

Central Washington University  
Laboratory Chemical Hygiene Plan

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# CENTRAL WASHINGTON UNIVERSITY

## CHEMICAL HYGIENE PLAN

### I. INTRODUCTION

#### A. Purpose

Central Washington University has a commitment to create, maintain and enhance a safe and healthful environment for all individuals associated with the institution.

Implementation of the Chemical Hygiene Plan (CHP) is a critical element in achieving a safe and healthful work environment in CWU laboratories. The purpose of this plan is to establish policies and procedures. In addition, it will provide general and specific guidelines and information to protect employees from health hazards associated with hazardous chemicals in the laboratory. In fulfilling this purpose, the CHP also satisfies the state requirements for the standard on "Occupational Exposures to Hazardous Chemicals in Laboratories" herein referred to as the Laboratory Safety Standard (WAC 296-62-40001 through 40025). A copy of this standard is provided as Appendix A. A list of defined terms from the Laboratory Safety Standard is found in Appendix B. Implementation of a chemical hygiene plan in the laboratory will assist in minimizing chemical exposures and in complying with mandated exposure limits.

#### B. Scope and Application

This Chemical Hygiene Plan is intended to safely limit laboratory workers' exposure to hazardous chemicals regulated by the Washington Industrial Safety and Health Administration (WISHA). Laboratory workers must not be exposed to hazardous chemicals in excess of the permissible exposure limits listed in WAC 296-62-075 through 296-62-07515, Air Contaminants. This list of air contaminants and their permissible exposure limits is found in Appendix C of this plan.

This standard applies where "laboratory use" of hazardous chemicals occurs. Laboratory use of hazardous chemicals refers to two factors: 1) when the handling or use of chemicals occurs on a "laboratory" scale, that is, the work involves containers which can easily and safely be manipulated by one person and 2) when multiple chemical procedures or hazardous chemicals are used. At a minimum, this definition includes

employees who use chemicals in teaching, research and clinical laboratories at CWU.

#### C. Implementation of the Chemical Hygiene Plan

1. In order to meet the requirements of the Laboratory Safety Standard, a chemical hygiene plan must be written for each CWU laboratory. The CHP must contain: a) standard operating procedures for use of hazardous chemicals, b) designated area provisions, c) descriptions of or provisions for fume hoods and other protective equipment, d) provisions for employee information, training, and medical monitoring and examination, e) evaluation criteria the employer will use to reduce exposure, f) prior approval provisions for special laboratory projects, g) a designation of the chemical hygiene officer and other person(s) responsible for implementation of the CHP, and h) any extra protection provisions.
2. The CHP must be readily available to all employees in the laboratory. The term "readily available" means accessible to all laboratory staff at any time, day or night. It must also be available to Environmental Health & Safety (EHS) staff and Washington State Department of Labor and Industries representatives.
3. The area for which the CHP is written may be adjoining rooms, a single room, or an area within a room as long as the definition of "readily available", as stated above, is met. The spatial definition of a "laboratory" is left to the discretion of the individual who will ultimately take responsibility for the safety of all employees who work within that area. This individual should be a department head, faculty laboratory instructor, laboratory supervisor, or principal investigator.
4. EHS has provided the basic elements of a "generic" or "core" chemical hygiene plan. Included in this plan are the established policies for CWU and various regulatory agencies.
5. Each laboratory must provide additional information to make this plan relevant to the area. A number of provided pages have questions or prompts which will assist the responsible laboratory supervisor with developing the site specific CHP.

#### D. Responsibilities

Consistent with CWU policy, responsibility for chemical hygiene and safety in the laboratory is shared by administrators, faculty, and principal

investigators, managers, supervisors, employees and students at all levels. Delegation of specific responsibilities is described below.

1. Environmental Health and Safety:
  - a. Provides consultation, technical assistance and recommendations relating to hazard communication, community right-to-know, chemical safety, and hazardous waste management.
  - b. Ensures that adequate programs are provided for compliance with safety and health regulations and for the protection of the health and safety of students, faculty, staff and the surrounding community.
  - c. Records, evaluates and reports incidents.
  - d. Develops and maintains training resources.
2. The Department Chair or Director:
  - a. Is responsible for the safety of all employees, students and visitors in their areas of control.
  - b. Reviews all accident reports and ensures that appropriate corrections are made.
  - c. Reviews the safety procedures and control methods used by laboratory supervisors and ensure that required authorizations to use restricted or regulated hazardous chemicals are on file in the department.
3. The Faculty, Laboratory Supervisor or Principal Investigator:
  - a. Is the Chemical Hygiene Officer for the laboratorie(s). Ensures compliance with CWU laboratory safety rules and establishes specific procedures for the laboratory.
  - b. Trains employees and students in safety procedures, corrects improper work practices, identifies defective environmental conditions which could result in personal injury, and develops a positive attitude among employees toward accident prevention.

