Needing Repair**: Contact the service company to determine if they require written verification of decontamination before they will service equipment. Certifying that equipment has been properly decontaminated is the responsibility of the lab. Consult the equipment manual for cleaning/decontamination procedures, policies, and chemical compatibility. If it is not possible to decontaminate the equipment, it must be properly packaged to prevent exposure and labeled to inform non-laboratory staff of the potential hazards present. When a service person (University or outside contractor) needs to work on equipment in the laboratory:

    - Prepare a working area which is clean and free of hazards,
    - Clear enough space for easy access around the equipment,
    - Remove any hazardous items stored near, on, or under the equipment,
    - Inform the individual of potential hazards in the laboratory (training),
    - Provide personal protective equipment if necessary.

2. **Centrifuge**: clean and decontaminate chamber, cups, and rotors or other parts as instructed by manufacturer (consult manual)

3. **Water baths, bio-fermenters, aquariums, reactors, and incubators**. Flush out all drains. Water jackets must be drained and emptied. Prior to water disposal, the water should be decontaminated before disposal down the sanitary drain.

4. **Biosafety Cabinets** All biological safety cabinets require a Biological Safety Program evaluation to determine required decontamination, even if they are not moved. If being moved, the equipment must be certified again after the move to ensure filter integrity. Make arrangements for this work in advance to allow contractors to meet your schedule.

All interior and exterior surfaces must be disinfected prior to moving them. This including under the work bench/grille and top of the BSC.

5. **Refrigerators**: Empty all refrigerators; clean and decontaminate inside and outside surfaces. Drain drip pans. Vacuum motor and grills.

6. **Freezers** containing biological commodities may be moved without emptying them if no infectious substances. If moving, complete inventory must be attached to the outside of the freezer. .

   Laboratory personnel are responsible for preparing freezers for the move, ensuring that all loose vials and containers are properly packaged using unbreakable containers (plastic, metal, or cardboard).

   All spaces within the freezer must be filled with packing material to prevent the contents from shifting during transit.

   Once the freezer is prepared to move, decontaminate the exterior of the freezer. Secure and lock down. The movers will secure the freezer lid with plastic straps before moving the freezer.

   If freezer will be defrosted prior to move, water must be sterilized prior to draining.

   Liquid nitrogen freezers, cryostats, Dewar flasks, etc. Call vendor for proper instructions.

E. Decommissioning a Lab

All horizontal surfaces, including bench tops, floors, shelves, fire extinguishers, waste cans, electrical conduits, etc. should have been cleaned and decontaminated with appropriate disinfectant with appropriate contact time.

Sanitary drains must be flushed with bleach.

All universal biohazard symbols should be removed (entry doorway, wastes trash cans, bench tops).

F. New Location

No manipulation without proper federal, state and UH authorization. A new floor plan should have been submitted to Biosafety Program. When the materials arrive at the new locations, lab personnel will need to check contents for breakage/damage. Open all parcel in a biosafety cabinet. All biosafety cabinets must be certified prior to use.

G. Post-Close-out/Move

If inspections by the BSP reveal that proper close-out procedures have not been followed. BSO will oversee correction/remediation of any problems created by failure to follow those procedures, and the cost of correcting those problems will be charged to the budget of the Level V unit within which the problems were identified by the BSP.

H. Equipment Owner Declaration Tag (Example)

Tag equipment, instruments, and apparatus as cleaned and decontaminated. Tags should be printed on light Green paper and secured to the face of the equipment being moved or relocated. Printable "Equipment Owners Declaration tags" in a PDF format (2 tags/page, form fillable).

Attachment 5

CLOSEOUT PROCEDURES FOR RADIOISOTOPE LABORATORIES

MOVING TO ANOTHER LABORATORY

1. Submit an Amendment Application to Authorization Form, RSP-3a, to add new laboratory location to your current authorization.

    a. Include floor plan of new lab space with areas marked for restricted area. Show where radioisotopes and radioactive waste will be stored on the floorplan.

    b. Show which sink will be the hot sink, if any.

2. Once new lab space is approved by the Radiation Safety Committee, do the following:

    a. Dispose of any radioactive waste by calling RSP for a waste pickup.

    b. if you need to move any radioisotopes to the new lab, call RSP to make arrangements to move your material.

    c. Clear out all big equipment not being kept at old lab. Clear all lab benches of materials, supplies, chemicals, etc.

        1) Move refrigerators, freezers, LSCs, gamma counters, and glassware from lab benches.

        2) Do a wipe test survey to ensure no contamination is left. Mark any fixed contamination that is present.

3. Call RSP to perform a final close out survey. If any contamination is found, you will have to decontaminate it and have RSP resurvey the area.

4. If you fail to clean up contaminated areas found, RSP will charge your department for its time used in cleaning up the laboratory.

LEAVING THE UNIVERSITY OR STOPPING RADIOISOTOPE USE

1. Submit a memorandum to the RSO stating that you will close out your authorization.

2. Arrange to have radioisotopes transferred to another PI or university, or dispose of your radioisotopes and arrange for a waste pick up. The RSP will assist you with the paperwork to transfer your radioisotopes to another university.

