

Chemical Hygiene Plan (CHP)

Oregon State University

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Department: _____

Principal Investigator: _____

Building & Room #'s: _____

Note: The most up-to-date version of the CHP can be found on the EHS website: ehs.oregonstate.edu/CHP

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1.0 Definitions

Combustible Liquid means a liquid mixture, substance or compound having a flashpoint at or above 100°F when tested in a Tagliabue closed cup tester.

Explosive Material shall mean any quantity of Class A, Class B or Class C explosives as classified by the Department of Transportation and any other chemical compounds or mixtures thereof used as the propelling or exploding material in any cartridge or other explosive device.

The **Lower Explosive Limit (LEL)** and **Upper Explosive Limit (UEL)** values are the minimum and maximum concentrations of a flammable gas or vapor between which ignition can occur. Concentrations below the LEL are too lean to burn, while concentrations above the UEL are too rich. All concentrations between LEL and UEL are in the flammable range, and special precautions are needed to prevent ignition or explosion.

Flammable Gas means a gas which will form an explosive mixture upon concentration with air or which will ignite in air. Utility gas piped into a laboratory shall not be considered as flammable gas for the purpose of classification under these regulations.

Flammable Liquid means any liquid mixture, substance or compound which will emit a flammable vapor at a temperature below 100°F when tested in a Tagliabue closed cup tester.

Flammable Solid means a solid substance other than one classified as an explosive, which is liable to cause fire through friction, through absorption of moisture, through spontaneous chemical changes, or as a result of retained heat from manufacturing or processing. Examples are white phosphorous, nitrocellulose, metallic sodium and potassium, and zirconium powder.

Flash Point is the lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel.

Hazardous chemical means any chemical which has a physical hazard or a health hazard.

Health hazard means any chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes.

Laboratory is a generic term denoting a building, space, equipment, or operation, wherein testing, research or experimental work is conducted and shall include laboratories used for instructional purposes.

Laboratory Unit means an enclosed, fire rated space used for testing, research, experimental or educational purposes. Laboratory units may or may not include offices, lavatories, and other contiguous rooms maintained for, or used by, laboratory personnel, and corridors within the units. It may contain one or more separate laboratory work areas.

Laboratory Work Area means a room or space within a laboratory unit for testing, analysis, research, instruction, or similar activities which involve the use of chemicals or gases. A work area may or may not be enclosed.

Lethal Concentration 50 (LC₅₀): The concentration of a material in air which, based on laboratory tests, is expected to kill 50 percent of a group of test animals when administered as a single exposure (usually 1 to 4 hours).

Lethal Dose 50 (LD₅₀): A single dose of a material expected to kill 50 percent of a group of test animals. The dose is expressed as the amount per unit of body weight, the most common expression being milligrams of material per kilogram of body weight (mg/kg of body weight). Usually refers to oral or skin exposure.

Oxidizing Material means a substance that yields oxygen readily to support combustion. Examples are chlorates, permanganates, peroxides and nitrates.

Physical Hazard means a chemical for which there is scientifically valid evidence that it is a combustible

liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

Reproductive Toxins are defined by the OSHA Laboratory Standard as substances that cause chromosomal damage (mutagens) and substances with lethal or teratogenic effects on the developing fetus.

Storage Cabinet means a cabinet for the storage of flammable liquid which is designed and constructed in accordance with "OSHA General Industry Standards - Flammable and Combustible Liquids."

Storage Room means a room where chemicals or gases are stored and not otherwise used or reacted.

Threshold Limit Values (TLVs) are guidelines prepared by the American Conference of Governmental Industrial Hygienists, Inc (ACGIH) to assist industrial hygienists in making decisions regarding safe levels of exposure to various hazards found in the workplace.

TLV-TWA: The allowable Time Weighted Average concentration for a normal 8-hour workday (40-hour work week).

TLV-STEL: The short-term exposure limit or maximum concentration for a continuous 15-minute exposure period (maximum of four such periods per day, with at least 60 minutes between exposure periods) and provided the TLV-TWA is not exceeded.

TLV-C: The ceiling exposure limit is the concentration that should never be exceeded, even instantaneously.

Unstable (Reactive) Chemical. - Unstable (reactive) chemical means a substance, other than one classified as an explosive or blasting agent, which will vigorously and energetically react, is potentially explosive, will polymerize or decompose instantaneously, undergo uncontrollable auto-reaction or can be exploded by heat, shock, pressure or combinations thereof. Examples are organic peroxides, nitromethane, and ammonium nitrate.