- c. Prepares a CHP keyed to the specific needs of each laboratory activity under his or her direction. Reviews and updates the CHP at least annually.
  - d. Investigates and reports every accident (whether or not an injury occurs) to EHS and to the Department Head or Director, and initiates corrective action that will ensure maximum safety for his or her workers.
4. The Employee:
- a. Knows and complies with safety procedures and policies required for the task assigned.
  - b. Reports unsafe conditions or accidents to the immediate supervisor, faculty instructor, principal investigator, department chair or EHS.

E. Site Specific Responsibility for Chemical Hygiene and Safety

**Department:** \_\_\_\_\_

**Division:** \_\_\_\_\_

**Building:** \_\_\_\_\_

**Department Chair or Director:** \_\_\_\_\_

**Faculty Member, Supervisor, or Principal Investigator** (person responsible for chemical hygiene and the Chemical Hygiene Plan in the unit or laboratory): \_\_\_\_\_

**\*Room(s) covered by this plan:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

**Implementation Date:** \_\_\_\_\_

**Annual Review Dates:** \_\_\_\_\_

\_\_\_\_\_

\*The room(s) for which the Chemical Hygiene Plan is written must be adjoining rooms, a single room or an area within a room as long as the plan is accessible to all laboratory staff at any time, day or night.

II. GENERAL CHEMICAL HYGIENE AND SAFETY:  
POLICIES AND RECOMMENDATIONS

**It is prudent to minimize all chemical exposures. State Occupational Health Standards have established Permissible Exposure Limits (PELs) for over 600 chemical agents. Exposure to these agents must be controlled in such a manner that the workers' exposure shall not exceed the applicable limits (WAC 296-62-07515).**

Because few laboratory chemicals are without hazards, the following general precautions for handling all laboratory chemicals are presented below. Precautions for handling specific chemicals are contained in Section IV.

A. Basic Rules and Procedures

- 1. Material Safety Data Sheets (MSDSs) for chemicals used or stored in laboratories must be readily available to employees. The Hazard Communication Standard states that laboratories must maintain any MSDS received with incoming shipments of hazardous chemicals.**
- 2. Appropriate eye protection must be worn when working with hazardous chemicals.**
- 3. Chemical containers must be labeled in accordance with the State Hazard Communication Standard.**
- 4. Mouth suction must not be used to pipet chemicals or to start a siphon. A pipet bulb or an aspirator must be used to provide a vacuum.**
- 5. Food and drink must not be stored, handled or consumed in laboratories using hazardous chemicals or radioactive materials. Glassware or utensils that have been used for laboratory operations must never be used to prepare or consume food or beverages. Laboratory refrigerators, ice chests, and cold rooms must not be used for food storage.**
- 6. Skin contact with chemicals should be avoided. Do not smell or taste chemicals.**
- 7. Wash hands before leaving the laboratory area. Never wash with organic solvents.**

- 8. Do not work alone in the laboratory if procedures being conducted are hazardous.**
- 9. Avoid use of contact lenses in the laboratory. If it is necessary to wear contact lenses, notify the laboratory supervisor that you are wearing them and always wear appropriate eye protection.**
- 10. Know the safety precautions that apply to the work that is being done. Determine the potential hazards from information available on the MSDSs, department reference materials, or EHS. Use ventilation systems appropriately.**
- 11. Know the types of protective equipment available, including face shields, gloves, and other special clothing or footwear, and use the proper type for each job.**
- 12. Know the location of and how to use the emergency equipment in your area (emergency showers/eyewashes, fire extinguishers, spill kits, etc.).**
- 13. Know how to obtain additional help in an emergency and be familiar with emergency procedures.**
- 14. Correct or report unsafe conditions in the laboratory. Report unsafe conditions to the laboratory supervisor or EHS.**
- 15. Equipment must be used only for its designed purpose.**
- 16. Reagents must be combined in appropriate order to minimize violent chemical reactions.**
- 17. Reaction apparatus should be positioned and clamped in order to permit manipulation without the need to move the apparatus before the entire reaction is completed.**
- 18. Handle and store laboratory glassware with care to avoid damage. Do not use damaged glassware. Use extra care with apparatus that evacuates air from glassware. Shield or wrap the glassware to contain chemicals and glass fragments should implosion occur.**
- 19. Do not leave operations unattended. If it is necessary to temporarily leave the operation, minimize the time away and provide a brief note on the entrance to the facility about where you are and how long you will be away.**

