

Willamette University Chemical Hygiene Plan

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Table of Contents

<u>Section</u>	<u>Title</u>
0.0.....	Important Contact Information & Resources
1.0.....	Chemical Hygiene Plan
2.0.....	Safe Operating Procedures
3.0.....	Employer Criteria for Control Measures
4.0.....	Respiratory Protection
5.0.....	Fume Hood and Protective Equipment
6.0.....	Employee Information and Training
7.0.....	Prior Approval Circumstances
8.0.....	Medical Consultations and Exam
9.0.....	Designation of Responsible Person
10.0.....	Employee Protection Provisions
11.0.....	Recordkeeping
12.0.....	Annual Review

APPENDICES

- APPENDIX A Laboratory Specific SOP Template & Examples
- APPENDIX B Examples of High Hazard Chemicals
- APPENDIX C DHS List of Reportable Chemicals
- APPENDIX D Common SOPs
- APPENDIX E Alphabetical List of Abbreviated Terms

Introduction

The implementation of this Chemical Hygiene Plan provides employees with the information and training necessary to improve workplace safety and health and to prevent chemical-related injuries and illnesses in our laboratories. This plan will act as a supplement to the Willamette University Hazard Communication Program and provide more detailed information regarding the methods and practices necessary from the hazards associated with using chemicals at Willamette University

OSHA standard 29 CFR 1910.1450, the Occupational Exposure to Hazardous Chemicals in Laboratories standard, requires a written Chemical Hygiene Plan. This document will serve as the Chemical Hygiene Plan for the Willamette University.



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0.0 Important Contact Information & Resources

Emergency Response	911
Willamette University Campus Safety	503-370- 6911
Willamette University Physical Plant	503-370-6003

OSHA 29 CFR 1910.1450: Occupational exposure to hazardous chemicals in laboratories
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=10106

National Research Council of the National Academies
<http://dels.nas.edu/resources/static-assets/bcst/miscellaneous/Chemical-Laboratory-Safety-and-Security.pdf>

Office of Research Services – National Institutes of Health: Resources for Lab Workers
<http://www.ors.od.nih.gov/sr/dohs/Resources/lab/Pages/default.aspx>

American Chemical Society
<http://portal.acs.org/portal/acs/corg/content>

Division on Earth & Life Studies: Board on Chemical Sciences & Technology
<http://dels.nas.edu/bcst>

1.0 Chemical Hygiene Plan

1.1 ORGANIZATION OF PLAN

In accordance with the Occupational Safety and Health Administration's (OSHA) Occupational Exposure to Hazardous Chemicals in Laboratories standard (29 CFR 1910.1450), referred to as the Laboratory Standard, the following mandatory elements are included in this Chemical Hygiene Plan (CHP):

- Safe Operating Procedures (SOPs)
- Employer criteria for control measures
- Fume hoods and other protective equipment
- Employee information and training
- Prior approval circumstances
- Medical consultation and medical examinations
- Designation of responsible personnel
- Employee protection provisions for particularly hazardous substances

1.2 RESPONSIBILITIES

The Chemical Hygiene Officer (CHO) has been assigned the responsibility for implementing the Willamette University Chemical Hygiene Plan (CHP). The CHO and the University Safety Committee will review the CHP annually and update it as necessary. Copies of the written program can be obtained online at <http://willamette.edu/about/federal-compliance/index.html>

It is the responsibility of Primary Investigators (PIs), lab managers, instructors, and supervisors to:

- 1 Perform hazard analyses for specific laboratory, studio, or other work processes
Examples can be obtained from *lcoop@willamette.edu*
- 2 Develop Safe Operating Procedures (SOPs) for specific laboratory, studio, or other work processes (See Appendix A)
- 3 Provide and document general safety training as well as training needs identified by specific hazards analysis
- 4 Comply with routine inspections and make corrections of violations

2.0 Safe Operating Procedures

2.1 UNIFORMITY OF PRACTICE

Uniformity of practice during potentially hazardous activities ensures safety and efficiency. SOPs create a standard of practice that is to be followed by **ALL** Faculty, Staff, and Students working in the laboratory. They assure that work practices and procedures are in place to protect employees and students from chemical and physical hazards.

The following guidelines represent the **MINIMUM** safe practices for the performance of hazardous activities in laboratories and studios at Willamette University. Each laboratory and studio **MUST** develop procedures specific to their situations. In **ALL** situations, individual faculty and staff are responsible for enforcing safety measures in the area under their supervision. A template for the development of activity-specific SOPs is located in Appendix A. SOPs for common laboratory practices are found in Appendix B.

2.2 SAFE OPERATING PROCEDURES FOR ALL LABORATORIES

Accidents and spills

Eye Contact: Promptly flush eyes with water for at least 15 minutes and seek medical attention.

Ingestion: Follow Safety Data Sheet (SDS) recommendations and seek medical attention.

Skin Contact: Promptly flush the affected area with water for at least 15 minutes and remove any contaminated clothing. Follow SDS recommendations and seek medical attention.