2.0 Introduction

As part of the Oregon State University's Environmental Health and Safety (EHS) Program, this Chemical Hygiene Plan (CHP) establishes and maintains a safe and healthy work environment for all laboratory employees. This plan and required training provide procedures to comply with the Occupational Safety and Health Administration (OSHA) "Occupational Exposure to Hazardous Chemical in Laboratories" Standard C9 CRR 1200.1450

(<https://www.osha.gov/lawsregs/regulations/standardnumber/1910/1910.1450>).

This Plan covers all locations associated with Oregon State University in which laboratory work involving the use of hazardous materials is performed. While the CHP primarily addresses chemical hazards, other materials and processes, such as radiological and biological hazards, are referred to and must be controlled according to specific standards outlined in their respective manuals. This plan is available on the EHS website, hard copies are available upon request via EHS.

3.0 Objective

The primary objective of the OSU Chemical Hygiene Plan is to minimize and reduce exposure to hazardous chemicals that laboratory personnel encounter while performing their daily job functions. To achieve this, this CHP identifies and lists standard operating procedures for all labs and the hazards they work with. Particular attention is given to procedures in those labs working with chemical hazards that required higher levels of protection.

4.0 Applicability

This CHP covers all aspects of laboratory work involving the use of chemicals for all locations that are a part of Oregon State University (including any applicable off-campus locations).

5.0 Responsibilities

The OSU CHP establishes the following responsibilities per 29CFR 1200.1450(e)(3)(vii):

5.1 Chemical Hygiene Officer (CHO) and Laboratory Safety Officer (LSO)

EHS is responsible for administering and overseeing institutional implementation of the CHP. The CHO is a member of EHS and, with support from other EHS personnel, has the following responsibilities:

- Review and evaluate the effectiveness of the CHP at least annually and update as appropriate;
- Develop and implement chemical hygiene best practices and seeks ways to improve the chemical hygiene program;
- Have working knowledge of current health and safety rules and regulations;
- Assist with review and compliance of the High Hazard Operating Procedures (HHOP);
- Maintain inspection, personnel training, and inventory records;
- Conduct regular inspections of laboratories, prep rooms, and chemical storage rooms and submit laboratory inspection reports to administration;
- Monitor procurement, use, storage, and disposal of chemicals; and
- Provide consultation and assistance to laboratory supervisors and staff in developing and maintaining a safe and healthy laboratory environment.

5.2 Chemical Safety Committee (CSC)

The Chemical Safety Committee is appointed by the Vice President for Finance and Administration and administered by EHS. The CSC is responsible for recommending policy, rules, and procedures regarding the use of hazardous chemicals, and reviewing and approving the use of chemical carcinogens and other special hazardous chemicals as required by OSHA or another regulatory agency as applicable. The CSC will annually review the CHP.

5.3 Environmental Health & Safety (EHS)

- Develops, maintains, and disseminates the CHP;
- Serves as a resource for the collection and distribution of Safety Data Sheets (SDSs);
- Conducts health and safety training and provides educational materials, assistance, and training programs for faculty, staff, and student employees;
- Responds promptly to detected problems, undertakes corrective action in coordination with relevant campus partners;
- Maintains records of EHS required training, spills, emergencies, and exposures;
- Collects waste and maintains waste records;
- Conducts monitoring and auditing of all labs as part of the lab safety program;
- Provides technical assistance and exposure assessments for complying with the CHP as needed; and
- Administers the fume hood testing program.

5.4 Department Head/Chair

- Assumes responsibility for the safety of work undertaken within their areas, for supporting a culture of health and safety, and for holding their employees accountable for knowing and following health and safety policies including the safety requirements and best practices set forth by the CHO and the CHP;
- Establishes priorities and committing resources for the correction of health and safety deficiencies;

- Ensures individuals under their supervision have sufficient authority and support to properly implement health and safety practice, regulations, policies, rules, and procedures;
- Reviews all lab inspection reports to ensure timely actions correcting deficiencies and to support a safe work and academic environment that complies with applicable federal, state and local laws, and university policies and standards;
- Ensures compliance with mandatory health and safety training in their units;
- Ensures all new PIs are registered with EHS prior to working in a laboratory; and
- Inform EHS when a PI vacates a laboratory. Ensure vacated laboratory spaces have been decontaminated.

5.5 Department Unit Safety Contact

- Act as a liaison between their respective department/unit safety advisory committee and EHS, and campus safety committees when applicable;
- Disseminate health and safety information to their respective department/unit;
- Assist EHS in department level safety procedures; and
- Work with department chair to ensure new PIs are registered with EHS and vacating PIs have let EHS know of their impending departure.