- 20. Apparatus (vacuum pumps, distillation columns, etc.) which may discharge hazardous vapors, gases, etc., should be vented into exhaust systems (fume hoods, etc.). Do not allow release of hazardous chemicals in cold or warm rooms, since these may have recirculated atmospheres.**
- 21. Fume hoods are not intended for the storage of chemicals. Items stored in fume hoods should be kept to a minimum and should not block vents or alter airflow patterns.**
- 22. Due to the potential for earthquakes, all shelves should be anchored securely to walls, fitted with lipped edges, and enclosed with latched doors. Heavy objects should be stored on lower shelves.**

Give the location of the laboratory spill kit for this laboratory or any special instructions concerning spill clean-up and emergency response.

Location:

Contents:

Instructions for re-stocking:

Building \_\_\_\_\_ Room(s) \_\_\_\_\_

## B. Chemical Procurement, Distribution, and Storage

### 1. Procurement

No container will be accepted without an adequate identifying label (identity of chemical, hazard warnings, manufacturer's name and address).

Before a chemical is received, information on proper handling, storage, and disposal should be known.

### 2. Peroxidizable chemicals must be dated when opened and used or disposed of within the period specified for specific chemical.

### 3. Distribution

When chemicals are hand carried, the container should be placed in an outside container or acid-carrying bucket to protect against breakage and spillage. Freight-only elevators should be used, if possible.

### 4. Laboratory Storage

- a. Hazardous chemicals should be segregated in a well-identified area, and whenever practical chemicals should be stored in vented cabinets. Chemical storage on bench tops is not advised.
- b. Highly hazardous chemicals should be stored in secondary containers that are chemically-resistant and unbreakable.
- c. Stored chemicals should be examined periodically for deterioration, container integrity, or possible replacement.
- d. The amount of chemicals permitted for storage should be as small as practical.
- e. Exposure of chemicals to heat or direct sunlight should be avoided.
- f. Fume hoods are not intended for the storage of chemicals.

## C. Environmental Monitoring

**The employer shall measure the employee's exposure to any regulated hazardous chemical if there is reason to believe that exposure levels for that chemical routinely exceed the action level or in the absence of an action level, the PEL. (WAC 296-62-40007).**

Representative air monitoring is mandatory for the following chemicals because they are regulated by substance-specific health standards:

Acrylonitrile  
1,2-Dibromo-3-chloropropane  
Inorganic Arsenic  
Asbestos  
Ethylene Oxide  
Lead  
Benzene  
Formaldehyde  
Vinyl Chloride

Additional air monitoring may be needed when there is a change in lab procedure or design, which may cause overexposure to hazardous substances.

Events or circumstances that might reasonably constitute overexposure include:

1. A hazardous chemical leaked, spilled, or otherwise was released in an uncontrolled manner.
2. A laboratory employee had direct skin or eye contact with a hazardous chemical.
3. A laboratory employee manifests symptoms such as headache, rash, nausea, coughing, tearing, irritation, or redness of eyes, irritation of throat, dizziness, loss of motor dexterity or judgement, and:
  - a. Some or all of the symptoms disappear when the person is taken away from the exposure area and breathes fresh air.
  - b. The symptoms reappear soon after the employee returns to work with the same hazardous chemicals.

4. Two or more persons in the same laboratory work area have similar complaints.

If you suspect that chemical exposures may exceed permissible limits, contact EHS (963-2252) for assistance with environmental monitoring.

#### D. Housekeeping

1. Do not use stairways, hallways, or mechanical spaces as storage areas.
2. Access to exits, emergency equipment, controls, and the like must never be blocked.
3. Floors should be cleaned regularly and kept free of obstructions. CWU custodial services clean floors in laboratories; however, laboratory personnel must keep floors free of obstructions and hazards to allow custodial staff to do their jobs effectively and safely.
4. The number of chemicals in a laboratory should be kept to a minimum. Avoid stockpiling chemicals. Call EHS to pick up old or unneeded chemicals.
5. Chemical spills should be cleaned up immediately using laboratory spill kits. Contact EHS to dispose of waste.
6. Unlabeled containers and chemical wastes must be disposed of promptly. Always label secondary containers. Unknown waste chemicals are very expensive to identify and dispose of.
7. Equipment and chemicals should be stored properly; clutter should be minimized.
8. Waste should be deposited in appropriate receptacles. Custodial services will not collect waste containing hazardous chemicals.