Clean up: Promptly clean up spills using appropriate protective apparel and equipment, and proper disposal procedures.

Avoidance of "routine" exposure

Develop and encourage safe habits. Avoid unnecessary exposure to chemicals. Do not smell or taste chemicals. Vent any apparatus (vacuum pumps, distillation columns, etc.) that might discharge toxic chemicals into some type of local exhaust device (fume hood). Inspect gloves and test glove boxes before use. Do not allow release of toxic substances in cold rooms and warm rooms, since these have re-circulated atmospheres.

Choice of chemicals

Use only those chemicals for which the quality of the available ventilation system is appropriate. Whenever possible, use the least toxic chemical options.

Eating, smoking, etc.

Eating, drinking, gum chewing, or application of cosmetics in areas where laboratory chemicals are present is prohibited. Wash hands before conducting these activities elsewhere. Do not store food or beverages in storage areas or refrigerators used for laboratory operations. Do not consume food or drink using glassware or utensils that have been used for laboratory operations.

Equipment and glassware

Use equipment only for its designed purpose. Handle and store laboratory glassware with care; do not use damaged glassware. Shield or wrap glassware to contain chemicals and fragments in procedures that have the potential for implosion or explosion.

Exiting

Thoroughly wash areas of exposed skin before leaving the laboratory. Do not wear lab coats outside the lab. Do not take lab coats into areas designated for food consumption or non-laboratory activities. Maintain them inside the designated work area.

Horseplay

The lab can be a fun and interesting place. It is important to realize that practical jokes and pranks can lead to accidents. Do not engage in horseplay when in the lab.

Mouth suction

Do not use mouth suction for pipetting or starting a siphon.

Personal apparel

Confine long hair and loose clothing to prevent contact with chemicals. Wear fully enclosed shoes at all times in the laboratory. Wear long pants or a long skirt to cover legs. Wear long sleeves or a lab coat to cover arms. When possible, choose fabrics such as cotton and wool that are not easily ignited.

Personal housekeeping

Keep the work area clean and uncluttered; properly label and store chemicals and equipment; clean the work area on completion of an operation or at the end of each day.

Personal protection

Assure that all persons, including visitors to areas where chemicals are stored or handled, wear appropriate eye protection. Wear appropriate gloves when the potential for contact with toxic materials exists; inspect the gloves before each use, and replace them periodically. Use appropriate respiratory equipment when air contaminant concentrations are not sufficiently

restricted by engineering controls. Inspect respirators before use. Use additional protective and emergency apparel and equipment as appropriate. Remove laboratory coats immediately on significant contamination. Remove gloves before exiting lab or when changing tasks (i.e., computer use).

Planning

Seek information and advice about hazards, plan appropriate protective procedures and waste disposal, and plan positioning of equipment before beginning any new operation.

Unattended operations

Leave lights on, place an appropriate sign on the door, and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water) to an unattended operation.

Use of fume hood

Use the fume hood for operations which might result in release of toxic chemical vapors or dust. As a rule of thumb, use a fume hood or other local ventilation device when working with any appreciably volatile substance with a Threshold Limit Value (TLV) of less than 50 parts per million (ppm). Confirm adequate hood performance before use; keep hood closed at all times except when adjustments within the hood are being made; minimize storage of materials in hoods and do not allow anything to block vents or air flow. Leave the hood "on" when it is not in active use if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off".

Use of Vacuum (House System)

Many labs are equipped with a house-vacuum system. This is a shared system in which all connections lead to a central collection tank. Any chemical or biological materials requiring vacuum processes must be filtered or trapped using an appropriate means of collecting hazardous vapors or particulate matter prior to entering the vacuum system. Appropriate methods can include cold-traps, kill-traps, aspirators or individual vacuum pumps exhausted through a chemical fume hood.

Vigilance

Be alert to unsafe conditions and see that they are corrected when detected.

Waste disposal

Assure that each laboratory includes plans and training for waste disposal.

Working alone

Avoid working alone in a building; **DO NOT** work alone in a laboratory if the procedures being conducted are hazardous.

3.0 Employer Criteria for Control Measures

Based on OSHA regulations, criteria have been developed for determining and implementing control measures to reduce employee exposure to hazardous materials in the workplace. These include:

1. The degree of toxicity of the substances to be used
2. The exposure potential of the chemical procedures to be performed and the capacity of the engineering controls
3. Administrative/work practices or protective equipment to control exposure
4. Engineering controls: general ventilation, fume hoods, glove boxes, and other exhausts systems
5. Work practice: controls such as restricting eating and drinking areas, prohibiting mouth pipetting, and performing work in such a manner as to minimize exposure to hazardous chemicals and to maximize the effectiveness of engineering controls
6. Personal protective equipment (PPE): the type of PPE available and how it should be used