5.6 Principal Investigators and Other Laboratory Supervisors

- Assume responsibility for the safety of work undertaken within their areas, for supporting a culture of health and safety in their laboratories, and for holding their employees accountable for knowing and following health and safety policies;
- Provide oversight of facilities, equipment, and practices to support a safe work and academic environment that complies with applicable federal, state and local laws, and university policies and standards;
- Ensure individuals under their supervision have sufficient authority and support to properly implement health and safety practices, regulations, policies, rules, and procedures;
- Ensure compliance with mandatory health and safety training, including lab-specific training;
- Support EHS to monitor adherence to applicable health and safety regulations, policies, rules, and procedures;
- Establish priorities and commit resources for the correction of health and safety deficiencies;
- Ensure that all laboratory personnel comply with the OSU CHP;
- Maintain an updated chemical inventory for laboratories or facilities;
- Identify hazardous conditions or operations in the laboratory and determine safe operating procedures and controls;
- Ensure that Safety Data Sheets (SDSs) are readily accessible to all lab personnel and emergency responders;
- Provide Personal Protective Equipment (PPE) to lab personnel as required and ensure it is used properly;
- Train laboratory personnel on the principles of this plan;
- Promptly report all safety, health, or environmental hazards, near misses, on-site incidents, and injuries to their supervisors and to the online accident reporting system; and
- As a new PI, register laboratory and hazards with EHS.

5.7 Laboratory Personnel

Laboratory personnel is anyone whose work within a laboratory setting requires the handling of potentially hazardous materials. This includes employees whose work promotes a research PI or faculty member, teaching assistants in instructional laboratories, volunteers, and students.

- Observe and follow health and safety regulations, policies, rules and procedures, including all those outlined in the CHP;
- Adhere to recommendations made by the CHO and the LSO;
- Participate in mandatory health and safety training and all lab-specific training with their PI/Lab Supervisor, as applicable;
- Planning, reviewing and understanding the hazardous materials or processes they work with prior to actually conducting work;
- Develop good personal chemical safety and hygiene habits, including keeping the work area safe, clean and uncluttered;
- Wear PPE as required per chemical recommendations, EHS, or laboratory/PI;
- Participate in a medical surveillance program if work requires such program enrollment;
- Promptly report all safety, health or environmental hazards, near misses, on-site incidents, and injuries to their supervisor and to the online reporting system; and
- Consider personal safety and the safety of others at all times while in the work and learning environment, especially when performing assigned tasks.

5.8 OSU Occupational Health Services

- Provide medical surveillance oversight for exposure to hazardous chemicals, in addition to other services such as, the hearing conservation program, respiratory program, animal exposure program, and immunizations program for designated University employees; and
- Provide work-related injury support for student employees.

6.0 Annual Verifications

All Principal Investigators are required to complete/review and submit annual verification of lab hazards, chemical inventory, and laboratory personnel every year via SciShield, EHS's information management system. This verification alerts EHS to current and future research activities that may present new hazards in the lab.

7.0 Chemical Toxicology and Routes of Exposure

Chemicals enter the body through three primary routes and two lesser routes of entry. Chemicals may affect the route of entry organ or they may travel and target specific organs where they will do damage:

- Respiration – primary target lungs (asbestos, osmium tetroxide, phosgene), and other target organs (carbon monoxide – blood, methylmercury – brain)
- Ingestion – primary target gastrointestinal tract (acids), other target organs (lead – bones)
- Dermal Absorption – primary target skin, including mucous membranes, other target organs (solvents, phenol – Central Nervous System)
- Ocular – primary target eyes (acids, bases), targets other organs (solvents)
- Subcutaneous – injected into the blood, transferred to target organ

7.1 Acute Exposure

Short term, high exposure which results in an acute effect, including:

- Allergic reaction
- Coughing
- Shortness of breath
- Skin rash
- Burning eyes

7.2 Chronic Exposure

Long term, low exposure which may result in chronic effect, including:

- Asbestosis (asbestos)
- Central nervous system disorders (organic mercury, metallic mercury)
- Various cancers including lung, kidney, bladder, and liver (carcinogens)

8.0 Exposure and Medical Monitoring

8.1 Exposure Monitoring

EHS is available to monitor and evaluate exposure to chemicals in the workplace. This may be done to evaluate the success of a hazard control program, or to evaluate levels of exposures prior to designing a program. EHS will also provide exposure monitoring if there is reason to believe laboratory personnel are being over-exposed to a particular chemical they are working with.

8.1.1 Exposure Monitoring Methods

Monitoring can be accomplished using direct reading instruments such as a portable photoionization detector which gives an instant but sometimes nonspecific reading.

The OSHA approved method for monitoring involves placing a badge on an individual or by drawing air through tubes of filters filled with a designated media for a particular chemical over the course of a specified time period by using a personal sampling pump. After sampling is completed, collected media are sent for processing and analysis by an independent environmental laboratory.