#### E. Medical Surveillance

**Laboratory employees who suspect they have been overexposed, or are having symptoms consistent with overexposure to a hazardous chemical, will be provided, at a reasonable time and place without cost to the employee, medical examinations and consultations**

**conducted by or under direct supervision of a licensed physician. (WAC 296-62-40001 through 40025).**

Employers must provide employees an opportunity to receive medical services if:

- a. An employee develops signs or symptoms associated with exposure to a hazardous chemical.
- b. Monitoring reveals an exposure level routinely above regulated levels.
- c. A spill, leak, or explosion in the work area results in the likelihood of exposure.

Medical consultation, exams and surveillance, which may be required under the standard, will be coordinated through EHS.

**Staff involved in any emergency situation should go directly to the nearest emergency room or call 911 for assistance.**

To report a non-life-threatening spill, leak, or explosion or a concern regarding monitoring, call EHS at 2252 or 2338.

## F. Personal Protective Equipment

**Principal Investigators (PI's) or laboratory supervisors are required to provide adequate personal protective equipment to employees as required by the WISHA. (WAC 296-24-075).**

1. Apparel
  - a. **Appropriate clothing must be worn, including a protective apron or laboratory coat when working with large quantities of hazardous chemicals that are likely to splash.** Use protective apparel, including face shields, gloves, and other special clothing or footwear as needed.
  - b. Skin, eyes and respiratory tract should always be protected from possible exposure by use of appropriate laboratory clothing, safety glasses and respirators.
  - c. Remove jewelry from wrists and hands to prevent chemicals from collecting underneath, contacting electrical sources, catching on laboratory equipment, and/or damaging the jewelry itself.

- d. To prevent spreading contamination, laboratory coats should be removed before leaving the laboratory.
- e. Loose apparel should be confined.
- f. Open-toed shoes or sandals should not be worn in the laboratory.
- g. Laboratory coats contaminated with hazardous chemicals should be removed immediately.

## 2. Gloves

- a. Appropriate gloves should be worn whenever working with chemicals, rough or sharp-edged objects, or very hot or very cold materials.
- b. Select gloves based on the material being handled, the particular hazard involved, and their suitability for the procedures being conducted. In order to select the appropriate glove, see the glove selection chart in appendix E, read the MSDS, or consult with EHS.
- c. Chemicals eventually permeate gloves. Glove manufacturers list thickness and permeation rates of all gloves for various chemicals. Inspect gloves before each use for discoloration, punctures, and tears.
- c. Gloves should be changed often depending on their frequency of use and permeability to the chemicals being handled.

## 3. Respirators

Respirators should not be needed in a normal laboratory setting. However, if administrative and engineering controls cannot assure that concentrations of airborne hazardous chemicals are maintained below permissible exposure levels (PEL's) or when atmospheric conditions are unknown, respiratory protection must be used. (WAC 296-62-071).

The CWU Respiratory Protection Program is established to ensure a healthful work environment for CWU employees through proper training in the use of respiratory protective equipment. All use of respirators at CWU falls under the requirements of the CWU

Respiratory Protection Program. The requirements of the CWU Respiratory Protection Program are as follows:

- a. A hazard identification/work area evaluation will be conducted by EHS.
- b. Proper selection of respiratory equipment.
- c. Respiratory Protection training, fit testing, and certification is conducted by EHS.
- d. Medical Certification that an employee is physically able to work in a respirator.
- e. Respirator users must be re-certified annually.

For more information about the CWU Respiratory Protection Program call EHS.

## G. Recordkeeping

1. Current chemical inventories must be maintained for each laboratory and made available in case of an emergency.
2. The Chemical Hygiene Plan should be reviewed and updated at least annually by the PI or Laboratory Supervisor and be available to all employees.
3. Employee accident report records are maintained in the EHS office.
4. Environmental Health & Safety maintains records of employee attendance at EHS sponsored safety and health training. Copies of these records are available to departments on request. The PI or Laboratory Supervisor should maintain records of all internal safety and health training.

## H. Signage and Labeling

1. Chemicals must have the manufacturer's name and address, the chemical name, and the hazard warning printed on the original label.
2. Chemicals transferred from the original container to secondary containers must be labeled with chemical name and hazard

warnings. The only exception is when the chemical will be used by one person within their work shift.