4.0 Respiratory Protection

Respiratory protection is to be used only as an interim measure or when engineering or work practice controls are not feasible. Use of respiratory equipment must comply with the requirements of Title 29 CFR 1910.134, which specifies factors such as selection, medical clearance, fit, use, and maintenance. Respirator criteria will be based on the degree of toxicity of the substances to be used, the exposure potential of the chemical procedures to be performed and the capacity of the engineering controls, administrative practices, or protective equipment to control employee exposure. Additional requirements must be included in the CHP where appropriate to protect employees working with particularly hazardous chemicals, such as select carcinogens, teratogens, and chemicals exhibiting a high degree of acute toxicity. Each employee **MUST** be cleared by a physician to wear a respirator. The clearance consists of a Pulmonary Function Test (PFT) and chest X-Ray. It is recommended that students also be medically cleared to wear a respirator if a hazard assessment deems this level of protection to be necessary.

5.0 Fume Hoods and Other Protective Equipment

Fume hoods and other protective equipment must function properly. Specific measures are taken to ensure proper and adequate performance of such equipment as listed below.

Hoods: A laboratory hood with 2.5 linear feet of hood space per person is required when handling hazardous chemicals. If a fume hood does not have a continuous monitoring device to verify proper performance, then substances of unknown toxicity must be avoided or other types of local ventilation provided.

Other local ventilation devices: Ventilated storage cabinets, canopy hoods, snorkels, etc. are provided as needed by each department. Each canopy hood or snorkel should have a separate exhaust duct.

Modifications: Alteration of the ventilation system requires thorough testing to verify that worker protection from airborne toxic substances is adequate.

Performance: A rate of 4-12 room air changes/hour is adequate ventilation if local exhaust systems, such as hoods, are used as the primary method of control.

Quality: General airflow should not be turbulent and should be relatively uniform throughout the laboratory, with no high velocity or static areas; airflow into and within the hood should not be excessively turbulent; hood face velocity should be 80-120 linear feet per minute (lfm) at any point with an average face velocity of 100 lfm.

Evaluation: Quality and quantity of ventilation must be evaluated upon installation, monitored, and reevaluated whenever a change in local ventilation devices is made. Facilities services will certify that fume hoods meet flow requirements at least annually or as needed.

6.0 Employee Information and Training

Willamette University provides all persons affected by 29 CFR 1910.1450 with information regarding how to protect themselves when working with hazardous chemicals. Training will be provided to new employees upon hire, if working with a new hazard, and at least annually. The CHO or University Safety Education Officer will provide training, to include the following components:

1. The components of the Chemical Hygiene Plan and how it is implemented in the workplace.
2. The hazards of the chemicals in the work area and protective measures required.
3. Specific procedures put into effect by the employer to provide protection, including engineering controls, work practices, and PPE.
4. Methods and observations (e.g., continuous monitoring procedures, visual appearance, or odors) that workers can use to detect the presence of hazardous chemicals.

7.0 Approval for Hazardous Operations

Laboratory activities involving particularly hazardous materials, equipment, or that will require specific engineering controls (glove boxes, specialized ventilation systems, storage systems, etc.) require prior approval from the CHO and department head. Examples of particularly hazardous materials are listed in section 10.0 of this document, and in Appendix C: Examples of Hazardous Chemicals.

8.0 Medical Consultations and Examination

8.1 AVAILABILITY

All employees who work with hazardous chemicals will have an opportunity to receive medical attention, including any follow-up examinations that an examining physician determines necessary, under the following circumstances:

1. Whenever an employee develops symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory.
2. Where exposure monitoring reveals an exposure level above the action level or PEL for a regulated substance for which there are exposure monitoring and medical surveillance requirements.
3. Whenever a spill, leak or other incident results in the likelihood of a hazardous exposure.

8.2 ARRANGING FOR EXAMS

All medical examinations and consultations shall be coordinated through WU Human Resources. In the event of a life-threatening illness or injury, dial 911 and request an ambulance.

9.0 Designation of Responsible Personnel

9.1 CHEMICAL HYGIENE OFFICER

The CHO is qualified by training or experience to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan required by OSHA 1910.1450 Laboratory Standard. The CHO may assign areas of responsibility to departments, department safety and health committees, supervisors, and other individuals, as necessary, to implement and carry out the provisions of the CHP.

9.2 DEPARTMENT HEADS

- Implement and maintain the CHP in their respective work areas.
- Provide means and motivations to allow all supervisors and employees to comply with occupational safety regulations.

Selection of one or more individuals to serve as coordinators may allow more efficient implementation of the CHP. Department safety and health committees can also assume these responsibilities.

9.3 LABORATORY SUPERVISORS AND PRINCIPAL INVESTIGATORS

- Ensure workers know and follow the chemical hygiene rules.
- Ensure Hazard Assessments have been conducted and a written hazard assessment certification has been posted in each work area.
- Provide clean, functioning PPE and other protective equipment.
- Provide appropriate information and training.
- Implement good housekeeping practices.
- Promptly satisfy requests for information or action from the CHO or University Safety Committee.