8.1.2 Exposure Evaluation

The purpose of an exposure evaluation is to help determine the employee's occupational exposure in order to reduce exposure and determine control measures. EHS will use any of the following criteria in order to reduce and control employee exposure:

- Verbal information obtained from employees regarding chemical usage
- Visual observations of chemical use or laboratory operations
- Evaluation of existing engineering control measures or administrative practices
- Recommendations expressed in Safety Data Sheets
- Regulatory requirements (e.g., OR-OSHA)
- Professional organization recommendations (e.g., NIOSH)
- Direct reading instrumentation results
- Employee exposure monitoring results

- Medical evaluation, exam, and/or surveillance findings

The findings of an exposure evaluation will be interpreted according to current accepted industrial hygiene practices. Levels will be compared with the OSHA Permissible Exposure Levels (PEL) Tables to determine if the individual is being exposed at the Action Level or the PEL.

If exposure levels require additional exposure prevention and control, EHS will determine the appropriate modifications to the work activity in accordance with Section 9.0 – Exposure Prevention and Controls.

8.2 Medical Monitoring

Medical surveillance is the process of using medical examinations, questionnaires and/or biological monitoring to determine potential changes in health as a result of exposure to a hazardous chemical or other hazard. OSU will provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary as required by 29CFR 1910.1450(g)

8.2.1 Scenarios Requiring Medical Monitoring

The following scenarios may require medical monitoring:

- Symptoms Develop – Lab personnel develop signs or symptoms associated with hazardous chemical exposure.
- Exposure Monitoring – Exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the PEL – see section 7.1.2) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements. Medical surveillance shall be established for the affected employee as prescribed by the particular standard.
- Hazardous Event – An event occurs in the work area such as a spill, leak, explosion, or other occurrence resulting in the likelihood of a hazardous exposure, the affected individual shall be provided an opportunity for a medical consultation and/or examination.

8.2.2 Examples of Hazards Monitored Through the Medical Surveillance Program

- Noise (Hearing Conservation Program)
- Respirator Use (Respiratory Protection Program)
- Animal Exposure
- Various Particularly Hazardous Substances
- Various Biohazardous Materials

8.2.3 Accident Reports

Accident reports are kept on record through Insurance and Risk Management Services with a copy of the report sent to the EHS office. EHS will evaluate and investigate the exposure and make recommendations to avoid re-occurrence. To report an accident, use the workers' compensation forms found here: <https://risk.oregonstate.edu/workerscomp>

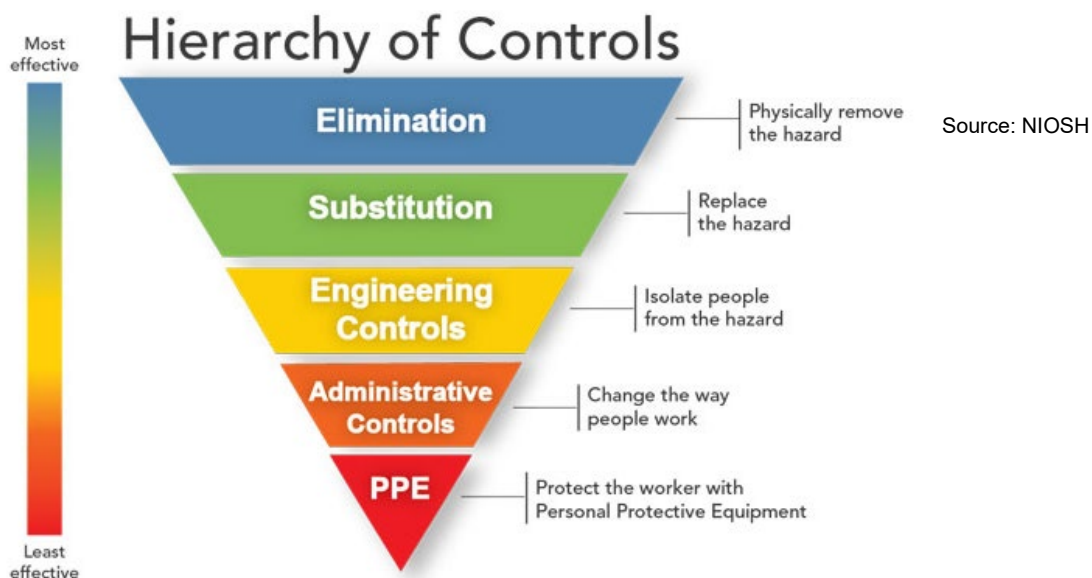
8.2.4 Information to Provide Clinician for Exposure Evaluation

At the time of the medical evaluation, provide the following information to the Clinician:

- Any personal information requested or needed, including your university employee ID number.
- Common name for the hazardous chemical you may have been exposed to.
- A description of conditions under which the exposure occurred.
- Quantitative data, if available.
- Signs and symptoms employees may be experiencing.
- SDS of chemical in question.
- Any additional information that can be of use to the clinician.

