University of Portland

CHEMICAL HYGIENE PROGRAM

UNIVERSITY OF PORTLAND

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University of Portland

CHEMICAL HYGIENE PLAN

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CHEMICAL HYGIENE PLAN

INTRODUCTION

University of Portland is dedicated to the safety, health, and well-being of its laboratory employees. The goal of University of Portland is to provide a safe working environment and to reduce injuries and illnesses to the lowest possible level. In keeping with this commitment, this Chemical Hygiene Plan (CHP) was developed.

The CHP provides information to laboratory personnel with regard to protecting themselves from potential hazards associated with the use of chemicals. Compliance with the provisions of the CHP is mandatory for all employees working in University of Portland laboratories. The provisions of this program are guided by the requirements of OSHA standard "Hazardous Chemicals in Laboratories" (29 CFR 1910.1450). University of Portland requires all personnel working with hazardous chemicals in a laboratory to comply with the provisions of the CHP. University of Portland recognizes that unique chemical and physical hazards may be found in laboratories and this CHP is designed to address those hazards by stating laboratory-specific requirements and guidelines. It is a requirement that all supervisors, engineers, scientists, technical staff, faculty, students, contractors, and visitors who work in the lab areas, and/or chemical and waste storage areas at University of Portland's facility be familiar with and follow the requirements of this document. Students must be familiar with applicable elements of this plan as determined by the Chemical Hygiene Officer (CHO) or faculty laboratory supervisors.

A variety of hazardous chemicals are used in research and teaching laboratories at University of Portland. Chemicals may cause injury or property damage if they are explosive, toxic, flammable, corrosive, or reactive. The degree of personal risk associated with the use of these chemicals depends on how these substances are handled and stored, as well as on the specific reactions and processes in which the chemicals are used.

This CHP is adapted to reflect the unique tasks performed in University of Portland labs and to outline the methods of mitigating the risks associated with those tasks.

This written CHP is available upon request to any University of Portland student or employee, their designated representative(s), and the Oregon or Federal Occupational Safety and Health Administration. No student or employee will be discharged or otherwise discriminated against for exercising his/her rights afforded by this plan.

CHEMICAL HYGIENE RESPONSIBILITIES

The responsibility for maintaining a safe laboratory environment lies with the Administrator for each respective lab, which may be a faculty or staff member. Every individual in the lab is expected to conduct all operations and procedures involving chemicals in a safe and prudent manner.

Laboratory Administrator

The Laboratory Administrator has the overall responsibility for chemical hygiene and the implementation of the CHP in the laboratory. Laboratory Administrators include principal investigators in academic labs, researchers in charge of research labs, laboratory instructors for laboratory based classes, and laboratory staff whose job responsibilities include overseeing laboratories. The Laboratory Administrator for a particular lab may be a staff member whose job description includes managing a particular laboratory space, or a faculty member who conducts research in a laboratory. The Laboratory Administrator may in some situations be the Chemical Hygiene Officer. The Laboratory Administrator has the following duties:

1. Complete all required safety training and acquire the necessary knowledge and information to recognize and control chemical hazards in the laboratory.
2. Ensure that appropriate training has been provided and all laboratory personnel, including students working in the laboratory, recognize and control chemical hazards and follow the standard procedures for dealing with accidents involving hazardous chemicals. All laboratory personnel must be trained to follow the provisions outlined in this CHP.
3. Ensure that the necessary protective and emergency equipment is available and in working order.
4. Ensure that periodic laboratory inspections are performed and that deficiencies are corrected. Laboratory inspections include those conducted with the Office of Environmental Health and Safety.
5. Understand the current legal requirements concerning regulated hazardous substances used in the laboratory.
6. Develop, review and evaluate the effectiveness of the laboratory manual procedures and/or standard operating procedures (SOPs) at least annually and update as necessary.
7. Know the signs and symptoms of overexposure, as well as physical and sensory characteristics (odor, appearance) of particularly hazardous chemicals.
8. Consult with the Chemical Hygiene Officer or Environmental Health and Safety before purchasing or producing any particularly hazardous substance.
9. Maintain the laboratory in accordance with the Laboratory Safety Manual.

Laboratory Employees

Laboratory employees are responsible for:

1. Completing required safety training.
2. Planning and conducting each operation in accordance with practices and procedures established in this CHP.
3. Using equipment only for its designed purpose.

4. Being alert to unsafe conditions and actions and calling attention to them so corrections can be made as soon as possible.
5. Being familiar with emergency response procedures including the location and use of emergency equipment as well as how to summon additional help in an emergency.
6. Knowing the types of protective equipment available and using the proper type for each procedure.
7. Maintain personal work areas in accordance with the Laboratory Safety Manual.

Chemical Hygiene Officer

The Laboratory Standard requires the appointment of a Chemical Hygiene Officer (CHO). The University of Portland Chemical Hygiene Officer (CHO) is qualified by training or experience to provide technical guidance in the development and implementation of the provisions of the CHP. The CHO has the following duties:

1. Assist the Laboratory Administrator(s) and other laboratory personnel with development and implementation of standard operating procedures and safety practices. Provide consultation for safe work practices for hazardous chemicals.
2. Assist the Office of Environmental Health and Safety with laboratory inspections, and maintenance of the University of Portland CHP.
3. Keep current of legal requirements concerning regulated substances and communicate changes to Laboratory Administrators and laboratory employees.
4. Monitor procurement, use, and disposal of chemicals in laboratories.
5. Assist with the review the CHP annually and updating it as necessary to remain current with regulatory requirements and seek ways to improve the overall University of Portland CHP.

Environmental Health and Safety

1. Work with the laboratory community, administrators, and other employees to provide adequate facilities and to develop and implement appropriate policies and practices. Provide consultation for safe work practices for hazardous chemicals and answer chemical safety questions for employees.
2. Review the CHP annually and update it as necessary to remain current with regulatory requirements and seek ways to improve the overall University of Portland CHP.
3. Oversee and arrange for exposure monitoring of student and employee to hazardous materials as needed and as defined by the Standard.
4. Conduct laboratory inspections annually to ensure laboratory employees and students are following all requirements of the Chemical Hygiene Plan. Monitor procurement, use, and disposal of chemicals in laboratories.
5. Investigate accidents and chemical exposures within the University departments.
6. Maintain records of training, exposure monitoring and medical examinations related to chemical exposure.

7. Work with the Chemical Hygiene Officer to determine laboratory safety issues and develop strategies for compliance.

Department Directors and Faculty

The Department Directors, faculty, and staff are responsible for the safe performance of day to day work with hazardous chemicals in their respective department laboratory, shop, or work areas. They are responsible for:

1. Ensure the appropriate technical and administrative human resources, budget, and equipment are provided to achieve the requirements of this CHP.
2. Provide leadership and direction regarding chemical hygiene and safety within their respective areas
3. Implementing the pertinent requirements of this document in their respective areas
4. Providing specialized training to ensure that students and personnel working under their direction in their area or with their equipment are trained specifically on the chemical and physical hazards associated with that work. This training must take place at the beginning of each school term or semester or use of new equipment, new job or class assignment, or changed job or class assignment.
5. Ensure that laboratory manual procedures or Standard Operating Procedures (SOPs) are developed for all “high hazard” operations
6. Ensure that students and employees are aware of, and familiar with, emergency procedures and the proper use of emergency equipment.
7. Ensure that good housekeeping is practiced
8. Taking appropriate disciplinary action (in coordination with the CHO and EHS) when employees or students do not follow safe work procedures
9. Placing defective or unsafe equipment out of service and arranging for servicing of equipment that is in need of maintenance and/or repair.
10. Maintaining an up-to-date chemical inventory, and ensuring that hazardous materials are handled, stored, transported, and disposed of in the correct manner

Students and Employees

Students and employees should be alert to the potential hazards of all substances/operations in their work areas. Students and employees are responsible for:

1. Following documented lab or work procedures and operating equipment in accordance with the manufacturer's and University of Portland's specifications found in laboratory manual procedures and/or SOPs.
2. Promptly reporting any accidents, unsafe conditions, or unsafe acts to faculty or to their supervisor.
3. Reviewing SDS information for chemicals with which they work.
4. Being familiar with and following emergency and evacuation procedures
5. Know the location of safety and emergency equipment and how to operate it
6. Maintain personal work areas in accordance with the Laboratory Safety Manual

Contractors

When contractors perform work on campus involving hazardous chemicals, University personnel (including the CHO, EHS, and Laboratory Administrators) must:

1. Ensure SDSs are obtained for all maintenance related chemicals procured and used at the University of Portland.
2. Communicate potential chemical hazards to all facilities-related contractors prior to the commencement of work
3. Obtain information on hazardous work performed by the contractor (ex. welding, volatile substance use, operating equipment powered by internal combustion engines, laser use, etc.)
4. Prepare a contingency plan for isolating the construction/work area from adjacent occupied work areas and for preventing the release of hazardous materials to the environment (for example, the release of a contaminated liquid to a storm drain)
5. Ensure that contractors provide University of Portland with all the appropriate chemical hazard documentation prior to the commencement of work
6. Prevent University of Portland students and employees from being exposed to maintenance-related chemicals by coordinating facility projects in a safe manner
7. Inform contractors of precautions and protective measure to be utilized while working in specific areas

When contractors perform work on campus involving hazardous chemicals, contractors must:

1. Ensure SDSs are available for all materials used on the job
2. An explanation of the labeling and/or warning system used to identify hazardous chemicals or materials, if different than standard GHS system
3. Information on hazardous work performed by the contractor (ex. Welding, volatile solvent use, operating equipment power by internal combustion engines, laser use, etc.).
4. Contingency plan for isolating the construction/work area from adjacent occupied work areas and for preventing the release of hazardous materials to the environment (such as release of contaminated liquid to a storm drain).
5. Contractors must provide all personal protective equipment for their employees
6. Contractors must remove all hazardous waste from the University of Portland and dispose of it properly at the contractor's own facility.