3. Emergency telephone numbers to be called in case of fire, accident, hazardous chemical spill or other emergency should be posted prominently in each laboratory and on each telephone.
4. Emergency contact telephone numbers should be posted on the outside of the laboratory entrance.
5. Location signs should be posted for safety showers, eyewash stations, fire extinguishers, first aid equipment, exits and other safety equipment. Areas should be labeled where food and beverages are NOT to be consumed or stored.
6. Warnings should be posted in areas or on equipment where special or unusual hazards exist.

## I. Chemical Spill/Accident Response Guidelines and Reporting Requirements

1. Laboratory Spill Response Guidelines
  - a. Spills that do not endanger workers in the immediate area may be cleaned up by laboratory personnel that are properly equipped to handle the situation. Chemical spill guidelines should be established by the PI or lab supervisor and should take into consideration the following:
    - The hazards of the chemicals involved
    - The amount of the chemicals spilled
    - The possible spill locations
    - Availability of spill clean up materials or kits
  - b. If the spill is large and/or extremely hazardous:
    1. Evacuate all personnel from the area.
    2. Report the event to:

Fire Dept.	911 (Campus Police will be notified)
EHS	2252 or 2338
3. When placing an emergency call:
  - Give your name
  - Give your location (room & Building)
  - Give the phone number you are using
  - Describe the emergency/injuries

-Advise emergency responders of details when they arrive

## 2. Reporting Accidents

- a. For any incident involving personal injury, seek medical attention immediately.
- b. EHS requires CWU Accident/Incident Report to be filed within 24 hours following the accident. For copies of the form and assistance call EHS at 2248. The forms should be available in the departmental office.
- c. When medical treatment is required for a work-related injury or illness; fill out a Washington State Department of Labor and Industries Accident Report available from your health care provider.

## J. Training and Information

The Principal Investigator (PI) or laboratory supervisor must provide employees with information and training to ensure that they understand the hazards of the chemicals present in their work area. (EHS has a variety of resources to assist in this process.)

1. Chemical hazard information must be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The employing department must provide this information.

Employees shall be informed of:

- a. The contents of the Laboratory Safety Standard: Appendix A.
- b. Location and availability of the Chemical Hygiene Plan
- c. Permissible Exposure Limits
- d. Signs and symptoms of overexposure: Information from Material Safety Data Sheets or other references.
- e. Laboratory safety references
- f. Labeling requirements

2. Employee training shall include:
  - a. Methods and observations that may be used to detect the presence or release of hazardous chemicals.
  - b. The physical and health hazards of chemicals in the work area.
  - c. The measures that employees can take to protect themselves from these hazards, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.
  - d. The applicable details of the laboratory's Chemical Hygiene Plan.

#### K. Material Safety Data Sheets

1. Material Safety Data Sheets (MSDS) are documents provided by manufacturers describing the physical and health hazards of hazardous chemicals and trade name products and must be accessible to all employees on all work shifts. Laboratories must keep on file any MSDS received with incoming shipments of hazardous chemicals. (WAC 296-62-05403).

#### L. Chemical Inventories

1. An inventory must be provided for each room where chemicals are used and/or stored.

### III. Laboratory Facilities

**In working with hazardous chemicals, chemical exposures must be prevented whenever possible by using auxiliary local ventilation devices and safety equipment. (WAC 296-62-40001 through 40025).**

#### A. Floor Plan for Laboratory

Draw a floor plan for each room of your laboratory. Note the location of the following safety equipment and other safety features as appropriate.

1. Eyewash stations
2. Emergency showers
3. Flammable liquid storage cabinets
4. Fire extinguishers
5. First Aid kits (if applicable)
6. Auxiliary local ventilation systems
7. Laboratory spill kit
8. Emergency phone number sheet
9. Direction of exit
10. Gas turn-off valve
11. Circuit Breaker box
12. Designated Area for hazardous chemical use\*

\* A designated area must be established for work with select carcinogens, reproductive toxins, or chemicals that have a high degree of acute toxicity (see section IV). The entire laboratory, a fume hood, or a portion of the laboratory may be considered as a designated area.

#### B. Safety Equipment

This section contains a general list of types of safety equipment found in CWU laboratories, including information on use and maintenance.

## Eyewash stations

- a. Flush the eyewash stations in your laboratory at least weekly. Eyewash stations should provide a soft stream or spray of water no less than 1.5 liters per minute for at least fifteen minutes. (WAC 296-62-130).
- b. Laboratory personnel must be able to reach eyewash stations within ten seconds and be within a travel distance of no more than 50 feet. (WAC 296-62-130).
- c. Because chemical splashes to the eyes may impair vision, laboratory workers should memorize the location and usage of all eyewash stations in the area.
- d. When used, flush eye for at least fifteen minutes holding the eyelid open. Prompt medical attention is important regardless of the severity of the injury.