3. Clean your lab equipment of any contamination and transfer equipment to another PI or have them disposed. Notify RSP if giving fixed equipment to another PI.

4. Clear lab benches as much as possible of all lab supplies which were used with radioisotopes.

5. Call RSP for a close out survey or decommissioning survey. If any contamination is found, you must decontaminate the areas and have RSP resurvey your lab. If you do not decontaminate the area, RSP will charge your department for the time spent in the cleanup.

APPENDIX XII

WORKPLACE SAFETY COMMITTEE
INSPECTION AND ENFORCEMENT PROCEDURES

WORKPLACE SAFETY COMMITTEE

INSPECTION AND ENFORCEMENT PROCEDURES

In order to ensure that University facilities are operating in as safe a manner as possible, the University's Environmental Health and Safety Office (EHSO) under the auspices of the Workplace Safety Committee (WSC) will conduct periodic inspections of work sites. The procedures that will be followed are described below and on the attached flowchart.

Initially, the supervisor in charge of the work area will be given prior notice that an inspection will be conducted. On the appointed day, a member of the EHSO will conduct an inspection of the facility. The supervisor is strongly encouraged to accompany the EHSO representative. A report will be issued to the PI and/or the supervisor. If deficiencies were observed during the inspection, the report will list a response date by which the supervisor must reply to the EHSO indicating when and how all the deficiencies will be corrected.

Once the response from the supervisor has been received and reviewed by the EHSO, a compliance date will be established. If the supervisor does not respond to the report, the EHSO will establish the compliance date. In either case, the supervisor will be informed about the compliance date. Once the compliance date has been reached, the EHSO will conduct a follow-up inspection to ensure the deficiencies have been corrected. If all the deficiencies have been corrected, then no further action will be taken and the PI and/or supervisor will be informed. If only minor deficiencies (as defined by the EHSO) remain after the follow-up inspection, then the EHSO and the supervisor will establish a new compliance date.

If major deficiencies (as defined by the EHSO) remain, a second report will be generated and sent to the original report's recipients and the President's office. A meeting will be scheduled between the supervisor, the EHSO and a member of the WSC. The participants at this meeting will discuss how the deficiencies can be corrected. A new compliance date will be scheduled at this meeting.

The EHSO will conduct the second follow-up inspection on the new compliance date. If all deficiencies are corrected, then no further action will occur and the supervisor, Department Chairperson, the Dean/Director and the President's office will be informed. However, if any deficiencies still remain, then the WSC will formally send the matter to the appropriate Dean/Director for further action. The Dean/Director may take appropriate action including disciplinary action in accordance with applicable collective bargaining agreements. The Dean/Director will inform the WSC of all activities taken to correct the situation in a timely manner.

APPENDIX XIII

LABORATORY PERSONNEL SAFETY CHECKLIST

Laboratory Personnel Safety Check List

Employee/Student Name_____ Date _____

Department_____ Bldg._____ Rm.# _____

Principal Investigator _____ OR
Print

Lab Supervisor_____
Print

The following procedures have been reviewed with this employee/student.

1. _____ Has the PI/Lab Supervisor discussed the nature of the research being conducted in the laboratory?

2. _____ Has the PI/Lab Supervisor discussed all hazardous components of the research?

   a._____ chemical
   b._____ biological
   c._____ physical
   d._____ radioactive

3. _____ Has the employee/student received instruction on known symptoms associated with exposure to highly toxic chemicals or biological commodities used in the laboratory?

4. _____ Has the PI/Lab Supervisor discussed the need for the employee/student to inform health care providers of the hazardous substances (chemical, biological, radioactive) used in the laboratory during each medical visit?

5. _____ Has the PI/Lab Supervisor reviewed the laboratory Chemical Hygiene Plan and all Standard Operating Procedures with the employee/student?

6. _____ Has the PI/Lab Supervisor identified the location of Material Safety Data Sheets to the employee/student and demonstrated methods of access? (e.g., EHSO website, hardcopy, etc.).

7. _____ Has hazard assessment information concerning Personal Protective Equipment required in laboratory been reviewed, and has the supervisor and employee signed off?

8. _____ Does the employee/student need a respirator? If yes, arrange for exposure evaluation, training and fit testing through the Environmental Health & Safety Office at x6-3204.

9. _____ Have the Emergency Response Procedures been identified to the employee/student and pertinent procedures reviewed for:

a._____ spills
b._____ fire
c._____ personal injury
d._____ meeting location upon evacuation _____

10. _____ Have all Emergency Equipment locations/procedures been identified to the employee/student?

a._____ Emergency Shower
b._____ Emergency Eyewash
c._____ Fire Alarm Pull Station
d._____ Spill Kit (posted chemical spill procedures)
e._____ Emergency action plan (DPS website: http://manoa.hawaii.edu/dps/emergency.html)
f._____ Telephone (x6-6911)

11. _____ Have the locations of the Satellite Accumulation Area and Hazardous Material Management Plan been identified to the employee/student and waste procedures explained for:

a._____ solvents?
b._____ acids/bases?
c._____ radioactive material?
d._____ sharps/broken glass?
e._____ biological material?