TRAINING

Environmental Health and Safety ensures 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.

Refresher information and training on the laboratory CHP is conducted as needed.

All laboratory personnel receive training:

1. The requirements of the OSHA Standard, "Occupational Exposure to Hazardous Chemicals in Laboratories", 29 CFR 1910.1450

2. The contents of the University of Portland CHP and location of the CHP
3. The permissible Exposure Limits (PELs) for OSHA regulated substances or recommended exposure limits where there is no applicable OSHA standard.
4. The methods and observations that may be used to detect the presence or release of a hazardous chemical; e.g., exposure monitoring, visual appearance or odor of hazardous chemicals when being released, etc.
5. The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and PPE to be used.
6. Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.
7. The location of reference materials on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, how to look up Safety Data Sheets (SDSs) and container labels.
8. University of Portland hazardous waste management practices and procedures.
9. Laboratory Manual Procedures and/or Standard Operating Procedures (SOPs).
10. Emergency and first aid procedures to follow if students or employees are exposed to hazardous substances/agents.
11. Where to get help and information on health and safety issues.

Students, faculty, and employees must be provided area-specific training on the hazards to which they may be exposed and the means to avoid these hazards. Training must be updated when a new hazard is introduced into the work place. The CHO, faculty supervisors, and the Laboratory Administrator is responsible for providing assistance in the development of this training and ensuring that training is provided to all laboratory personnel including employees and students.

Additional training from faculty supervisors is required when personnel are using or in the vicinity of a variety of hazardous chemicals and materials. Examples include: Formaldehyde, Methylene Chloride, Chloroform, Phenol, Hydrofluoric Acid, Laboratory Sharps Safety (see the University of Portland Bloodborne Pathogen Exposure Control Plan), Biosafety Cabinets, and Radiation Safety. These are required for all employees working with these hazards.

CIRCUMSTANCES REQUIRING PRIOR APPROVAL

Employees must obtain prior approval to proceed with a laboratory task from the Laboratory Administrator when:

1. Radioactive materials will be used.
2. Recombinant DNA or biological material of Biosafety Level 2 or greater will be used.
3. It is likely that exposure limit concentrations could be exceeded or that other harm is likely.
4. There is failure of any equipment used in the process, especially safeguards such as chemical fume hoods.
5. Members of the laboratory staff become ill, suspect that they or others have been exposed, or otherwise suspect a failure of any safeguards.

LABORATORY-SPECIFIC STANDARD OPERATING PROCEDURES (SOPs) OR LABORATORY MANUAL PROCEDURES

Standard Operating Procedures (SOPs) are operation specific, step-by-step instructions for conducting a procedure. SOPs may also be written as policies and procedures in Laboratory Manuals specific to a laboratory. They are required for "high hazard" operations and recommended for other potentially hazardous operations. SOPs should include:

1. Training requirements for lab personnel.
2. Information on the specific hazards posed by the chemicals or equipment used in the procedure.
3. Information on the personal protective equipment (PPE) needed during the procedure, including specific information on glove type.
4. A step-by-step description of the process.
5. First aid measures.
6. Waste disposal instructions.

Below are some examples of when the University of Portland implements laboratory SOPs and/or Laboratory Manual Procedures:

- ❒ Operation of laboratory equipment such as: lasers, atomic absorption spectrometers, muffle furnaces, freeze-dryers, electrophoresis equipment, etc.
- ❒ Operations posing a special hazard, such as: using perchloric acid, working with pyrophoric chemicals, conducting electrophoresis, performing distillations and/or extractions, handling infectious agents, etc. This includes equipment, processes and operations which use known or suspected carcinogenic, mutagenic, or teratogenic substances.
- ❒ Operations such as equipment and processes that involve hazardous electricity, ionizing and non-ionizing radiation, laser lights, very high or low temperatures, or high or low pressures.
- ❒ Operations that use a chemical that is listed in the lab's chemical inventory as needing an SOP.
- ❒ Neutralizing non-contaminated acid wastes.
- ❒ Specific procedures for operations that are to be conducted in fume hoods.
- ❒ Transporting hazardous chemicals

See Appendix A-1 for the University of Portland SOP template tool (which can also be used a Laboratory Manual Procedure template tool)

PERSONAL PROTECTIVE EQUIPMENT (PPE) AND APPAREL

Carefully inspect all PPE prior to use. Do not use defective equipment.

Eye Protection

Eye protection (safety glasses, chemical-resistant goggles, or face shield) shall be worn at all times in laboratories where chemicals are being used.

1. All eye protection must meet American National Standards Institute (ANSI) 87.1Z – 2010.
2. Ordinary prescription glasses are not considered safety glasses.

3. Safety glasses should be worn over prescription glasses or prescription safety glasses must be provided to employees who must wear corrective lenses.
4. Contact lenses may be worn as long as additional appropriate eye protection is used.
5. Additional information regarding the use of contacts in a chemical environment is outlined in the National Institute of Occupational Safety and Health Publication Number 2005–139

Gloves

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 resistant to permeation by the substance shall be worn. No one glove can protect against all hazards.

1. Cloth gloves, while not appropriate for use around liquids, can protect against light abrasive materials and moderate temperature changes.
2. Synthetic or rubber gloves protect against corrosives, solvents, and poisons. Some solvents permeate the commonly-used nitrile gloves very quickly. Consult the SDS or glove manufacturer's glove selection charts for more information.
3. Leather gloves, often used for tasks like welding, protect against sparks, heat, and rough abrasives.

Clothing

1. 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 when working with large volumes of chemicals.
2. Low-heeled shoes with fully covered uppers shall be worn at all times in the laboratory. Shoes or sandals with open toes or shoes with mesh covered uppers shall not be worn.
3. Long pants and long sleeves should be worn when working with or around chemicals.
4. Long hair should be held in place behind the head.
5. Loose clothing, especially loose trouser legs and sleeves, should not be worn in the laboratory.

Fume Hoods and Respirators

1. Fume hoods must be used whenever possible.
2. A proper respirator must be worn whenever exposure by inhalation is likely to exceed the action level or the PEL and a fume hood is not available.

   NOTE: Prior to wearing a respirator, employees must be medically evaluated, trained, and fit-tested. Proper procedures are outlined in the University of Portland Respiratory Protection Program.

Care and Maintenance of PPE

Personal protective clothing and equipment shall be used and maintained in a sanitary and reliable condition and shall be cleaned regularly to avoid spreading contamination.

- ➔ Remove laboratory coats and gloves before you leave the laboratory to prevent spreading contamination to other areas.
- ➔ Do not wear gloves outside the laboratory.
- ➔ Do not wear contaminated or potentially contaminated shoes outside the laboratory.

Laboratory coats shall never be washed at home. Regular clothing that is suspected of being contaminated shall be evaluated by chemical hygiene staff to determine whether or not it can be

decontaminated or if it should be disposed. Contaminated clothing shall not be washed with or come into contact with other personal laundry.

LABORATORY SAFETY RULES AND REGULATIONS

Additional Laboratory Safety Rules and Regulations can be found in the Laboratory Safety Manual

General Rules for laboratory work with chemicals

1. Regular (day-time) work schedules should be followed unless a deviation is authorized by the laboratory supervisor or Laboratory Administrator. Employees should avoid working alone after hours.
   - ➔ Arrangements should be made between individuals working in separate laboratories outside of regular working hours to crosscheck each other periodically
   - ➔ Procedures known to be hazardous should not be undertaken by an employee who is alone in the laboratory
2. Unauthorized experiments shall not be performed
3. Plan and review safety procedures before beginning any operation
4. Follow Standard Operating Procedures and/or Laboratory Manual Procedures at all times
5. Always review the SDS and container label before using a chemical
6. Wear appropriate PPE at all times
7. Use appropriate ventilation when working with hazardous chemicals
8. Pipetting should never be done by mouth. Use mechanical devices, such as pipet bulbs, pipet wheels, electric pipettors, or Pipetman® devices
9. Wash hands with soap and water immediately after working with any laboratory chemicals, even if gloves have been worn
10. Do not use 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.
11. Eating, drinking, gum chewing, applying cosmetics, and taking medicine in laboratories where hazardous chemicals are used or stored is strictly prohibited
12. Smoking is prohibited in all University of Portland facilities
13. Food, beverages, cups, and other drinking and eating utensils shall not be stored in areas where hazardous chemicals are handled or stored
14. Laboratory refrigerators, ice chests, cold rooms, and ovens shall not be used for food storage or preparation
15. Eating and office areas must be clearly separated from laboratory and chemical storage areas
16. Maintain situational awareness
17. Make others aware of any special hazards associated with your work
18. Notify the Laboratory Administrator of any chemical sensitivities or allergies, and consult with the University of Portland CHO of Environmental Health and Safety for assistance with identifying protective measures or alternatives
19. Report all injuries, accidents, incidents, and near misses to the laboratory supervisor

20. Unauthorized persons are not allowed in the laboratory
21. Report unsafe conditions to the Laboratory Administrator, laboratory supervisor
22. Properly dispose of chemical wastes
23. Contact the laboratory supervisor or Laboratory Administrator with all safety questions or concerns.