## 2. Emergency Showers

- a. Safety showers are tested by EHS to ensure the valve is operating, that all debris is removed from the system, and that safety showers have sufficient flow of water (no less than 30 gallons per minute). (WAC 296-62-130).
- b. Laboratory personnel must be able to reach showers within ten seconds and be within a travel distance of no more than 50 feet. (WAC 296- 62-130).
- c. Every laboratory worker should know the location of all safety showers in their area and how to use them.
- d. When used, remove contaminated apparel, flush area for fifteen minutes and obtain medical attention.

## 3. Flammable Liquid Storage Cabinets

- a. Maximum capacity: The quantity of Class I or Class II liquids shall not exceed 60 gallons and the total quantity of all liquids, including Class III, may not exceed 120 gallons.
- b. Cabinets must be labeled "Flammable - Keep Fire Away". (WAC 296-24-140).

- c. Storage of flammable liquids in excess of ten gallons must be stored in an UL listed or Factory Mutual (FM) approved flammable liquid storage cabinet outfitted with approved automatic or self-closing doors.
- d. Contact Environmental Health & Safety at 963-2252 for further information on flammable liquid storage cabinets.

NOTE: A storage cabinet for flammable liquids is NOT fireproof, but protects the contents from extreme temperatures for a limited time.

#### 4. Flammable Storage Refrigerators

Flammable chemicals or chemical mixtures which are required to be stored below room temperature must be stored in refrigerators or freezers specifically designed by the manufacturer to be explosion proof. All other refrigerators or freezers not specifically designed to be explosion proof should be labeled with a prominent warning sign indicating that they are unsuitable for the storage of flammable substances. For warning signs or information regarding Flammable Storage Refrigerator purchase, contact Environmental Health & Safety at 963-2252.

#### 5. Fire Extinguishers

University laboratories using hazardous chemicals should have a BC or ABC rated dry chemical fire extinguisher within 30 ft of any exit. These extinguishers are to be used on ordinary combustibles, flammable liquids, and electrical fires.

#### 6. First Aid Kits

The Washington State Department of Labor and Industries requires that first aid supplies be readily accessible to all employees at all times of day.

#### 7. Laboratory Spill Kits

All laboratories must have spill kits immediately available. The kits must be appropriate for the types of chemicals in the lab.

### C. Ventilation

**Permissible Exposure Limits (PEL's) established by the Washington Industrial Safety and Health Administration (WISHA) shall not be exceeded.**

Eight-hour and short-term permissible exposure limits to many chemicals have been set by WISHA to prevent adverse effects in workers. Local exhaust ventilation systems may be required in order to reduce exposure levels to these acceptable limits. For assistance in measuring chemical exposures and in comparing them to the appropriate limits, please contact Environmental Health & Safety 963-2252.

#### 1. Safe Fume Hood Use

Dilution ventilation or capture of chemical vapors and particles may control chemical exposure by local exhaust ventilation. The primary means of control should be by local exhaust ventilation with dilution ventilation as a back up to remove contaminants that escape local exhaust fume hoods.

- a. Perchloric acid **MUST** be used in a closed system or within a specially designed acid fume hood with wash down systems to prevent the accumulation of explosive perchlorates in the fume hood.
- b. Fume hood capture velocity is adversely affected by cross drafts and eddy currents. Cross- drafts occur when people walk in front of a fume hood or when nearby windows or doors are open. Eddy currents also occur around the person using the fume hood and around objects inside it. To limit these effects, fume hoods should not contain unnecessary objects and equipment should be placed as far to the back of the fume hood as practical. Work should be performed at least six inches inside the opening.
- c. Operations such as ongoing reactions, heating, or evaporating solvents, and transfer of chemicals from one container to another should normally be performed in a hood.
- d. If especially hazardous or corrosive vapors will be evolved, these exit gases should be passed through scrubbers or absorption trains.
- e. Control the rate and velocity of the released vapors and particles from chemical reactions in order to minimize risk of exposure.
- f. Sliding sashes should be kept closed or down to the lowest practical level to improve overall performance of the hood. Reacting chemicals placed in the fume hood with the sash closed places a physical barrier between workers and

chemical reactions. When hoods are not in use the sash should be closed (energy conservation).