- Customize their work area's Chemical Hygiene Plan as needed to provide specific Safe Operating Procedures, Emergency Procedures, and circumstances or operations requiring prior approval of the supervisor, if the hazards of the laboratory work are not sufficiently addressed by the non-customized CHP.

In customizing the work area Chemical Hygiene Plan, it is only permissible for the supervisor to add and clarify the requirements, standard operating procedures, restrictions and necessary protocols, not to omit or relax any which are given in the manual.

9.4 LABORATORY WORKERS

- Plan and conduct operations in accordance with University chemical hygiene procedures and for develop good personal chemical hygiene habits.

While students are not covered under the provisions of the OSHA Laboratory Standard, they should be made aware of chemical health and safety hazards in classroom situations, and provided with information and equipment to protect themselves from those hazards. Departments will provide specific safety training at the beginning of each course or class in which hazardous chemicals or equipment will be used.

10.0 Employee Protection Provisions

PARTICULARLY HAZARDOUS SUBSTANCES

Special provisions must be in place to protect employees working with select carcinogens, teratogens, or substances having a high degree of acute toxicity. These provisions include designated work areas, special containment devices in those work areas, decontamination procedures, waste removal procedures, and safe operating procedures. Work with particularly hazardous materials requires approval from the CHO and department head before work may begin. (See section 7.0)

A. ALLERGENS AND EMBRYOTOXINS

1. Allergens and Sensitizers

- Examples: diazomethane, isocyanates, bichromates
- Wear suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity.

2. Embryotoxins

- Examples: organomercurials, lead compounds, formamide
- Women of childbearing age must only handle these substances in a hood where satisfactory performance has been confirmed and use appropriate protective apparel (especially gloves) to prevent skin contact. Review uses annually or whenever a procedural change is made.

B. CHEMICALS OF MODERATE, CHRONIC OR HIGHLY ACUTE TOXICITY

Acutely toxic substances produce adverse effects when exposed individuals receive only small doses of that substance for a short period of time (hydrogen fluoride, for example). OSHA defines substances that have a high degree of acute toxicity as those “which may be fatal or cause damage to target organs as the results of a single exposure or exposures of short duration.” For many chemicals, the health effects in humans may not have been tested. Frequently, only basic animal testing has been done, such as the LD50 or the LC50. The LD50 is the Lethal Dose that kills 50 percent of the animals when the chemical is given orally or applied to the skin. The LC50 is the Lethal Concentration in air that kills 50 percent of the animals.

1. Access: Use and store these substances only in areas of restricted access. Assure that the controlled area is conspicuously marked with warning and restricted access signs and that all containers of these substances are appropriately labeled.
2. Location: Always use a hood or other containment device for procedures that can result in generation of aerosols or vapors; trap released vapors to prevent their discharge with the hood exhaust. Use a wet mop or a vacuum cleaner equipped with a HEPA filter instead of dry sweeping if the toxic substance is a dry powder.
3. PPE: Avoid skin contact by use of gloves, long sleeves, and other protective apparel as appropriate. Wash hands and arms immediately after working with these materials.
4. Records: Maintain records of the amounts of these materials on hand, amounts used, and the names of the workers involved.
5. Medical Surveillance: If using toxicologically significant quantities on a regular basis (three times per week or more), consult a qualified physician concerning regular medical surveillance.
6. Spills: Assure that contingency plans, equipment, and materials to minimize exposures of people and property in case of accident are available. Assure that at least two people are present at all times if a compound in use is highly toxic or of unknown toxicity. Store containers of these substances below eye level, in chemically resistant trays or other secondary containment, and in a limited access area. Perform work with these substances on spill trays. If a spill occurs outside the fume hood, evacuate the area; assure that cleanup personnel wear suitable protective apparel and equipment.
7. Housekeeping: Thoroughly decontaminate or incinerate contaminated clothing or shoes. Store contaminated materials and waste in closed, suitably labeled, impervious containers. Protect vacuum pumps against contamination by scrubbers or HEPA filters and vent them into the hood. Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the hood before removing them from the controlled area. Decontaminate the controlled area before normal work is resumed.
8. Glove boxes: For a negative pressure glove box, ventilation rate must be at least two volume changes per hour and pressure at least 0.5 inches of water. For a positive pressure glove box, thoroughly check for leaks before each use. In either case, trap the

exit gases or filter them through a HEPA filter and then release them into an operating fume hood.

11.0 Recordkeeping

11.1. EXPOSURE ASSESSMENT

The Chemical Hygiene Officer will establish and maintain an accurate record of any measurements taken to monitor exposures. Records, including those from monitoring provided by other qualified services, will be managed in accordance with OSHA standard 29 CFR 1910.1020, Access to Employee Exposure and Medical Records.

11.2. TRAINING

A copy of the outline of topics covered in Lab-Specific Chemical Hygiene Training must be kept with other training documents in the Lab Safety Training Kit. Training records are kept for at least three years after an employee or student leaves the University. Records for those who no longer work in a specific lab may be transferred to the CHO for storage.