Housekeeping

1. Proper housekeeping includes appropriate labeling and storage of chemicals, safe and regular cleaning of the facility, and proper arrangement of laboratory equipment.
2. All work areas, especially laboratory bench tops, should be kept clear of clutter to the extent possible.
3. All aisles, corridors, stairs, and stairwells shall be kept clear of chemicals, equipment, supplies, boxes, and debris.
4. Storage of empty cardboard boxes in the lab should be avoided.

Unattended Operations and Working Alone

Precautions should be taken for unattended laboratory operations that are carried out continuously or overnight. Unattended operations should be designed to be safe, and plans should be made to avoid hazards in case of failure. When possible arrangements should be made for routine surveillance (e.g., each hour) of the operation, leave the lights on, and leave an appropriate sign on the door to indicate that the operation is going but has been left unattended. In addition, the following procedures should be followed:

1. Name and telephone numbers of operator(s) and responsible faculty are to be posted on the entrance door for unattended operations that contain hazardous chemicals. Chemical hazards are also to be identified and posted on the door.
2. Faculty and/or employee supervisors must approve and be available at short notice to respond to emergencies if needed
3. Campus Safety security should be notified ahead of time and arrangements should be made for surveillance. Security must be informed of hazards, proper responses, possible incident scenarios, and how to respond.
4. Laboratory work known to be uniquely hazardous should not be undertaken by one student alone in the laboratory. At least 2 persons must be present.

Laboratory & Equipment Decommissioning

University Program Directors faculty, supervisors, and laboratory staff are responsible for assuring that all laboratory space is maintained free from undue hazards. When vacating a laboratory space, the Laboratory Administration or responsibility parties must ensure that all chemicals or hazardous wastes are removed and properly disposed. The CHO and EHS can provide assistance in labeling, packaging, and removing chemicals and waste. If laboratory premises are left in an environmentally unacceptable state, it may be necessary to obtain the services of outside contractors to identify and dispose of unidentified chemicals and waste, and the costs associated must be covered by the vacating department.

Equipment that is surplus or to be disposed of, must be checked for hazardous material contamination as part of the decommissioning process. Equipment decommissioning and decontamination may require the use of internal or external contractor services. The Laboratory Administrator (staff or faculty) is responsible to ensure that the decommissioning process leaves the equipment free of hazardous contamination prior to off-site transport or shutdown in place.

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EMERGENCY EQUIPMENT

Know the location and proper use of safety equipment. Access to emergency equipment, showers, eyewashes, fire extinguishers, exits and circuit breakers shall never be blocked or obstructed.

Emergency eyewashes and showers

OSHA (29 CFR1910.151) states:

> "Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use."

The ANSI standard Z358.1 recommends that:

1. The safety shower and eyewash be within 10 seconds or 55 feet of the work area for quick drenching or flushing of the eyes and body.
2. The equipment must be installed on the same level as the hazard (i.e. accessing the equipment should not require going up or down stairs or ramps).
3. The path of travel from the hazard to the equipment should be free of obstructions and as straight as possible.
4. Eyewash stations and showers will be tested monthly by building employees to determine proper pressure and flow rates. It is the responsibility of the laboratory personnel, CHO, or designated employee to test emergency equipment monthly to ensure the delivery of clear, tepid, debris-free water. These monthly tests must be documented in a written log.

Fire Extinguishers

University of Portland policy is to have employees and students exit the building in the event of a fire, not to remain behind to attempt to fight the fire. However, the university recognizes that individuals who are properly trained and equipped may be able to put out a small fire in a piece of equipment, thus reducing the amount of property damage to the equipment and surrounding lab.

Most laboratories on campus are equipped with a fire extinguisher. If your lab is a high fire hazard area, and you feel that a fire extinguisher is necessary, make arrangements to obtain the necessary number of extinguishers. All laboratory personnel must be trained annually in the proper use of the extinguisher via Moodle, and the proper extinguisher must be available in the lab. In the event of a fire, when using a

fire extinguisher always have an unobstructed route out of the building away from the fire. Never stay behind to fight a fire that is between you and the building exit.

CHEMICAL MANAGEMENT

There are three widely used systems for labeling hazardous materials. Each system has a specific purpose and it is important to recognize the differences between each. The below table provides a brief summary of the purpose and use of the three common systems. You may see more than one systems label on a container depending on the situation.

Label Type	Purpose	Typical Label Location	Label Example
NFPA 704 Diamond www.nfpa.org/704	Provides information about hazards that occur during emergency response	Outside buildings, on doors, on tanks, visible to emergency responders during spill or fire	
DOT Placard www.dot.gov/	Provides information about hazards to transportation workers and emergency responders	Tank cars, cargo tanks, portable tanks, bulk packages, vehicles or containers containing non-bulk packages	
OSHA HazCom 2012 www.osha.gov/	Provides information about hazards to workers using chemicals under normal conditions of use	Pipes, drums, and containers of materials that are used in the workplace	

The DOT placard system is used by vendors who pick up University hazardous waste or University vehicles that transport hazardous waste.

NFPA 704 labels provide an appropriate signal or alert for the protection of emergency response personnel, assist in planning for effective fire and emergency control operations. NFPA 704 labels are required when another federal, state, or local regulation or code requires their use. NFPA 704 does not specify when a container, tank, or facility must be labeled with the NFPA704 diamond, but does specify how to label when another Authority Having Jurisdiction (such as the Portland Fire Bureau) requires such labeling. Some of the most widely adopted and used NFPA codes that require 704 labels for specific occupancies, storage, and hazardous materials include:

- NFPA 1, Fire Code
- NFPA 30, Flammable and Combustible Liquids Code
- NFPA 45, Standard on Fire Protection for Laboratories Using Chemicals
- NFPA 55, Compressed Gases and Cryogenic Fluids Codes NFPA 400, Hazardous Materials Code

OSHA's Hazard Communication Standard provides information for workers exposed to materials primarily under normal conditions of us. The Hazard Communication Standard has incorporated the Globally Harmonized System (GHS). More information about this is available in the University of Portland Hazard Communication Plan. The Hazard Communication Plan follows the federal and Oregon Hazard Communication Standard and uses the GHS System for labeling and marking hazardous chemicals.

Chemical Procurement:

1. Information on proper handling, storage, and disposal should be provided to those who will be involved, before a chemical is received.
2. Only containers with proper labels identifying the chemical and its hazard may be accepted. All container labels must be compliant with the Globally Harmonized System (GHS).
3. Shipments with breakage or leakage should be refused, or opened in a chemical fume hood.
4. Only the minimum amount of the chemical needed to perform the planned work should be ordered.
5. Purchases of high-risk chemicals should be reviewed and approved by the CHO.
6. Proper protective equipment and handling and storage procedures should be in place before receiving a shipment.
7. Chemical shipments should be dated upon receipt and the stock should be rotated.

Chemical Storage:

1. Chemicals should be separated and stored according to hazard category and compatibility. Consult SDS and label information for storage requirements.
2. Maintain existing labels on incoming containers of chemicals and other materials.
3. Peroxide formers should be dated upon receipt, again dated upon opening, and stored away from heat and light with tight-fitting, nonmetal lids.
4. Label all containers of hazardous chemicals (including transfer vessels, beakers, flasks, and process equipment) with the chemical name and hazard warnings.
5. Open shelves used for chemical storage should be secured to the wall and have 3/4-inch lips.
6. Secondary containment (tubs, bins) should be used for liquids.
7. Consult the SDS and keep incompatibles separate during transport, storage, use, and disposal.

8. Oxidizers, reducing agents, and flammables should be stored separately to prevent contact in the event of an accident.
9. Chemicals should not be stored in the chemical fume hood, on the floor, in areas of egress, on the benchtop (except for small amounts of working solutions), near heat sources, or in direct sunlight.
10. Laboratory-grade, flammable-rated refrigerators and freezers should be used to store sealed chemical containers of flammable liquids that require cool storage.
11. Highly hazardous chemicals should be stored in a well-ventilated and secure area designated for that purpose.
12. Flammable chemicals should be stored in a spark-free environment and in approved flammable-liquid containers and storage cabinets. Grounding and bonding should be used to prevent static charge buildups when dispensing solvents.
13. Storage of flammable substances shall be limited to quantities specified in Appendix 8.
14. Chemical storage and handling rooms should be controlled-access areas. They should have proper ventilation, appropriate signage, diked floors, and fire suppression systems.

Chemical Handling:

1. A risk assessment should be conducted prior to beginning work with any hazardous chemical for the first time.
2. Read all SDS and label information before using a chemical for the first time, or if it has been a while since using the chemical.
3. Trained laboratory workers should ensure that proper engineering controls (ventilation) and PPE are in place.

Chemical Inventory:

An SDS is kept on file for each hazardous substance listed on University of Portland chemical inventory. The MSDS is the most current one supplied by the manufacturer, importer, or distributor. University of Portland uses an online chemical inventory system that stores all information electronically, MSDS Online. EHS maintains the contract for the online SDS management platform, while departments are responsible for adding new chemicals to the MSDS system (via their own account or the online request for available here).