- g. There should be an adequate number of fume hoods to accommodate research needs. Recommended guidelines are: One fume hood for each two workers, and the fume hoods should be large enough to provide each worker with at least 2.5 linear feet of working space at the face.
  - h. Fume hoods should not be regarded as the means for disposing of chemicals. Thus apparatus used in hoods should be fitted with condensers, traps, or scrubbers to contain and collect waste solvents or hazardous vapors or dusts. Highly hazardous or offensive vapors should always be scrubbed or absorbed before the exit gases are released into the fume hood exhaust.
  - i. Fume hoods should be tested to ensure adequate face velocities (typically 80-120 linear feet per minute) with the sash fully open. EHS will check the fume hood air velocities annually. If you suspect low face velocities or if the monitor alarm sounds, notify EHS and FMD.
  - j. Whenever practical, chemicals or apparatus should be moved from fume hoods to vented cabinets for storage where needed. Fume hoods are not to be used for storage purposes.
  - k. An emergency plan should be prepared for the event of ventilation failure or other unexpected occurrences that could disrupt fume hood function.
  - l. Use only explosion proof electrical equipment in fume hoods where flammable liquids are present.
2. Other Ventilation Systems
- a. If other exhaust systems are used in the laboratory, they must be installed by FMD.
  - b. Do not attach canopy hoods or snorkel systems to existing fume hood exhaust ducts without consulting FMD.
  - c. Glove boxes generally operate under negative pressure, though some operate under positive pressure in which case leaks could cause problems. Positive pressure glove boxes

should be thoroughly tested before each use and there should be a method of monitoring the integrity of the system (such as a shutoff valve or a pressure gauge designed into it).

- d. Hazardous chemicals should be stored in cabinets fitted with auxiliary local ventilation.
  - e. Laboratory apparatus that may discharge hazardous vapors (vacuum pumps, gas chromatographs, liquid chromatographs, and distillation columns) should be vented to an auxiliary local exhaust system such as a canopy or a snorkel.
3. Maintenance of Ventilation Systems
- a. Fume hood and other protective equipment must function properly. Specific measures must be taken to ensure proper and adequate performance of all ventilation systems. (WAC 296-62-40009).
  - b. Laboratory ventilation equipment scheduled for maintenance or repair work must be cleaned and/or decontaminated by laboratory personnel. Maintenance workers have the right to refuse to do work if the area or equipment is not clear of hazards.
  - c. All ventilation systems need routine maintenance for blocked or plugged air intakes and exhausts, loose belts, bearings in need of lubrication, motors in need of attention, corroded duct work, and minor component failure.
  - d. Filters should be replaced periodically in certain types of ventilation systems, such as electrostatic precipitators and cyclones for dust collection.
  - e. Monitoring devices have been installed in ventilation systems to keep the user aware of malfunctions.

## IV. Standard Operating Procedures

**Laboratories must provide employees with standard operating procedures (SOP's) to be followed when laboratory work involves the use of laboratory chemicals. (WAC 296-62-40001 through 40025).**

### A. Definitions

Standard Operating Procedures (SOP's) are required written safety and health guidelines for work with hazardous chemicals. "Hazardous chemicals" are defined as having statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees.

Included in the definition of hazardous chemical is a select group of chemicals that will require additional handling provisions. This group is referred to in the Laboratory Safety Standard as "particularly hazardous substances" and includes chemicals that meet any of the following criteria:

#### 1. High degree of acute toxicity:

The Environmental Protection Agency (EPA) has adopted the following criteria to identify acutely toxic chemicals based on data from mammalian testing.

- a. Dermal route: the median lethal dose ( $LD_{50}$ ) is less than or equal to 50 mg/kg.
- b. Oral route: the median lethal dose ( $LD_{50}$ ) is less than or equal to 25 mg/kg.
- c. Inhalation route: the median lethal concentration ( $LC_{50}$ ) is less than or equal to 0.5 mg/l where time of exposure is any time up to 8 hours.

$LD_{50}$  is a single dose of material expected to kill 50% of a group of test animals.  $LC_{50}$  is a calculated concentration of a material in air, exposure to which for a specified length of time is expected to cause death of 50% of a defined experimental animal population.