11.3. FUME HOOD MONITORING

Data on annual fume hood monitoring will be kept by the Facilities Office. Fume hood monitoring data are considered maintenance records, and as such, the full data will be kept for one year and summary data for five years.

11.4. INSPECTION REPORTS

Laboratory inspection records will be maintained by the CHO.

11.5. LABORATORY-SPECIFIC SOPS

Laboratory-specific SOPs must be maintained in the appropriate laboratory and made accessible to all laboratory personnel.

12.0 Annual Chemical Hygiene Plan Review

The CHO and the University Safety Committee will review the University's Chemical Hygiene Plan annually or as needed.

Appendix A: Template for Laboratory Specific SOP

1.0 TITLE

2.0 RESPONSIBILITIES - List who is responsible (by job title) for performing work, maintaining records, providing training, and ensuring that this procedure is carried out.

3.0 DEFINITIONS - List any terms, acronyms or abbreviations used that might not be commonly understood by a person new to this SOP.

4.0 HEALTH AND SAFETY WARNINGS

- List all Personal Protective Equipment needed for procedure.
- List hazards of chemicals used in procedure.
- List any special emergency equipment needed (eyewash, spill kit)
- List waste disposal requirements (amalgam, chemical waste)

5.0 MATERIALS - List chemicals and equipment needed for procedure. Be specific. Include chemical concentrations, catalog numbers, equipment names, model numbers, etc. Include any chemical or equipment set up procedures that need to be done before procedure can proceed (e.g. warm up water, dilute bleach, test glut levels). Cross reference any other SOPs for these procedures. Describe how to obtain equipment.

6.0 PROCEDURES - List a step-by-step description of the procedure in chronological manner using active verbs and direct statements. Describe any anticipated problems that may occur while performing this SOP, the course of action to be taken, including the job title to consult/report to if problem occurs.

7.0 REPORTING AND DOCUMENTATION - Describe any logs, reports or other documentation needed or produced during this SOP. Describe where records are kept. Include sign-in sheets for use of particular instruments.

8.0 REFERENCES - List other SOPs, regulations or references relating to this SOP.

9.0 ATTACHMENTS, FORMS, CHECKLISTS - Attach a copy of the MSDS for each chemical or mixture of chemicals to be used. Also attach the hazard checklist that accompanies this document.

10.0 REVIEWS AND REVISIONS - List review cycle (e.g. annually) and procedure (e.g. supervisor, committee). Include author & approval signatures.

Laboratory Specific SOP Template

	Signature	Job Title	Date
This SOP was written by:			
This SOP was reviewed by:			
This SOP was approved by:			

Process: _____ Date: _____

Chemical Hazards: Check all hazards for the chemicals used in this procedure. Attach list of chemicals.

<input type="checkbox"/> allergic reaction, sensitizer	<input type="checkbox"/> poison
<input type="checkbox"/> cancer or carcinogen	<input type="checkbox"/> poison inhalation hazard (gas _____)
<input type="checkbox"/> corrosive	<input type="checkbox"/> pyrophoric
<input type="checkbox"/> explosive	<input type="checkbox"/> reproductive effects: __mutagen __teratogen
<input type="checkbox"/> __flammable __combustible (select one)	<input type="checkbox"/> reactive
<input type="checkbox"/> heavy metals	<input type="checkbox"/> __toxic __acute __highly or extremely toxic (select one)
<input type="checkbox"/> lachrymator	__unstable __highly unstable (select one)
<input type="checkbox"/> oxidizer	<input type="checkbox"/> water reactive
<input type="checkbox"/> peroxide, peroxide forming	<input type="checkbox"/> unknown hazard
<input type="checkbox"/> target organ effect: __hepatotoxin __nephrotoxin __neurotoxin __hematopoietic __lungs, skin, eyes, mucous membranes	

Biological Hazards: Name or Organism: _____ BSL _____

Tissue culture: cell:	Virus	Fungus	Animal (live – IACUC Approval):
rDNA: IBC approval:	Bacteria	Yeast	Animal tissue
Human blood, OPIM	Toxin	Select agent	Other:

Process Hazards: Specify source when necessary.

Machinery/tools	
High noise levels	
Compressed gas cylinders	
Other:	
Nonionizing radiation: <input type="checkbox"/> microwave <input type="checkbox"/> ultrasound ultraviolet <input type="checkbox"/> infrared <input type="checkbox"/> laser (class:)	
Ionizing radiation: <input type="checkbox"/> x-ray <input type="checkbox"/> sealed RAM	

Health and Safety Requirements:

<input type="checkbox"/> eye protection, type:	<input type="checkbox"/> gloves, type:	<input type="checkbox"/> respirator, type:
<input type="checkbox"/> face shield	<input type="checkbox"/> earplugs/muffs	<input type="checkbox"/> protective clothing, type:
<input type="checkbox"/> shield	<input type="checkbox"/> local ventilation, type:	<input type="checkbox"/> emergency lights
<input type="checkbox"/> radiation badge	<input type="checkbox"/> warning signs, lights, alarms	<input type="checkbox"/> medical surveillance
<input type="checkbox"/> decontamination	<input type="checkbox"/> ultraviolet light	<input type="checkbox"/> exposure monitoring
<input type="checkbox"/> fume hood, insp.:	<input type="checkbox"/> biosafety cabinet, insp.:	<input type="checkbox"/> other:

Disposal Procedures:

<input type="checkbox"/> chemical hazardous waste (EPA listed, flammable, toxic, corrosive, or reactive)	<input type="checkbox"/> acutely hazardous waste (EPA & U-List)	<input type="checkbox"/> regulated medical waste__ Red Bag __Sharps container
<input type="checkbox"/> neutralize with:	<input type="checkbox"/> other:	<input type="checkbox"/> autoclave & regulated medical waste

Experience: Which of the following are you relatively inexperienced with or are not previously documented?

<input type="checkbox"/> chemicals or synergistic effects	<input type="checkbox"/> quantities used	<input type="checkbox"/> procedures
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Appendix B: Examples of Hazardous Chemicals

A-Acids

Liquids

- 1 Acetic acid 64-19-7
- 2 Acetic anhydride 108-24-7
- 3 Butyric acid 107-92-6
- 4 Chromosulfuric acid 14489-25-9
- 5 Formic acid 64-18-6
- 6 Hydrobromic acid 10035-10-6
- 7 Hydrochloric acid 7647-01-0
- 8 Hydrofluoric acid 7664-39-3
- 9 Lactic acid 50-21-5
- 10 Nitric acid 7697-37-2
- 11 Perchloric acid 7601-90-3
- 12 Phenol solution (carbolic acid) 108-95-2
- 13 Phosphoric acid 7664-38-2
- 14 Propionic acid 79-09-4
- 15 Sulfuric acid 7664-93-9
- 16 Trifluoroacetic acid 76-05-1

Solids

- 17 Benzoic acid 65-85-0
- 18 Cacodylic acid 75-60-5
- 19 Maleic acid 110-16-7
- 20 Oxalic acid 144-62-7
- 21 Periodic acid 10450-60-9
- 22 Salicylic acid 69-72-7
- 23 Tannic acid 1401-55-4
- 24 Trichloroacetic acid 76-03-9

B-Corrosive Materials

Liquids

- 25 Ammonium hydroxide 1336-21-6
- 26 Cresol 1319-77-3
- 27 Hydrazine 302-01-2
- 28 Morpholine 110-91-8
- 29 Potassium hydroxide solution 1310-58-3

- 30 Sodium hydroxide solution 1310-73-2

Solids

- 31 Aluminum sulfate 10043-01-3
- 32 Calcium hydroxide 1305-62-0
- 33 Chromic trioxide 1333-82-0
- 34 Ferric chloride 7705-08-0
- 35 Ferrous sulfate 7720-78-7
- 36 Iodine 7553-56-2
- 37 Phosphorus pentoxide 1314-56-3
- 38 Potassium dichromate 7778-50-9
- 39 Potassium hydroxide 1310-58-3
- 40 Sodium hydroxide 1310-73-2

C-Cyrogenic Materials

- 41 Nitrogen, refrigerated liquid 7727-37-9
- 42 Carbon dioxide, solid 124-38-9

D-Gases

- 43 Compressed air
- 44 Germane 7782-65-2
- 45 Helium 7440-59-7
- 46 Hydrogen 1333-74-0
- 47 Mixtures of N₂, O₂, CO₂
- 48 Oxygen, 100% 7782-44-7
- 49 Propane 74-98-6
- 50 Silane 7803-62-5
- 51 Sulfur dioxide 7446-09-5

E-Flammable Liquids

- 52 Acetaldehyde 75-07-0
- 53 Acetone 67-64-1
- 54 Acetonitrile 75-05-8
- 55 Amyl acetate 628-63-7
- 56 Amyl alcohol 71-41-0

57 Benzaldehyde 100-52-7
58 Benzene 71-43-2
60 Butyl alcohol 71-36-3
61 Carbon disulfide 75-15-0
62 Cyclohexane 110-82-7
63 Dimethyl sulfide 75-18-3
64 Dioxane 123-91-1
65 Ethyl acetate 141-78-6
66 Ethyl alcohol 64-17-5
67 Ethyl ether 60-29-7
68 Ethylene dichloride 107-06-2
69 Heptane 142-82-5
70 Hexane 110-54-3
73 Isoamyl alcohol 123-51-3
74 Isobutyl alcohol 78-83-1
75 Isopropyl alcohol 67-63-0
76 Kerosene 8008-20-6
77 Methyl alcohol 67-56-1
78 Methyl ethyl ketone 78-93-3
79 Mineral spirits 64475-85-0
80 Pentane 109-66-0
81 Petroleum ether 8032-32-4
82 Propyl alcohol 71-23-8
83 Pyridine 110-86-1
84 Tetrahydrofuran 109-99-9
85 Toluene 108-88-3
86 Triethylamine 121-44-8
87 Xylenes 1330-20-7