Management of chemicals in any laboratory is greatly facilitated by keeping an accurate, up-to-date chemical inventory. Chemicals that are no longer needed or are waste should be properly disposed.

A department should review their current chemical inventory annually to determine the actual chemicals and quantities present at University of Portland. The chemical inventory should be sent to EHS annually and should contain the following information:

1. Location of where the chemical is used
2. The common or trade name and the chemical name of the hazardous substance
3. The Chemical Abstract Service (CAS) registry number, if available
4. Physical state
5. Container type

6. Approximate quantity on-site
7. SARA Hazard Class

Transporting Chemicals:

1. Use secondary containment, such as bins and buckets, when transporting chemicals
2. Use a break-resistant transport container when transporting chemicals outside of the laboratory or between stockrooms and laboratories.
3. The outside of the secondary container must be free of any hazardous material so that personnel can carry the package safely between buildings without wearing gloves. Appropriate gloves shall be kept on the cart for protection of transporter in case of a spill during transit.
4. Wear safety glasses while transporting chemicals in secondary containment.
5. Avoid transporting chemicals through high-traffic areas.
6. Never transport chemicals in your personal vehicle.

Transferring Chemicals:

1. Use adequate ventilation (such as a fume hood) when transferring even a small amount of a particularly hazardous chemical.
2. Using drums for storage of chemicals is not appropriate for laboratories.
3. Transfer flammable liquids from 5-gallon containers (or less) to smaller containers only in a laboratory fume hood or an approved flammable liquid storage room.

Shipping Chemicals:

Outgoing chemical shipments must meet all applicable Department of Transportation (DOT) regulations.

COMPRESSED GAS SAFETY

Compressed gases present a number of chemical, physical, and health hazards. Improper handling and use can cause structural damage, severe injury, and possibly death.

1. Cylinders that are knocked over or dropped can be very dangerous. If a valve is broken off, the cylinder can become a lethal projectile.
2. Accidental releases may result in an oxygen-depleted atmosphere, a flammable atmosphere, or adverse health effects.

The following guidelines will help ensure safe handling, use, and storage of compressed gas cylinders.

Receiving and Storage:

1. Be sure to arrange a return agreement with suppliers prior to purchase since disposal of compressed gas cylinders is difficult and very expensive.
2. Cylinders should not be accepted unless the cylinder contents are clearly labeled.
3. Color code only should not be accepted, since it does not constitute adequate labeling.
4. Do not accept cylinders which are damaged or do not have a valve protection cap.
5. All gas cylinders shall be secured in an upright position in racks, holders, or clamping devices, with straps or chains placed at 1/3 and 2/3 the tank height.

6. When cylinders are grouped together, they should be individually secured and conspicuously labeled on the shoulder area so that labels are readily visible.
7. Never place oxygen cylinders near highly combustible materials, especially oil and grease, near stocks of carbide and acetylene or other fuel gas cylinders, nor near any other substance likely to cause or accelerate a fire.
    a) Systems and components used for other gases and purposes must never be used for oxygen or interconnected with oxygen.
    b) Signs should be conspicuously posted in areas where flammable compressed gases are stored, identifying the gases and the appropriate precautions to be taken.
8. 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.
9. Do not place cylinders near heat, sparks, or flames or where they might become part of an electrical circuit.
10. Do not store cylinders in exit corridors or hallways.

Handling and Use:

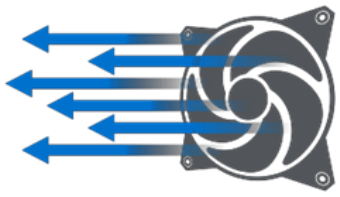
1. Only Compressed Gas Association fittings and components are permitted for use with gas cylinders.
2. Only use regulators approved for the type of gas in the cylinder.
3. Do not use adapters to interchange regulators.
4. Be careful when threading a regulator onto a cylinder. They can become stuck, causing the gas to be released from the cylinder. This may result in oxygen-depletion of the room, or in the development of a flammable atmosphere in the room.
5. Open cylinder valves slowly and face away from the valve when opening it. Ensure that others are not facing the valve when you open it.
6. Never force a gas cylinder valve. If the valve cannot be opened by the wheel or small wrench provided, the cylinder should be returned.
7. Transferring gases from one cylinder to another, refilling cylinders, or mixing gases in a cylinder in the laboratory is prohibited.
8. 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.
9. Compressed gases must not be used to clean your skin or clothing.
10. Never heat cylinders to raise their internal pressure.
11. Do not use copper (>65%) connectors or tubing with acetylene. Acetylene can form explosive compounds with copper, silver, and mercury.
12. Always leave at least 30 psi minimum pressure in all "empty" cylinders. Do not leave an empty cylinder attached to a pressurized system.

LABORATORY VENTILATION

General laboratory ventilation is normally designed to provide a minimum of eight air changes per hour. This flow is not necessarily sufficient to prevent accumulation of chemical vapors in the lab.

Fume Hoods:

Laboratory work shall be conducted in a fume hood, glove box, or similar device when:



1. Procedures call for work with toxic substances which are volatile; i.e., evaporate at normal temperature and pressure.
2. There is a possibility the action level or PEL will be exceeded.

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.

1. Continually monitor air being drawn into the hood. Many hoods have electronic monitors and will alarm if the air flow drops below the safe value. If no monitor is present, air flow can be checked by attaching a light-weight strip of paper, such as a Kim wipe, to the bottom of the sash. The paper should flutter inwards.
2. Operate the hood at a sash position that will provide splash protection for the user; e.g. 10-12 inch opening for hoods with vertical sliding (up and down) sashes and the sashes closed as much as possible for continuous air flow hoods with horizontal sliding (left and right) sashes. This helps to ensure optimum protection when conducting operations in the hood.
3. Avoid using the hood for storage of bottles and equipment, especially along the back wall of the hood.
4. 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 bench top) to allow air to flow freely around and beneath the item.
5. 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 due to turbulent air flow.
6. Minimize air turbulence across the face of the hood from fans, window air conditioning units, or excessive movement around the hood face.
7. Avoid walking past a fume hood when it is being used.
8. Avoid excessive arm movements when working inside a fume hood.
9. Exhaust hoods do not provide adequate protection for all operations involving toxic materials. A higher level of containment should be used for procedures where exposure to even small amounts of the chemical can be serious. If you are in doubt about the level of containment needed for your operation, ask your Laboratory Administrator, Lab Supervisor, or CHO.

Chemical Fume hoods should meet the provisions of 29 CFR 1910.1450(e)(3)(iii).

- Fume hoods should be considered backup devices that can contain and exhaust toxic, offensive, or flammable materials when the material being used generates vapors, gases, or dusts.
- Fume hoods should not be regarded as a means to dispose of chemicals
- Fume hoods should be evaluated by operators prior to and during each use by means of simple visual indicators for adequate air flow.
- Fume hoods should be evaluated annually to verify that adequate airflow is maintained through the hood face. Check for a current sticker on the side of the fume hood or other local exhaust equipment. The date should not be over a year old. Face velocities should be between 80 and 120 feet per minute (fpm).

In the event of a fume hood failure or low-flow alarm, discontinue all fume hood operations and, only if it is safe to do so, place lids on open containers, lower the hood sash and secure reactions that may be generating hazardous emissions.

1. Contact Facilities Management to report the alarm after following the steps listed above.
2. If the danger level is imminent, leave the lab immediately and call 911.

Other Ventilation Systems:

The installation or modification of other local exhaust systems used should be coordinated with faculty or department director for the area and conducted in accordance with ACGIH, American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), National Fire Protection Association (NFPA) requirements and other nationally recognized standards.

Do not attach canopy hoods or snorkel (elephant trunk) systems to existing fume hood exhaust ducts without consulting the Environmental Health and Safety and Physical Plant.

Apparatus/operations that may discharge hazardous vapors (vacuum pumps and distillation columns) should be directly ducted to an auxiliary local exhaust system.

EMERGENCY PROCEDURES FOR ACCIDENTS AND SPILLS

Spill Clean-up Procedures:

1. All labs must have a fully-stocked emergency chemical spill kit able to be quickly accessed.
2. Call 911 and/or Campus Safety in the event of an emergency or if anyone is in danger.
3. Spill response information should be included in the SOP for the procedure in which the chemical is being used. It is your responsibility to be familiar with spill response for all chemicals that you use.
4. If you do not feel comfortable cleaning up any spill, evacuate and call Campus Safety.
5. Attend to anyone who may have been contaminated during the spill or injured.
6. Notify occupants in the immediate area about the spill.
7. Evacuate all nonessential personnel from the spill area.

8. If the spilled material is flammable, turn off all ignition and heat sources; this includes magnetic stir plates.
9. Ensure that the fume hood is on.
10. Confine or contain the spill to a small area using dikes or spill pads.
11. Avoid breathing vapors of the spilled material. If medically qualified and trained as required in the Respiratory Protection Program, wear a respirator if necessary.
12. Obtain cleanup supplies. Wear suitable PPE, including appropriate gloves, lab coat, and chemically-resistant safety goggles. Ensure that PPE is resistant to the spilled material.
13. Use appropriate kit and materials to neutralize and absorb inorganic acids and bases.