9.0 Exposure Prevention and Controls

The purpose of the CHP is to minimize or eliminate occupational exposure to hazardous chemicals. Exposure prevention and control methods are defined by the Hierarchy of Controls as the elimination, substitution, engineering controls, administrative controls, and personal protective equipment from most effective to the least effective. This section, in conjunction with section 10.0, 11.0 and 15.0, satisfies 29CFR 1910.1450(e)(3)(ii).



(<https://www.cdc.gov/niosh/index.htm>)

9.1 Elimination or Substitution

Source controls are measures that prevent exposure to a hazardous chemical. Substitution, minimization and/or alteration of the chemical(s) or procedure (e.g., design out the hazard prior to the experiment) are examples of a source control. With chemical substitution, exposure to a high hazard chemical is controlled by utilizing a less hazardous chemical.

9.2 Engineering Controls

Engineering controls (e.g., chemical hoods) minimize exposure to a chemical hazard in the work area of the employee. Engineering controls are further discussed in Section 10.0.

9.3 Administrative Controls and PPE

Administrative controls and personal protective equipment (e.g., respirators, gloves, etc.) are utilized to minimize exposure to a chemical hazard for each individual employee. Administrative controls are a change in work procedures, such as schedules and training, with the goal of reducing the duration, frequency, and severity of exposure to hazardous chemicals. Personal protective equipment is further discussed in Section 11.0.

10.0 Engineering Controls

10.1 General Ventilation and Exhaust

The general ventilation system in laboratories must be well maintained with the laboratories operating under negative pressure. This negative pressure should be maintained in laboratories to ensure airflow into the laboratory from uncontaminated areas. General ventilation will not be relied upon to protect employees from toxic exposure. Chemical hoods and other local exhaust system devices must be used for these purposes.

10.1.1 Air Changes

Four to twelve (4-12) room changes per hour should be provided by general ventilation in laboratories where fume hoods are used as the primary method of control. Storage areas used for flammables should have at least six air changes per hour. Air should be 100% outside air (i.e., no re-circulation) in all active laboratories and chemical storage areas. Air removed from the laboratories through vents and ducts by general ventilation should be vented to the outside, not into the general facility circulation. Intake vents for the system should be far enough removed from the system's exit port to prevent cross-contamination. Ventilation from these areas is 100% exhaust.

10.2 Chemical Fume Hoods (Ducted)

An important safety device in the laboratory is a properly functioning chemical fume hood. The chemical fume hood protects users from inhaling chemicals by constantly pulling air into the hood and exhausting it out of the building. Chemical fume hoods also provide protection in the event of an explosion or fire. This section of the OSHA Lab Standard addresses fume hoods 29CFR 1910.1450(e)(3)(iii).

A chemical fume hood should be used when:

- Handling chemicals with inhalation hazards such as toxic gases, toxic chemical vapors, volatile radioactive materials, and respirable toxic powders.
- Carrying out experimental procedures with strong exothermic reactions.
- Handling chemicals with significant vapor pressure.
- Chemical vapors generated could cause a fire hazard.
- Working with compounds that have an offensive odor.

10.2.1 Chemical Fume Hood Operating Procedures

- Chemical hoods should operate with the average face velocity of 90-120 feet per minute (fpm), with the exception of low-flow fume hoods which may operate at around 80 fpm.
- Confirm that the chemical hood is operational. Check the air flow gauge if so equipped. Check a telltale (a piece of paper attached to the bottom of the sash). The telltale should be noticeably pulled toward the back of the hood.
- Position the hood sash to maximum of 18 inches high to ensure proper airflow velocities at the work opening. Adjust the sash to shield from splashes or flying

objects. In addition to aiding proper airflow, the sash acts as a physical barrier in the event of an unplanned incident in the hood.