F-Reactive Chemicals

Liquids

59 Benzyl chloride 100-44-7
71 Hydrogen peroxide solution, >3% 7722-84-1
72 Hypochlorite solution (bleach) >10%

Solids

88 Benzoyl peroxide 94-36-0

89 Lithium aluminum hydride 16852-85-3
90 Magnesium, metal 7439-95-4
91 Osmium tetroxide 20816-12-0
92 Picric acid, wet 88-89-1
93 Potassium nitrate 7757-79-1
94 Potassium nitrite 7758-09-0
95 Potassium permanganate 7722-64-7
96 Potassium, metal 7440-09-7
97 Sodium borohydride 16940-66-2
98 Sodium, metal 7440-23-5

G-Toxic Chemicals

Liquids

99 Aniline 62-53-3
100 Benzyl alcohol 100-51-6
101 Bromine 7726-95-6
102 Diethylene glycol 111-46-6
103 Dimethyl sulfoxide 67-68-5
104 Dimethylformamide 68-12-2
105 Ethylene glycol 107-21-1
106 Formamide 75-12-7
107 Glutaraldehyde solution 367-47-5
108 Glycerin 56-81-5
109 Mercaptoethanol 60-24-2
110 Mercury 7439-97-6
111 Nitrobenzene 98-95-3
112 Piperidine 110-89-4

Solids

113 Alpha-amanatin 23109-05-9
114 Benzophenone 119-61-9
115 Cobaltous chloride 7646-79-9
116 Colchicine 64-86-8
117 Cupric sulfate 7748-98-7
118 Cycloheximide 66-81-9
119 Ethidium bromide 1239-45-8
120 Hydroquinone 123-31-9
121 Hydroxyquinoline 148-24-8

122 Mercuric acetate 1600-27-7
123 Mercuric oxide 21908-53-2
124 Nitroaniline 100-01-6
125 Nitrophenol 88-75-5
126 Paraformaldehyde 30525-89-4
127 Potassium chromate 7789-00-6
128 Potassium thiocyanate 333-20-0
129 Resorcinol 108-46-3
130 Silver nitrate 7761-88-8
131 Sodium azide 26628-22-8
132 Sodium cacodylate 124-65-2
133 Sodium dichromate 10588-01-9
134 Uranyl acetate 541-09-3

H-Suspect Carcinogens

Liquids

135 Acrylonitrile 107-13-1
136 Carbon tetrachloride 56-23-5
137 Chloroform 67-66-3
138 Dimethyl sulfate 77-78-1
139 Formalin (formaldehyde solution) 50-00-0
140 Hematoxylin solution 517-28-2
141 Methyl chloroform 79-22-1
142 Methylene chloride 75-09-2
143 Toluidine, o- 95-53-4

Solids

144 Acrylamide 79-06-1
145 Arsenic trioxide 1327-53-3
146 Asbestos 12001-28-4
147 Benzidine 92-87-5
148 Thiourea 62-56-6

Appendix C: DHS list of 41 chemicals with low threshold reporting quantities that require prior approval from the CHO before purchasing.

Chemical Name (alternate name below)	CAS Number	Screening Threshold qty (g or lbs)
1,4-bis(2-chloroethylthio)-n-butane	142868-93-7	100g
bis(2-chloroethylthio)methane	63869-13-6	100g
bis(2-chloroethylthioethyl)ether	63918-89-8	100g
1,5-bis(2-chloroethylthio)-n-pentane	142868-94-8	100g
1,3-bis(2-chloroethylthio)-n-propane	63905-10-2	100g
2-chloroethylchloromethylsulfide	2625-76-5	100g
Chlorosarin	1445-76-7	100g
Chlorosoman	7040-57-5	100g
DF Methyl phosphonyl difluoride	676-99-3	100g
<i>N,N</i> -(2-diethylamino)ethanethiol	100-38-9	2.2lb
<i>o,o</i> -Diethyl S-[2-(diethylamino)ethyl] phosphorothiolate	78-53-5	2.2lb
Diethyl methylphosphonate	15715-41-0	2.2lb
<i>N,N</i> -Diethyl phosphoramidic dichloride	1498-54-0	2.2lb
<i>N,N</i> -(2-diisopropylamino)ethanethiol	5842-07-9	2.2lb
<i>N,N</i> -Diisopropyl phosphoramidic dichloride	23306-80-1	2.2lb
<i>N,N</i> -(2-dimethylamino)ethanethiol	108-02-1	2.2lb
<i>N,N</i> -Dimethyl phosphoramidic dichloride	677-43-0	2.2lb
<i>N,N</i> -(2-dipropylamino)ethanethiol	5842-06-8	2.2lb
Ethyl phosphonyl difluoride	753-98-0	100g
Ethylphosphonothioic dichloride	993-43-1	2.2lb
HN1 (nitrogen mustard-1) Bis(2-chloroethyl)ethylamine	538-07-8	100g
HN2 (nitrogen mustard-2) Bis(2-chloroethyl)methylamine	51-75-2	100g
HN3 (nitrogen mustard-3) Tris(2-chloroethyl)amine	555-77-1	100g
Isopropylphosphonothioic dichloride	1498-60-8	2.2lb
Isopropylphosphonyl difluoride	677-42-9	100g
Lewisite 1: 2-Chlorovinylchloroarsine	541-25-3	100g
Lewisite 2: Bis (2-Chlorovinyl)chloroarsine	40334-69-8	100g
Lewisite 3: Tris (2-Chlorovinyl)chloroarsine	40334-70-1	100g
Methylphosphonothioic dichloride	676-98-2	2.2lb
Sulfur Mustard (mustard gas (H)) Bis (2-chloroethyl) sulfide	505-60-2	100g
O-Mustard (T) Bis (2-chlorothioethyl) ether	63918-89-8	100g