EXPOSURE MONITORING

Initial Monitoring: (done by outside contractor, only when required/needed/requested)

Exposure monitoring shall be performed when there is reason to believe that exposures are in excess of the action level or the PEL. Substances which require monitoring under these conditions are listed in OSHA Regulations, 29 CFR 1910 Subpart Z. Initial monitoring will only be done when required or when there is a reason to believe it is needed, and is performed by an outside contractor.

Periodic Monitoring:

If initial monitoring reveals that exposures are in excess of the action level or PEL, the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.

Termination of Monitoring:

Monitoring may be terminated in accordance with the relevant standard.

Employee Notification:

Employees must be notified in writing within 15 working days after receiving any monitoring results. Documentation of exposure monitoring shall be kept and maintained as part of each employee's personnel record.

MEDICAL CONSULTATIONS AND EXAMINATIONS

Employees are provided an opportunity to receive medical attention, including any related follow-up examinations, at University of Portland expense, as follows:

1. When an individual develops signs or symptoms associated with exposure to hazardous chemicals in the laboratory.
2. When exposure monitoring reveals an exposure level routinely above the action level or PEL for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements.
3. When an accident such as a spill, leak, equipment failure, or explosion results in possible over-exposure to hazardous chemicals.

HEALTH HAZARDS

Criteria for determining whether a chemical is classified as a health hazard are detailed in Appendix A to 29 CFR 1910.1200.

Acute Toxicity refers to those adverse effects occurring following oral or dermal administration of a single dose of a substance or multiple doses given within 24 hours, or an inhalation exposure of 4 hours.

Skin Corrosion/Irritation

1. Corrosion is irreversible damage to the skin.
2. Irritation is reversible damage to the skin.

Serious Eye Damage/Irritation

1. Eye damage refers to tissue damage of the eye or serious decay of vision.
2. Eye irritation refers to changes to the eye that are reversible within 21 days of the exposure

Respiratory or Skin Sensitization

1. Respiratory Sensitization refers to a chemical that will lead to hypersensitivity of the airways following inhalation
2. Skin sensitization refers to a chemical that will lead to an allergic response following skin contact.

Germ Cell Mutagenicity is defined as a permanent change in the amount or structure of the genetic material in a cell.

Carcinogenicity: a substance or mixture which will induce cancer or increase its incidence. There are 3 categories for carcinogens:

1A: substances which are known to have carcinogenic potential for humans

1B: substances which are presumed to have carcinogenic potential for humans

1C: substances which are suspected human carcinogens

A list of chemicals that are classified as carcinogens by the National Toxicity Program is given in Appendix A-5, as are the thirteen chemicals listed by OSHA as carcinogens.

Reproductive Toxicity:

Reproductive toxicity includes adverse effects on sexual function in adult males and females, as well as adverse effects on development of the offspring. There are 2 categories for reproductive toxicants:

1: Known or presumed human reproductive toxicant

2: Suspected human reproductive toxicant

Specific Target Organ Toxicity, Single Exposure: refers to a specific, non-lethal target organ toxicity arising from a single exposure to a chemical.

Specific Target Organ Toxicity, Repeated or Prolonged Exposure: refers to specific target organ toxicity arising from repeated exposure to a substance or mixture.

Aspiration Hazard: refers to the entry of a liquid or solid into the trachea and lower respiratory system.

Simple asphyxiant:

A simple asphyxiant (as defined in 29 CFR 1910.1200(c)) is a substance or mixture that displaces oxygen in the ambient atmosphere, and can thus cause oxygen deprivation in those who are exposed, leading to unconsciousness and death.

PHYSICAL HAZARDS

Criteria for determining whether a chemical is classified as a physical hazard are detailed in Appendix B to 29 CFR 1910.1200.

Explosive: is a solid or liquid chemical which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings.

Flammable Gas: refers to a gas having a flammable range with air at 20°C (68°F) and a standard pressure of 101.3 kPa (14.7 psi).

Flammable Aerosols: refers to any non-refillable receptacle containing a gas compressed, liquefied or dissolved under pressure and fitted with a release device allowing the contents to be sprayed as a gas, foam, paste, powder, or liquid.

Oxidizing Gases: refers to any gas which may, usually by providing oxygen, cause or contribute to the combustion of other material above and beyond what air does.

Pressurized gases: refers to gases which are contained in a receptacle at a pressure of 200 kPa (29 psi) or more, or which are liquefied or liquefied and refrigerated.

Flammable Liquids: refers to liquids having a flash point of not more than 93°C (199.4°F). Flash point refers to the minimum temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air.

Flammable Solids: refers to a solid which is readily combustible solid or which may cause or contribute to fire through friction.

Self-Reactive Chemicals: refers to thermally unstable liquid or solid chemicals liable to undergo a strongly exothermic decomposition even without oxygen. Excludes explosives, organic peroxides, and oxidizing liquids or solids.

Pyrophoric Liquids: refers to a liquid which is liable to ignite within five minutes after coming into contact with air.

Pyrophoric Solids: refers to a solid which is liable to ignite within five minutes after coming into contact with air.

Self-Heating Chemicals: refers to a large amount of a solid or liquid chemical (excluding pyrophoric liquids or solids) which, by reaction with air and without an energy supply, is able to self-heat with hours or days.

Chemicals Emitting Flammable Gases when in Contact with Water

Oxidizing Liquids: refers to a liquid which, generally by yielding oxygen, cause or contribute to the combustion of other materials.

Oxidizing Solids: refers to a solid which, generally by yielding oxygen, cause or contribute to the combustion of other materials.

Organic Peroxides: refers to a liquid or solid that is a derivative of hydrogen peroxide.

1. Organic peroxides are thermally unstable chemicals and may undergo exothermic self-accelerating decomposition.
2. They are liable to explosive decomposition, burn rapidly, be sensitive to impact or friction and react dangerously with other substances.

Corrosive to Metals: refers to a chemical that can materially damage, or even destroy, metals.

Appendix A-1

Laboratory-Specific Standard Operating Procedures

[Name of procedure]

Location(s): list room number(s) and building(s) here

Chemical(s): list chemical(s) here

Specific Hazards:

List specific hazards for each chemical here (by chemical). This information is in the SDS.

1. Purchasing:

Include this verbiage if chemicals or hazardous materials are being purchased for use in this SOP. If not, just write "N/A".

All purchases of these materials must have approval from _____ before ordering. The user is responsible to ensure that a current Safety Data Sheet (MDS) is obtained unless a current one is already available within the laboratory. Quantities of this material will be limited to the smallest amount necessary to complete the experiments.

2. Storage:

Include this verbiage if chemicals or hazardous materials are being used as part of this SOP. If not, just write "N/A".

Materials will be stored according to compatibility and label recommendations in the designated storage area:

_____

Storage areas will be regularly inspected by lab personnel to ensure safety. Periodic inventory reductions will be scheduled.

3. Authorized personnel:

Include this verbiage if the use of this procedure should be limited in any way. If not, just write "N/A".

Use will be limited to the following personnel (check all that apply):

Laboratory Administrator ____ Graduate students___ Technical staff ___

Post-doctoral employees___ Undergraduates ___ Other (_____) ____

4. Training requirements:

The user must demonstrate competency and familiarity regarding the safe handling and use of these materials prior to using them. Training shall include the following:

Review of this SOP

Other examples: University of Portland Laboratory Safety training

University of Portland Hazardous Waste Management training

5. Use location:

This procedure will be done in [BUILDING AND ROOM HERE]. Also specify any other specific location, such as fume hood or biosafety cabinet.

6. Personal protective equipment (PPE):

All personnel are required to wear the following personal protective equipment (PPE) whenever conducting this procedure:

Examples: Lab coat

Safety goggles or safety glasses

Gloves: [must specify glove type, and thickness if necessary; may also include warnings against other types of gloves that are not recommended for that chemical]

7. Spill equipment: List spill response equipment here, including neutralizer, universal pads, etc.

8. Procedure:

Materials needed:

Number list of materials needed for procedure, including pipets, tips, beakers, hot plates, chemicals, etc.

Procedure Notes:

Provide any notes for the procedure. This will mostly be scientific or technical in nature, but may include any specific warnings about serious safety hazards. May not have this section in some SOPs.

Procedure Steps:

Numbered list of steps in procedure, beginning with "don PPE" and "gather materials".

1. Don PPE.
2. Gather materials.
3. Continue here.

9. Waste disposal and clean up:

If no wastes are generated, just write "It is not anticipated that any wastes will be generated during this procedure." Otherwise, include this:

The authorized person using this material is responsible for the safe collection, preparation and proper disposal of waste unless otherwise stated below. Waste shall be disposed of as soon as possible and in accordance with all laboratory and University of Portland procedures.

Then, write specific instructions for liquid and solid wastes:

Specific instructions:

1. Liquid wastes
    a. Obtain a _[specify type if relevant]___ bottle and label with "__[concentration and name of waste that will be generated]__". Note, this should be specified for EACH bottle of waste if more than one type of waste will be generated.
    b. Further instructions here, if necessary (e.g., using a funnel, carefully decant the supernatant into the waste bottle and recap waste bottle.)
    c. Store liquid wastes in secondary containment until the bottles are full or they are no longer needed (all samples have been prepared). Store in __[list appropriate area here]___. DO NOT store in a fume hood.
2. Solid wastes
    a. Specific instructions here, including labeling of bag and storage of bag.