- The sash should be closed or lowered to a 2-inch opening when the hood is not being used.
- Keep hood storage to an absolute minimum. Excess materials in the hood disrupt airflow and can act as a barrier or cause airflow to bounce back across the face of the hood. Do not block ventilation by storing unused equipment or chemicals in the hoods. If large items must be kept in the hood, contact EHS for an evaluation, certification, and a smoke test.
- Keep all work at least six inches inside the hood. The capture ability of a hood may not be 100% at the front of the hood.
- Keep the hood clean. Remove old glassware and clutter. Wipe up spilt chemicals or residues. Ensure the glass sash remains clear for visibility.
- Do not heat up perchloric acid in standard chemical hoods. Perchloric vapors may create explosive perchlorates in the ductwork. Contact EHS if you are performing perchloric acid digestions.
- Separate and elevate each instrument. Use blocks or racks to elevate equipment one or two inches off the hood deck surface so that air can easily flow around all apparatus with no disruption.
- Avoid opening and closing the hood sash rapidly and swift arm movements in front or inside the hood. These actions may cause turbulence and reduce the effectiveness of hood containment.
- Use extreme caution with ignition sources inside a hood. Ignition sources such as electrical connections and equipment, hot plates, controllers, and open flames can ignite flammable vapors or explosive particles from materials used in the hood.
- Never put your head inside a hood while operations are in progress. The plane of the sash is the imaginary boundary that should not be crossed except to set up or dismantle equipment.
- Report airflow problems and problems with the physical structure of the chemical hood to Facilities Management or EHS as soon as possible. If a hood fails while working with highly hazardous materials, immediately close the sash. Leave the immediate area and contact EHS for further assistance.

10.2.2 Chemical Fume Hood Certification

Chemical hoods are tested and certified by EHS on an annual basis. EHS will contact Facilities Services to repair chemical hoods which are failing or restricted. In the event of a fume hood failure, EHS will also close the fume hood and post signage indicating that the hood should not be used until the flow rate can be certified. Chemical hoods are tested with the sash at 18 inches.

- **Pass** – Chemical hoods with an average face velocity between 90-120 feet per minute (fpm). If the hood flow rate is above 120 fpm, it may still pass but a smoke test is also required to ensure that there is no turbulence in the flow. Low-flow fume hoods will pass at 80fpm.
- **Fail** – Chemical hoods with a flow rate under 90 fpm are considered failing and must not be used until they have been repaired and cleared for use. Hoods that exceed 120 fpm fail only if they also fail the smoke test that EHS conducts.

10.2.3 Shutdown Notification

Notifications will be posted when chemical hood fans will be shut down. For minor shutdowns affecting only a few hoods, notifications will be placed directly on each hood affected. For large shutdowns affecting the entire building, laboratory personnel will be notified in advance as with other utility shutdowns.

10.3 Chemical Fume Hoods (Ductless)

10.3.1 Performance Requirements

Ductless chemical hoods are used when the requirements of the lab are such that a ducted hood is not required. The ductless chemical hoods make use of a filter bed that can filter such hazards as particulates, vapors, acids, and bases. The same performance standards apply for the use of these hoods as with ducted hoods with the one addition that the filter system must be changed as per manufacturer's directions if the filter bed is exhausted. Before a ductless hood is purchased or used, contact EHS for an evaluation to determine if the hood is acceptable for the hazard.

10.3.2 Use of Ductless Chemical Hoods

- Filters used must be appropriate for the chemical(s) used.
- These hoods are to be used with low levels of chemicals only.
- Highly toxic, explosive, or reactive chemicals or procedures are not to be used with these hoods.
- Filter usage must be tracked, and filters changed on a vendor recommended basis.

10.3.3 Required Work Practices with Ductless Hoods

- Hood fans should be turned on when in use.
- Ensure hood face velocity has been monitored by EHS within the last year before using the hood.
- Filters should be in good working condition.
- Set the sash to the lowest possible position for maximum face velocity.
- Do not store chemicals and equipment in the hood.
- Wash the hood surface as often as necessary.

10.4 Glove Boxes

Glove boxes can be used for working with known carcinogens and highly toxic chemicals, or to provide an inert atmosphere when working with environmentally sensitive compounds. Glove boxes are effective in controlling hazards as they offer complete containment. Follow all maintenance and manufacturer instructions when working in a glove box.

10.5 Splash Shields

Splash shields provide low cost and effective personal protection against splashes when working in the laboratory. Splash shields are effective engineering control to minimize splash hazards for activities such as:

- Pipetting or pouring materials.
- Using hand-held equipment to mix or homogenize materials.
- Working with materials under pressure.
- Working in a hood above 18 inches.

10.6 Local Exhaust Snorkels

Snorkels capture hazardous dusts or vapors in small areas or by individual instruments. Snorkels are less effective than chemical fume hoods since their capture zone is only local to the placement of the device. Snorkels should never be used for hazardous atmospheres or as an alternative to a fume hood. EHS can help ensure snorkels are working properly and that they are being used in the correct manner.

10.7 Gas Cabinets

Gas cabinets should be used to house hazardous gas cylinders, they allow for the removal of leaking hazardous gases before laboratory workers are exposed. A hazardous gas with an NFPA health rating of 3 or 4 in a cylinder larger than a lecture bottle should be stored and piped from a gas cabinet.