Nitrogen mustard hydrochloride		
Bis (2-chloroethyl)methylamine hydrochloride	55-86-7	2.2lb
Propylphosphonothioic dichloride	2524-01-8	2.2lb
Propylphosphonyl difluoride	690-14-2	100g
Sarin		
<i>o</i> -Isopropyl methylphosphonofluoridate	107-44-8	100g
Sesquimustard		
1,2-Bis(2-chloroethylthio)ethane	3563-36-8	100g
Soman		
<i>o</i> -Pinacolyl methylphosphonofluoridate	96-64-0	100g
Tabun		
<i>o</i> -Ethyl-N,Ndimethylphosphoramidocyanidate	77-81-6	100g
Thiodiglycol	111-48-8	2.2lb
VX		
<i>o</i> -ethyl-S-2-diisopropylaminoethyl methyl phosphonothiolate	50782-69-9	100g

Appendix D: Common SOPs and Related Policies

Accidents and Injuries SOPs

First Aid Kits
On-the-Job Injuries

Biosafety SOPs

Autoclave Operation and Performance Testing
Biosafety Training
Sharps - Handling and Disposing

Bloodborne Pathogens SOPs

Cleaning Up Spills of Bloodborne Pathogens
Handling Laundry Potentially Contaminated with Bloodborne Pathogens

Chemical Safety SOPs

Chemical Container Labeling
Chemical Security
Chemicals of Concern - United States Department of Homeland Security Chemical Facility Anti-Terrorism Standards
Cryogenic Material
Hydrofluoric Acid
Storage and Use of Flammable and Combustible Liquids
Use and Storage of Peroxide-Forming Chemicals

General / Other Safety SOPs

Cart and Hand Truck Safety
Chancellor's University Safety Committee (CUSC)
General Electrical Safety
Job Safety Assessment
Personal Protective Equipment (PPE) - Eyes and Face
Slips, Trips, Falls - Reducing Risk and Avoiding Injury

Laboratory SOPs

Acrylamide
Centrifuge Safety
Compressed Gas Cylinders in Laboratories
Electrophoresis Safety
Emergency Eyewash and Shower Equipment
Exposure Control for Chemical Reproductive Hazards
Ground Glass and Glassware Safety
Hot Plates, Drying Ovens, and Other Heating Devices
Laboratory Decommissioning
Laboratory Ergonomics
Laboratory Hood/Cabinet Identification and Use

Laser Safety SOPs

Laser Classification and General Safety Control Measures

Waste Management SOPs

Aerosol Can Collection

Battery Disposal

Computers, Electronic Equipment, and Smoke Detectors

Disposal of Chloroform Contaminated Materials

Disposal of Office Items

Empty Container Disposal

Ethidium Bromide Disposal

Fluorescent and Other Non-Incandescent Lamps, Light Bulbs, and Ballasts

Hazardous/Radioactive Material Collection Procedures

Items / Materials Prohibited from Trash Cans and Dumpsters

Preserved Specimens Hazards, Storage, Labeling, and Disposal

Sewer Disposal List

Solvent Distillation

Used Motor Oil and Filter Management & Disposal

APPENDIX E

Alphabetical List of Abbreviated Terms Used in the Chemical Hygiene Plan

CAS Chemical Abstracts Service

CFR Code of Federal Regulations

CHO Chemical Hygiene Officer

CHP Chemical Hygiene Plan

EHS Environmental Health and Safety

EPA Environmental Protection Agency

HEPA High Efficiency Particulate Air

LF Linear Feet

LFM Linear Feet per Minute

MSDS/SDS Material Safety Data Sheet/Safety Data Sheet

OSHA Occupational Safety and Health Administration

PEL Permissible Exposure Limit

PI Principal Investigator

PPE Personal Protective Equipment

PPM Parts per Million

SOP Standard Operating Procedure/Safe Operating Procedure

TLV Threshold Limit Value