10. Decontamination:

Instructions for decontaminating items (Example: Triple-rinse any non-disposable items with water.)

11. Exposures: Emergency procedures to be followed (from SDS):

Eye contact for any or all chemicals used in these procedures

Symptoms:

List symptoms for each chemical from SDS.

First aid:

Describe first aid measures for each chemical as they are given in the SDS.

Call a physician.

Skin contact for any or all chemicals used in these procedures

Symptoms:

List symptoms for each chemical from SDS.

First aid:

Describe first aid measures for each chemical as they are given in the SDS.

Call a physician if necessary.

Ingestion for any or all chemicals used in these procedures

Symptoms:

List symptoms for each chemical from SDS.

First aid:

Describe first aid measures for each chemical as they are given in the SDS.

Call a physician immediately.

Inhalation

Symptoms:

List symptoms for each chemical from SDS.

First aid:

Describe first aid measures for each chemical as they are given in the SDS.

Call a physician immediately.

12. Spills:

May adjust this area to fit particular chemical(s) and circumstances. Here is an example:

In case of a spill outside of the fume hood: evacuate the area. Call 911 (if serious injury or exposure has occurred) to report the spill and request cleanup assistance.

In case of a spill inside the fume hood:

Do not turn the fume hood off until area is cleaned. Continue to wear gloves, lab coat, and chemical safety goggles. Absorb the spill with gray absorbent pads. Wash the area with water.

Place all pads in plastic bag. Place gloves in bag. Report the spill. Wash hands and forearms thoroughly after cleaning up the area.

13. Phone numbers:

List phone numbers of departments/personnel to contact in the event of a spill.

14. Other important information:

Include any other important information regarding the hazards associated with these chemicals and this procedure. If there aren't any, write "N/A".

Prepared by: Name(s) here

Date: Date here

Reviewed/Revised: _____

Appendix A-2

HAZARDOUS MATERIALS PICKUP AND DISPOSAL PROCEDURES

Hazardous materials are defined as those materials that are: flammable, corrosive, air or water reactive or toxic (see Definitions of Hazardous Materials below). The office of Environmental Health and Safety (EHS) is responsible for removing all hazardous materials, used and unused, from University of Portland facilities but departments are responsible for maintaining their hazardous waste before pickup. Materials picked up by this EHS are recycled or disposed of properly via a third party vendor.

TO HAVE HAZARDOUS MATERIALS/WASTE REMOVED FROM YOUR LAB, YOU MUST:

- Communicate the need for the removal of hazardous materials or other chemicals (including unknowns) to the EHS Officer (email ehs@up.edu)
- Fill out and affix a yellow waste sheet on waste containers and promptly place in approved hazardous material collection areas.
- At the time when the accumulation of a material begins, the date should be clearly marked and visible for inspection (mark “satellite accumulation start date” on transfer label).

PROCEDURES FOR PROPERLY COLLECTING, STORING, HANDLING AND TRANSPORTING HAZARDOUS MATERIALS AND WASTE:

- Keep all hazardous materials in appropriate closed containers with airtight lids.
- Do not store hazardous materials in a fume hood.
- Keep all hazardous material containers closed at all times except when adding or removing the material.
- Do not mix incompatible chemicals (i.e. oxidizers with flammables).
- Do not mix hazardous materials with non-hazardous materials. It greatly increases waste disposal costs.
- Accurately label all containers with full chemical names, hazards and exact content as well as date it became full. It is imperative to avoid producing containers whose contents are unknown. Disposal of such materials is very expensive.

PACKAGING REQUIREMENTS FOR ALL HAZARDOUS MATERIALS/WASTE:

- The outside of the containers must be clean and free of chemical contamination.
- Use appropriate containers. All glass containers must be securely packaged to prevent breakage during transport.
- All containers of liquids must have screw lids and must not leak when inverted. Corks, cotton plugs, tape, or parafilm are not acceptable lids for containers of hazardous materials.
- If possible, use the same container for disposal of used material that originally held the new material.
- Metal cans are not acceptable for accumulating hazardous solvents - except for waste oil.
- Loose solid materials must be placed in a sealed container or in a cardboard box lined with two polyethylene bags.
- Containers storing hazardous materials must be kept closed, except when adding or removing contents.

DEFINITIONS OF HAZARDOUS MATERIALS

Hazardous materials are those that "could cause injury or death; or damage or pollute land, air, or water." Hazardous wastes are defined as substances that are ignitable (flammable), corrosive, toxic, explosive, or reactive,

(react with air, water, or acids or bases). Specific definitions are found in the Code of Federal Regulations: 40CFR part 261. These are summarized below.

Ignitable: This category contains materials that are easily combustible or flammable. This includes liquids that have a flash point less than 60C (140F), and non-liquids that are capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture, or spontaneous chemical change and when ignited burn so vigorously and persistently that they create a hazard, and any ignitable compressed gas described in 40 CFR 173.300. Examples are solvents and spent solvents (acetone, benzene, ethyl acetate, ethyl ether, methanol, methyl isobutyl ketone, xylene); ignitable paint waste (some paint removers, brush cleaners, and stripping agents; epoxy resins and adhesives (epoxies, rubber cements and marine glues); inks containing flammable solvents, and some degreasers. For additional information see 40 CFR 261.21.

Corrosive: This category includes acids and bases or mixtures having a pH less than or equal to 2 or greater than or equal to 12.5, and materials that burn the skin or dissolve metals. Examples are strong mineral acids (chromic, sulfuric, hydrochloric, or nitric) strong alkalis (potassium hydroxide), rust removers, and acid or alkaline cleaning fluids. This category also includes solids that when mixed with water form solutions that are strongly acidic or basic (ferric chloride, sodium hydroxide). For additional information see 40 CFR 261.22

Reactive: This category includes materials that are unstable or undergo rapid or violent chemical reaction when exposed to air, water or other material, generate toxic gases or vapors when mixed with water or when exposed to pH conditions between 2 and 12.5 (as in the case with cyanide or sulfide containing materials), forms potentially explosive mixtures with water, are capable of detonation or explosive reaction when heated or subjected to shock. Examples are acetyl chloride, chromic acid, cyanides, hypochlorides, organic peroxides, perchlorates, permanganates, sulfides, some plating materials and bleaches. For additional information see 40 CFR 261.23

Toxic: This category includes heavy metal compounds such as: arsenic, barium, cadmium, chromium, lead, mercury, silver, selenium, etc. Pesticides such as, Aldrin, arsenic pentoxide, arsenic trioxide, cacodylic acid, chlordane, copper cyanides, DDT, Dieldrin, dimethylcarbamoyl chloride, Endrin, Lindane, pentachlorophenol, strychnine, etc.

Pathogenic, Infectious, and Etiologic agents: Includes any material that can directly cause an infectious disease in humans or animals, including viable microorganisms, toxins, and viruses. Infectious waste includes wastes that may contain bloodborne pathogens such as hepatitis B virus or Human Immunodeficiency Virus).

Sharps: Sharps are defined as any non-contaminated sharp object that can penetrate the skin, including, but not limited to: broken capillary tubes and pipettes, blades from power tools, glass microscope slides and cover plates, and hypodermic and non-hypodermic needles.

There may be other hazardous substances that are not described here. It is your responsibility to determine if the materials you use are hazardous to human health or the environment.

You can find information about your material by looking at the Safety Data Sheet, available from the manufacturer. You should already have Safety Data Sheets accessible for all substances utilized in the lab.

Appendix A-3

SELECT CARCINOGENS

The following standards apply to substances that are classified as carcinogens or potential carcinogens by the National Toxicity Program (NTP) and listed in OSHA's "13 Carcinogens" (29 CFR 1910.1003). The applicable OSHA standard for the substance is listed next to the substance name. Carcinogens that are commonly found in research laboratories are highlighted in yellow.

2-Acetylaminofluorene	29 CFR 1910.1014
Acrylonitrile	§ 1910.1045
4-Aminodiphenyl	§ 1910.1011
Inorganic Arsenic	§ 1910.1018
Asbestos	§ 1910.1001
Benzene	§ 1910.1028
Benzidine	§ 1910.1010
bis-Chloromethyl ether	§ 1910.1008
1,3-Butadiene	§ 1910.1051
Cadmium	§ 1910.1027
Chromium (VI)	§ 1910.1026
Coke oven emissions	§ 1910.1029
1,2-dibromo-3-chloropropane	§ 1910.1044
3,3'-Dichlorobenzidine (and its salts)	§ 1910.1007
4-Dimethylaminoazobenzene	§ 1910.1015
Ethylene oxide	§ 1910.1047
Ethyleneimine	§ 1910.1012
Formaldehyde	§ 1910.1048
Methyl chloromethyl ether	§ 1910.1006
Methylene chloride	§ 1910.1052
Methylenedianiline	§ 1910.1050
alpha-Naphthylamine	§ 1910.1004
beta-Naphthylamine	§ 1910.1009
N-Nitrosodimethylamine	§ 1910.1016
beta-Propiolactone	§ 1910.1013
Vinyl chloride	§ 1910.1017

The following is a PARTIAL list of known or potential carcinogens:

Chemical Name	CAS Number	Category*
2-Acetylaminofluorene	53-96-3	NTPRAHC OSHA 13
Acrylonitrile	107-13-1	IARC 2B;NTPRAHC
Actinomycin D	50-76-0	IARC 3
Adriamycin	23214-928	IARC 2A;NTPRAHC
Aflatoxins	1402-68-2	IARC 1;NTPKHC
2-Aminoanthraquinone	117-79-3	IARC 3; NTPRAHC
o-Aminoazotoluene	97-56-3	IARC 2B
4-Aminobiphenyl (4-aminodiphenyl)	92-67-1	IARC 1;NTPKHC, OSHA 13
2-Amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole	712-68-5	IARC 2Bs
Amitrole	61-82-5	IARC 2B;NTPRAHC
Ortho-Anisidine	90-04-0	IARC 2B;NTPRAHC

Chemical Name	CAS Number	Category*
O-Anisidine hydrochloride	134-29-2	NTPRAHC
Aramite®	140-57-8	IARC 2B;NTPRAHC
Arsenic	7440-38-2	IARC 1;NTPKHC
Arsenic compounds	7440-38-2	NTPKHC
Arsenic pentoxide	1303-28-2	IARC 1
Arsenic trioxide	1327-53-3	IARC 1;NTPKHC
Arsenic, inorganic compounds	7440-38-2	IARC 1;NTPKHC
Asbestos (all forms)		IARC 1;NTPKHC
Auramine	492-80-8	IARC 2B
Azaserine	115-02-6	IARC 2B
Azathioprine	446-86-6	IARC 1;NTPKHC
Benzene	71-43-2	IARC 1;NTPKHC
Benzidine	92-87-5	IARC 1;NTPKHC, OSHA 13
Benzo(a)pyrene	50-32-8	IARC 1
Benzo(b)fluoranthene	205-99-2	IARC 2B
Benzotrichloride	98-07-7	NTPRAHC
Benzyl violet	1694-09-3	IARC 2B
Beryllium and compounds	7440-41-7	IARC 1;NTPKHC
Bis-(chloromethyl) ether	542-88-1	IARC 1;NTPKHC, OSHA 13
Bis-chloroethyl nitrosourea	154-93-8	IARC 2A;NTPRAHC
1,4-Butanediol dimethane-sulphonate	55-98-1	IARC 1;NTPKHC
beta-Butyrolactone	3068-88-0	IARC 2B
Cadmium and compounds	7440-43-9	IARC 1;NTPKHC
Carbon tetrachloride	56-23-5	IARC 2B;NTPRAHC
Chlorambucil	305-03-3	IARC 1;NTPKHC
Chloramphenicol	56-75-7	IARC 2A
Alpha-Chlorinated toluenes		IARC 2A
1-(2-Chloroethyl)-3-cyclo-hexyl-1-nitrosourea	13010-47-4	IARC 2A;NTPRAHC
4-Chloro-o-phenylenediamine	95-83-0	IARC 2B;NTPRAHC
Chromium hexavalent compounds	1333-82-0	IARC 1;NTPKHC
Cisplatin	15663-27-1	IARC 2A
Citrus red no. 2	6358-53-8	IARC 2B
Creosote(s)	8001-58-9	IARC 2A
para-Cresidine	120-71-8	IARC 2B;NTPRAHC
Cupferron	135-20-6	NTPRAHC
Cycasin	14901-08-7	IARC 2B;
Cyclophosphamide	50-18-0	IARC 1;NTPKHC
Dacarbazine	4342-03-4	IARC 2B;NTPRAHC
Daunomycin	20830-81-3	IARC 2B
DDT	50-29-3	IARC 2B;NTPRAHC
N,N'-Diacetylbenzidine	613-35-4	IARC 2B
2,4-Diaminoanisole sulfate	39156-41-7	IARC 2B;NTPRAHC
4,4'-Diaminodiphenyl ether	101-80-4	IARC 2B
2,4-Diaminotoluene	95-80-7	IARC 2B;NTPRAHC
Dibenz(a,h)acridine	226-36-8	IARC 2B;NTPRAHC
Dibenz[a,j]acridine	224-42-0	IARC 2A;NTPRAHC
Dibenz[a,h]anthracene	53-70-3	IARC 2A;NTPRAHC
Dibenzo(a,e)pyrene	192-65-4	IARC 3
Dibenzo[a,h]pyrene	189-64-0	IARC 2B;NTPRAHC
Dibenzo([a,i]pyrene	189-55-9	IARC 2B;NTPRAHC

Chemical Name	CAS Number	Category*
Dibenzo[q,i]pyrene	189-55-9	IARC 2B;NTPRAHC
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	IARC 2B;NTPRAHC
3,3'-Dichlorobenzidine	91-94-1	IARC 2B;NTPRAHC, OSHA 13
3,3'-Dichloro-4,4'-diaminodiphenyl ether	28434-86-8	IARC 2B
Diethyl sulfate	64-67-5	IARC 2A;NTPRAHC
Diethylstilbestrol	56-53-1	IARC 1;NTPKHC
Dihydrosafrole	94-58-6	IARC 2B
3,3'-Dimethoxybenzidine	119-90-4	IARC 2B;NTPRAHC
trans-2((Dimethylamino)methylimino)5-(2-(5-nitro-2-furyl)vinyl)-1,3,4-oxadiazole	25962-77-0	IARC 2B
1,1-Dimethylhydrazine (UDMH)	57-14-7	IARC 2B;NTPRAHC
Dimethyl sulfate	77-78-1	IARC 2A;NTPRAHC
Para-Dimethylaminoazobenzene	60-11-7	IARC 2B;NTPRAHC, OSHA 13
Dimethylcarbamoyl chloride	79-44-7	IARC 2A;NTPRAHC
1,4-Dioxane	123-91-1	IARC 2B;NTPRAHC
Estrone	53-16-7	IARC 1;NTPKHC
Ethyl methanesulfonate (EMS)	62-50-0	IARC 2B
Ethylene dibromide (EDB)	106-93-4	IARC 2A;NTPRAHC
Ethylenethiourea	96-45-7	IARC 3;NTPRAHC
Ethyleneimine	15-15-64	OSHA 13
Formaldehyde	50-00-0	IARC 1;NTPKHC
2-(2-Formylhydrazino)-4-(5-nitro-2-furyl)thiazole	3570-75-0	IARC 2B
Glycidylaldehyde	765-34-4	IARC 2B
Hexachlorobenzene	118-74-1	IARC 2B;NTPRAHC
Hexamethylphosphoramide	680-31-9	IARC 2B;NTPRAHC
Hydrazine, sulfate (1:1)	10034-93-2	NTPRAHC
Lasiocarpine	303-34-4	IARC 2B
Lead acetate	301-04-2	NTPRAHC
Lead chromate(VI) oxide	18454-12-1	IARC 2B;NTPKHC
Lindane, and mixed isomers	58-89-9	NTPRAHC
Melphalan	148-82-3	IARC 1;NTPKHC
Merphalan	531-76-0	IARC 2B
Mestranol	72-33-3	IARC 2B;NTPKHC
Methyl chloromethyl ether	107-30-2	OSHA 13
4,4'-Methylenebis-(2-chloroaniline)	101-14-4	IARC 1;NTPRAHC
4,4'-Methylene bis(N,N-dimethyl)benzeneamine	101-61-1	NTPRAHC
4,4'-Methylene bis (2-methylaniline	838-88-0	IARC 2B
Methylenedianiline	101-77-9	IARC 2B;NTPRAHC
Methylenedianiline dihydro-chloride	13552-44-8	NTPRAHC
Methyl iodide	74-88-4	IARC 3;
Methyl methanesulfonate (MMS)	66-27-3	IARC 2A
Methylnitroanthraquinone	129-15-7	IARC 2B
Methylnitronitrosoguanidine	70-25-7	IARC 2A
Methylazoxymethanol acetate	592-62-1	IARC 2B
Methylthiouracil	56-04-2	IARC 2B
Metronidazole	443-48-1	IARC 2B;NTPRAHC
Michler's ketone	90-94-8	IARC 2B;NTPRAHC
Mirex	2385-85-5	IARC 2B;NTPRAHC
Mitomycin C	50-07-7	IARC 2B
Monocrotaline	315-22-0	IARC 2B

Chemical Name	CAS Number	Category*
Mustard gas (Sulfur mustard)	505-60-2	IARC 1;NTPKHC
1-Naphthylamine (alpha-naphthylamine)	134-32-7	IARC 3;OSHA 13
2-Naphthylamine (beta-Naphthylamine)	91-59-8	IARC 1;NTPKHC, OSHA 13
5-Nitroacenaphthene	602-87-9	IARC 2B
4-Nitrobiphenyl	92-93-3	IARC 3;OSHA 13
5-Nitro-ortho-anisidine	99-59-2	IARC 3;NTPRAHC
N-Nitrosodimethylamine	62-75-9	IARC 2A;OSHA 13
beta-Propiolactone	57-57-8	IARC 2B;OSHA 13

*Notes on categories:

IARC International Agency for Research on Cancer

Group 1 The agent (mixture) is carcinogenic to humans. The exposure circumstances entail exposures that are carcinogenic to humans.

Group 2A The agent (mixture) is probably carcinogenic to humans. The exposure circumstance entails exposures that are probably carcinogenic to humans.

Group 2B The agent (mixture) is possibly carcinogenic to humans. The exposure circumstance entails exposures that are possibly carcinogenic to humans.