11.0 Personal Protective Equipment (PPE)

Choose PPE and clothing based on the types of chemicals handled, the degree of protection required, and the areas of the body which may become contaminated. All clothing and equipment must, at a minimum, meet standards set by the American National Standards Institute (ANSI). Every effort must be made to evaluate the effectiveness of equipment and make improvements where possible. PIs and departments are responsible for purchasing appropriate PPE and other safety equipment for employees at no cost to the employee.

11.1 Eye and Face Protection

Laboratory personnel usually need to wear some type of eye protection when working in the laboratory. Eye protection can help protect from chemical, biological, and radiological hazards as well as physical hazards.

11.1.1 Eye and Face Protection Standards

All eyewear must meet ANSI's "Practice for Occupational and Educational Eye and Face Protection," Z87.1 – 1989. Prior to use, personnel will verify that the equipment has been approved for the procedure (e.g., ANSI certified for chemical splashes but not for impact).

For labs, ANSI standards required a minimum lens thickness of 3mm impact resistance, passage of flammability test, and lens retaining frames.

11.1.2 Eye and Face Protection Selection

The following table should be consulted in choosing protective eyewear:

Condition Requiring Eye/Face Protection	Type of Eye/Face Protection Required
Handling of aqueous solutions, biologicals, mild corrosives, etc.	Safety glasses with side shields and brow guard
Handling strong corrosives, solvents, large volume of chemicals, any aqueous solution with a high splash hazard, etc.	Chemical resistant goggles
Working with glassware under reduced or elevated pressure. Glassware in high temperature operations.	Impact protection glasses/goggles
Potential for flying objects, particles or chemical splash	Face shield with safety goggles underneath
Vacuum systems, reactions with potential for explosions	Face shield with safety goggles
Lasers, ultraviolet, infrared, or other light sources, glass blowing, welding, torch use.	Specialized eye protection

Contact Lens Use

Contact lens' may be worn in a laboratory setting in accordance with the Centers for Disease Control (CDC) and NIOSH publication *Contact Lens Use in a Chemical Environment*, <https://www.cdc.gov/niosh/docs/2005-139/default.html>.

In the event of a chemical exposure, begin eye irrigation immediately and remove contact lenses as soon as practical. Do not delay irrigation while waiting for contact lens removal. Contact lenses should be removed only in a clean environment after the workers have thoroughly washed their hands. Direct handling application or removal of contact lenses while in a chemical laboratory is prohibited. Standard eye protection requirements (e.g., safety goggles, glasses or face shield) still apply.

11.2 Gloves

Gloves should be always worn in the lab whenever there is a chance for hand contact with chemicals, biologicals, radiologicals, and other potentially contaminated laboratory materials. At a minimum, disposable latex gloves should be worn. The addition of heavier weight gloves may be required in the event chemicals involved are easily absorbed through the skin (e.g., hydrofluoric acid use) or acute or chronic toxins. There are a variety of gloves, both disposable and non-disposable, to resist degradation and permeation (chemical breakthrough) depending on the material they are made of and their thickness. If an employee has an allergy to a specific glove type, contact EHS for assistance in selecting another glove type.

11.2.1 Glove Selection and Glove Chart

- Provide lab personnel that have latex allergies with latex-free gloves.
- Lab personnel should consult the glove manufacturer's permeation and resistance charts to ensure the glove provides adequate protection for the required duration of use and chemical hazards.

Glove Type	Recommended Use	Good for (specific chemicals)
Natural Rubber (Latex)	Good for: dilute acids and bases, biologicals, buffers, water-based dyes Not good for: chlorinated & aromatic hydrocarbons, diethyl ether, ethidium bromide	Solutions of acetic, hydrochloric, sulfuric acids, ammonium hydroxide, sodium hydroxide, ethanol, isopropanol, methanol, formaldehyde, acetone
Nitrile Rubber	Good for: a wide variety of solvents and petroleum products Not good for: aromatic hydrocarbons, chlorinated hydrocarbons, acetone	Oils, greases, aliphatic hydrocarbons, DMSO, alcohols, acid solutions, formalin, ethidium bromide
Butyl Rubber	Good for: ketones, esters and acids Not good for: aliphatic, aromatic, chlorinated hydrocarbons, gasoline, petroleum products	Glycol ethers, acetone, ethanol
Neoprene	Good for: acids and bases, peroxides, petroleum products, hydrocarbons, alcohols, phenols Not good for: halogenated and aromatic hydrocarbons	Ethanol, isopropanol, acetic acid, acetone, acetonitrile, DMSO, formalin, hydrochloride acid, ethidium bromide