#### 2. Select carcinogens(Appendix I):

- a. Listed as "known carcinogens" in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition), or

- b. Listed under Group 1 (carcinogenic to humans) by the International Agency for Research on Cancer (IARC) Monographs (latest editions), or
  - c. Listed in either Groups 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:
    - 1. 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/m<sup>3</sup>; or
    - 2. After repeated skin application of less than 300 mg/kg of body weight per week; or
    - 3. After oral dosages of less than 50 mg/kg of body weight per day.
  - d. Listed as a WISHA regulated carcinogen.
3. Reproductive toxins (Appendix J)

Use Material Safety Data Sheets (MSDS) to assist in determining whether chemicals are hazardous or particularly hazardous. Environmental Health & Safety will provide assistance in identifying hazardous chemicals.

## B. Guidelines

Standard Operating Procedures (SOP's) are required to be written for chemicals currently in use in the laboratory. When new chemicals are introduced for use they must be included in existing SOP's or in a new SOP.

Standard Operating Procedures must be written in one or more of the following ways:

- 1. By process, such as distillation, peptide synthesis, or glove box use.
- 2. By each hazardous chemical, such as benzene.
- 3. By class of hazardous chemicals, such as organic solvents or peroxidizable chemicals.

In appendix G, there are examples of standard operating procedure formats that you may use. If you already have SOP's for pieces of equipment, chemical processes, mixture preparation, etc., attach those to this portion of the Chemical Hygiene Plan (CHP). You may organize or format this information in any way that makes it useful to the employees of this area as long as the required elements are addressed.

### C. Required Elements of Standard Operating Procedures (SOP's)

The following eleven required elements must be included in your SOP's. Elements 1 through 8 must be completed for each process, class of chemicals, or individual chemical. For "particularly hazardous substances" three additional elements, 9 through 12 are required to be completed. A form titled "Standard Operating Procedures for Hazardous Chemicals" has been provided with the eleven required elements listed on it.

#### Element 1. Process

If applicable, list the process or type of process that involves the use of hazardous chemicals in this laboratory. This process may be described in general terms, such as "extraction" and "distillation" or in more detailed terms, such as "spectrophotometer analysis of cholesterol extraction". If processes do not apply to your laboratory then proceed to Element 2b.

#### Element 2. Hazardous Chemicals/Class of Hazardous Chemicals

- a. For each process, list the hazardous chemicals and the expected by-products produced; or
- b. List the class of chemicals or individual chemicals presently used in your laboratory.

#### Element 3. Personal Protective Equipment

Discuss the personal protective equipment and hygiene practices used with each process, class of chemicals or individual chemical.

- a. Personal protective equipment includes gloves, coats/garments, eyeglasses, goggles, face-shields, and air purifying respirators. Include the type of gloves needed for each phase of the process. If

laboratory coats, eye protection or respirators are required, indicate when and why.

- b. For respirator use, include the type of respirator that should be worn, the kind of cartridges to be used, how often the cartridges should be changed, and how fit testing will be provided.
- c. If the processes and/or chemicals used in your laboratory are changing on a daily basis, making it difficult to be specific concerning personal protective equipment, then list the specific references available in your laboratory that contain personal protective equipment information. Employees should then be required to determine the appropriate protective equipment to wear before using any laboratory chemical and/or equipment.

Element 4. Engineering/Ventilation Controls

Please describe engineering controls designed to reduce employee exposures to hazardous chemicals, such as ventilation devices, aerosol suppression devices, and safety features on equipment.

Element 5. Special Handling Procedures and Storage Requirements

- a. Describe storage requirements for hazardous chemicals in your laboratory. Include restricted access plans, ventilation systems used, special containment devices, etc.
- b. Describe safe methods of transporting chemicals, such as double containment and the use of freight elevators.

Element 6. Spill and Accident Procedures

Indicate how spills or accidental releases will be handled and by whom.

Element 7. Waste Disposal

Describe Waste disposal procedures for these chemicals.

Element 8. Special Precautions for Animal Use

Indicate whether any of these chemicals are being administered to animals. Describe safety procedures that apply to working with animals (e.g. aerosol suppression devices, animal waste disposal).

**Elements number 9 through 11 below should be answered only if work involves the use of "Particularly Hazardous Substances".**

Element 9. Approval Required

Discuss the circumstances under which a particular laboratory operation, procedure, or activity will require prior approval from the department before implementation.

Element 10. Decontamination

Discuss decontamination procedures for equipment and glassware. Include controlled areas (glove boxes, restricted access hoods, perchloric acid fume hoods, or designated portions of the laboratory) in your discussion.

Element 11. Designated Area

Indicate the designated area for your laboratory. A DESIGNATED AREA must be established for work with "Particularly Hazardous Substances". The entire laboratory, a fume hood, or a portion of the laboratory may be considered as a designated area.