Group 3 The agent (mixture or exposure circumstances) is unclassifiable as to carcinogenicity in humans.

Group 4 The agent (mixture, exposure circumstance) is probably not carcinogenic to humans.

NTP National Toxicology Program

RAHC Reasonably Anticipated To Be Human Carcinogen

KHC Known To Be Human Carcinogen

OSHA - Occupational Safety and Health Administration

13 OSHA Regulated carcinogens

LABORATORY EMERGENCY PROCEDURES DURING POWER OUTAGES

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

- Fully 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. and returned to their proper storage location.
- All non-essential electrical devices should be turned off, especially computers, printers, and other devices with sensitive circuitry (including autoclaves and laminar flow hoods).
- Keep the doors of refrigerators and freezers closed.
- Ensure that no flammable chemicals are stored in domestic refrigerators and freezers. When the power returns to these appliances, a reaction may be ignited by the refrigerator light or other electrical source.
- Check to ensure that lasers, radio frequency generators, etc. have been turned off.
- Turn off all gas cylinders at the tank valves when not in use (cylinders should be shut when not in use, some are in continuous use).
- 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 Standard Operating Procedure specific for the process (see Appendix A-1).
- Check all pressure, temperature, air, or moisture sensitive materials and equipment. This includes vacuum work, distillations, glove boxes used for airless or moisture less reactions, etc.

University of Portland

Appendix A-5

INTERNATIONAL BUILDING AND FIRE CODE FOR STORAGE AND HANDLING OF FLAMMABLE AND COMBUSTIBLE LIQUIDS

CLASS	IA	IB	IC	II	IIIA
FLASH POINT	<73°F	<73°F	73° – 100°F	100° - 140°F	140°-200°F
BOILING POINT	<100°F	> 100°F			
FLAMMABILITY POTENTIAL	Extremely High	Very High	High	Moderate	Moderate
EXAMPLES OF COMMONLY USED MATERIALS	acetaldehyde ethyl ether pentane	acetone ethanol butylamine gasoline methanol isopropanol	amyl acetate butanol chlorobenzene turpentine xylene	formaldehyde hydrazine	aniline glycol glycerine kerosene nitrobenzene
NFPA 704 HAZARD RATINGS*	4	4	3	2	2
MAXIMUM CONTAINER SIZE					
Glass	1 pint** (500 ml)	1 quart** (1 liter)	1 gallon (4 liters)	1 gallon (4 liters)	1 gallon (4 liters)
Metal--other than DOT drums or approved plastic	1 gallon	2 gallons	2 gallons	2 gallons	2 gallons
Safety cans	2 gallons	2 gallons	2 gallons	2 gallons	2 gallons
DOT metal drums	N/A	5 gallons	5 gallons	60 gallons	2 gallons
Polyethylene (DOT Spec. 34 or as authorized by DOT Exemption	1 gallon	2 gallons	2 gallons	2 gallons	2 gallons

*National Fire Protection Association. NFPA 704, Standard System for the Identification of the Fire Hazards of Materials for Emergency Response, provides planning guidance to fire departments for safe tactical procedures in emergency operations. The Hazard Identification System is not intended to identify the nonemergency health hazards of chemicals.

** Exception: Class IA and Class IB flammable liquids may be stored in glass containers of not more than one-gallon capacity if the required liquid purity (e.g., ACS analytical reagent grade or higher) would be affected by storage in metal containers or if the liquid would cause excessive corrosion of the metal container.

STORAGE REQUIREMENTS

1. Flammable and/or combustible 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 the table above.
3. Quantities stored in flammable storage cabinets shall be limited to 60 gallons of class I, II or III liquids and the total of all liquids shall not exceed 120 gallons. Please refer to the table above for maximum allowable container size for each class. Not more than three cabinets shall be located in the same room.
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. Flammable and combustible liquids shall not be stored near exit doorways, stairways, in exit corridors, or in a location that would impede egress from the building.
6. Flammable aerosols and unstable liquids shall be treated as class I-A liquids. Please refer to the table above.
7. Materials which will react with water or other liquids to produce a hazard shall be segregated from flammable and/or combustible liquids.

HANDLING AND DISPENSING

1. Class I 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.

Appendix A-6

CHEMICAL INCOMPATIBILITY TABLES

Compound/Class/Chemical	Avoid Storage Near or Contact With
Acetic acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetone	Conc. Nitric acid and sulfuric acid mixtures
Acetylene	Fluorine, chlorine, bromine, copper, silver, mercury
Alkaline metals (e.g., Na, K, Mg, Ca, Al)	Carbon dioxide, carbon tetrachloride or other chlorinated hydrocarbons, halogens, water
Ammonia (anhyd.)	Mercury, chlorine, bromine, iodine, hydrofluoric acid, calcium hypochlorite
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenicals	Reducing agents (or will generate arsine)
Azides	Acids (or will generate hydrogen azide)
Bromine	Ammonia, acetylene, butadiene, methane, propane, butane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals
Calcium oxide	Water
Carbon, activated	Calcium hypochlorite, oxidizing agents
Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organic or combustible materials
Chromic acid, Chromium trioxide	Acetic acid, naphthalene, camphor, glycerol, turpentine, alcohol, or other flammable liquids
Chlorine	Ammonia, acetylene, butadiene, methane, propane, butane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals

Compound/Class/Chemical	Avoid Storage Near or Contact With
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Organic or inorganic acids
Cyanides	Acids (or will generate hydrogen cyanide)
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Fluorine	Isolate from everything
Hydrazine	Hydrogen peroxide, nitric acid, other oxidants
Hydrocarbons (propane, butane, benzene, gasoline, turpentine, etc.)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkalies
Hydrofluoric acid (anhyd.)	Ammonia (aq. or anhyd.)
Hydrogen peroxide	Copper, chromium, iron, most other metals or their salts, alcohols, acetone, or other flammable liquids, aniline, nitromethane, or other organic or combustible materials
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids (or will generate chlorine or hypochlorous acid)
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, ammonia, fulminic acid (produced in nitric acid- ethanol mixtures)
Nitrates	Sulfuric acid (or will generate nitrogen dioxide)
Nitric acid (conc.)	Acetic acid, aniline, chromic acid, acetone, alcohol, or other flammable liquids, hydrocyanic acid, hydrogen sulfide, or other flammable gases, nitratable substances; copper, brass, or any heavy metals (or will generate nitrogen dioxide/nitrous fumes)
Nitrites	Acids (or will generate nitrous fumes)
Nitroparaffins	Inorganic bases, amines

Compound/Class/Chemical	Avoid Storage Near or Contact With
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen, other flammable gases, liquids, or solids
Perchloric acid	Acetic acid, bismuth & its alloys, alcohol, paper, wood, grease, oils
Peroxides (organic)	Organic or inorganic acids. Also: avoid friction and store cold
Phosphorus (white)	Air, oxygen, caustic alkalies as reducing agents (or will generate phosphine)
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Acids, especially sulfuric acid
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents (or will generate hydrogen selenide)
Silver	Acetylene, oxalic acid, tartaric acid, fulminic acid (produced in nitric acid-ethanol mixtures), ammonium compounds
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium peroxide	Any oxidizable substance such as methanol, ethanol, glycerol, ethylene glycol, glacial acetic acid, acetic anhydride, furfural, benzaldehyde, methyl acetate, ethyl acetate, carbon disulfide
Sulfides	Acids (or will generate hydrogen sulfide)
Sulfuric acid	Light metals (lithium, sodium, potassium), chlorates, perchlorates, permanganates
Tellurides	Reducing agents (or will generate hydrogen telluride)

Appendix A-7

CAMPUS FUME HOOD INVENTORY

Building	#	Room	Hood #	Hood Usage	Floor
Swindells Hall					
	1	113	1	Radiological	First Floor
	2	118	1	Radiological	First Floor
	3	120	1	Chemical	First Floor
	4	128	1	Chemical	First Floor
	5	141	1	Chemical	First Floor
	6	143	1	Chemical	First Floor
	7	145	1	Chemical	First Floor
	8	228	1	Biological	Second Floor
	9	237	1	Biological	Second Floor
	10	237	2	Biological	Second Floor
	11	237	3	Biological	Second Floor
	12	241	1	Chemical	Second Floor
	13	243	1	Chemical	Second Floor
	14	245	1	Chemical	Second Floor
	15	312	1	Chemical	Third Floor
	16	312	2	Chemical	Third Floor
	17	312	3	Chemical	Third Floor
	18	312	4	Chemical	Third Floor
	19	318	1	Chemical	Third Floor
	20	326	1	Chemical	Third Floor
	21	326	2	Chemical	Third Floor
	22	326	3	Chemical	Third Floor
	23	326	4	Chemical	Third Floor
	24	326	5	Chemical	Third Floor
	25	326	6	Chemical	Third Floor
	26	337	1	Chemical	Third Floor
	27	341	1	Chemical	Third Floor
	28	341	2	Chemical	Third Floor
	29	341	3	Chemical	Third Floor
	30	341	4	Chemical	Third Floor
	31	343	1	Chemical	Third Floor
	32	345	1	Chemical	Third Floor
	33	345	2	Chemical	Third Floor
Engineering Building					
	34	312	1	Chemical	Third Floor
	35	103	1	Chemical	First Floor