12. _____ Has the PI/Lab Supervisor reviewed with the employee/student, the laboratory signage system as indicated on the door?

13. _____ Have basic laboratory safety requirements been explained & reinforced?

14. _____ Training (refer to website www.hawaii.edu/ehso for schedule):

_____ a. If new employee/student, has the employee student signed up for Chemical Hygiene/Laboratory Safety training at x6-5180.

_____ b. If biological commodity user, has the employee/student signed up for training with the Biological Safety Office at x6-3197.

_____ c. If radioactive material user, has the employee/student signed up for training with the Radiation Safety Office at x6-6475.

All laboratory personnel must: **know** the hazards
understand the hazards
have **skills** to execute safe practices

Employee/Student Name_____ _____
Signature Date

Principle Investigator/Lab Supervisor _____ _____
Signature Date

Keep the completed form with employee records

APPENDIX XIV

SAFE HANDLING PRACTICES FOR MOVING CHEMICALS

Safe Handling Practices For Moving Chemicals

Moving chemicals from one laboratory or area to another can be a very dangerous activity when safe handling precautions are not practiced. This fact sheet will explain the basic chemical handling and storage precautions to practice when moving chemicals between labs and buildings.

1. First, perform a pre-move visual inspection and inventory of the chemicals that will be moved.

    - Make a list of the chemicals and note of the type (e.g. Acid, Base, Reactive, Toxic), and amounts of the chemicals to be moved.

    - Make sure that each container is correctly labeled as to its contents.

    - Observe the general condition of each chemical container.

    - Observe each containers cap or closure seal for the formation of crystals. CAUTION DO NOT TIGHTEN, OPEN OR MOVE CONTAINERS THAT HAVE CRYSTALS FORMING ON THE CAPS AND SEALS.

    - Observe whether crystals, which could be the signs of decomposition, have formed INSIDE the container. Ethers and other classes of organic peroxides can decompose and produce potentially dangerous and explosive crystals.

2. Locate the Safety Data Sheet (SDS) for each chemical to be moved. Each SDS has chemical specific handling and safety information that must be properly followed in order to move the chemical safely.

3. Plan the move. Choose the best route to take from point A to point B. Do not to take containers up and down stairs if possible.

4. Prepare the chemicals for the move.

    - Remember to use the proper goggles, gloves and other personal protective equipment before handling any chemicals.

    - Group the containers for the move by Hazard Class. Do not move acids with toxics, or oxidizers with organic solvents. Make a separate move for each Hazard Class.

- Transfer salvageable chemicals from deteriorating or contaminated containers to new containers with new labels. Properly dispose of unsalvageable and excess chemicals as Hazardous Waste.

- Box chemical containers if possible, using the correct packing materials (e.g. Vermiculite, original packaging boxes).

- If you use a cart to move containers make sure it has rails so the containers don't slip off. Place heavy containers on the bottom rack of the cart. Do not over load the cart, make several trips if necessary.

- Take a chemical spill kit with you in the event you have a spill along the move. This can be a coffee can filled with Vermiculite or the Acid/Base neutralizer kits found in many labs.

5. Compressed cylinder handling.

   - Always remove regulators from the cylinders before moving.

   - Always replace the metal valve cover on the cylinder before moving.

   - Move the cylinder with a cylinder dolly made especially for moving cylinders. Make sure the cylinder is securely chained or strapped to the dolly.

   - DO NOT lay cylinders on their sides. Laying a cylinder on its side can cause condensed liquids in the cylinder to enter the valve. When the valve is opened the liquid can rapidly volatilize and expand. This can produce potentially explosive conditions.

6. Before the move, rethink the storage system where you're moving to. The best way to store reactive chemicals is by family groups, making sure that you don't put certain groups right next to each other. For example, store phenols and amines well away from acid chlorides. Inorganics should be separated from organics. The inert or low-reactive materials can still stored in alphabetical order. This "mixed" system can work well and will help you comply with chemical storage requirements.

7. During the move. Be prepared for unexpected events during the move.

   - Stay with the containers. Do not let them out of you sight while you are moving them between points "A" and "B."

   - Be aware of the surroundings. Watch for doors opening in your way. Warn people of the hazard before they get close to you.

- If it begins to rain while you are outside of a building you will need to find safe cover for the containers.

- Have your spill kit available as well as the phone numbers to call in the event you have a spill along the move. Familiarize yourself with the UH chemical hygiene plan “Spill Clean-Up Procedures.”
  The emergency contact numbers are;

  UH EH&S Office X68660
  Campus Security X66911

By following these basic chemical handling practices during your move, you can ensure your safety, as well as the safety of other people around you.