Glove Type	Recommended Use	Good for (specific chemicals)
Polyvinyl Chloride (PVC)	Good for: acids and bases, limited for organics, amines, and peroxides Not good for: most organics	Solutions of acids and bases, alcohols
Polyvinyl Alcohol (PVA)	Good for: aromatics, ketones, and chlorinated solvents Not good for: water-based solutions (PVA coating is water soluble).	Benzene, toluene, chlorobenzene, chloroform, methylene chloride, carbon tetrachloride, hexane, carbon disulfide
Vitcon™	Good for: exceptional for chlorinated and aromatic hydrocarbons	Benzene, toluene, chloroform., PCBs
Silver Shield™ / 4H™	Good for: large variety of chemicals Not good for: gloves have poor dexterity	Aromatics, esters, chlorines and ketones

11.2.2 Glove Use

- Inspect gloves prior to use.
- No glove completely resists degradation or permeation. Replace gloves periodically depending on how often they are used and based on the concentration of chemicals being used and duration of use.
- Disposable latex or nitrile gloves are not intended to provide protection from prolonged or repeated contact with chemicals. Remove and replace disposable latex and nitrile gloves if there is any sign of damage or if they have any chemical contamination.
- Wear gloves with long cuffs or sleeve covers when there is skin exposed between the glove and your lab coat.
- Wash hands thoroughly after removing gloves.
- Wash reusable gloves before removal, except those that are permeable to water.
- Depending on the material being handled, individuals may need to wear two disposable gloves on each hand to prevent contamination when removing the top glove layer.
- If the need for gloves arises when walking through public spaces, keep one hand gloved and the other hand gloveless for opening doors and pressing elevator buttons. Do not touch door handles and elevator buttons with a gloved hand in order to prevent the spread of cross-contamination.

11.3 Laboratory Coats and Other Protective Clothing

The choice of protective clothing depends upon the degree of protection required for the lab or the work being conducted. Protective and appropriate clothing is required when a potential exists for chemical splashes, exposure to hazardous dusts, fire, extreme heat or cold, excessive moisture or radiation. Protective clothing which should be readily available depending on chemical hazards used in the laboratory includes:

- Lab coats
- Lab aprons
- Shoe covers
- Coveralls
- Sleeve covers

Instruct laboratory personnel to consider the following characteristics in protective clothing selection and purchase:

- Ability to resist fire, heat and chemicals used
- Comfort, permitting easy execution of tasks when worn
- Chemical impermeability when needed
- Ease of cleaning (unless disposable)
- Ability to be removed during an emergency or chemical splash

EHS, in collaboration with CINTAS, provides laboratories with appropriate lab coats and laundering service. Selection is limited to standard white cotton blend lab coats, chemical and fire-resistant lab coats, and barrier coats. Each department has a central pickup and drop-off location. Contact EHS or visit the EHS website for more information.

Laboratory coats should be removed before exiting the building, entering the cafeteria, restrooms, or any public area.

11.4 Respiratory Protection

The OSHA Respiratory Protection Standard requires training, proper selection of respirators, fit testing and medical exam. Choose respiratory protection in consultation with EHS, as there are regulatory requirements as to the use and distribution of these devices. Respiratory protective equipment should not be used unless approved by EHS to ensure compliance with the OSHA Respiratory Protection Standard (Title 29, Code of Federal Regulations, Part 1910.134).

Respirators may need to be worn in the lab when performing non-routine operations such as chemical waste disposal, or spill response, or those procedures that pose a respiratory hazard (e.g., working with extremely toxic materials or doing a procedure where the fume hood is not sufficient or available). These procedures will require the use of a negative pressure half-face, full-face, or self-contained breathing apparatus. Filtering facepiece respirators (dust masks) and N95 respirators are used for particulates and dusts. If a dust mask or n95 respirator is to be worn for nonhazardous tasks, it may be worn voluntarily. Each lab, in conjunction with EHS, must determine the operations that require the use of a respirator.

Respirators are available, at no cost to the employee, to individuals that:

- Routinely clean-up chemical spills
- Work with toxic chemicals or gases that recommend respiratory protection
- Work with chemicals in locations where chemical hoods are not accessible
- Work with biologicals that required the use of a respirator
- Work with chemicals or biologicals in aerosol generating equipment
- Work with hazardous dusts or fine metal powders

12.0 Safety Data Sheets (SDSs)

Safety Data Sheets (SDSs) provide basic information about the safety and health hazards posed by a chemical and precautions to take when using it. The OSHA Laboratory Standard requires that:

- Maintain any SDSs that are received with incoming shipments of hazardous chemicals and ensure that they are readily accessible to laboratory employees.
- Ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.

Individual laboratories maintain notebooks or electronic access to Safety Data Sheets (SDSs) for chemicals used in the lab. Employees are encouraged to consult the SDSs before working with new chemicals, or to call or write to EHS for additional information. EHS also maintains a webpage with links to a variety of internal and external websites for SDS and other chemical safety related information.

EHS will provide information to laboratories, including the Chemical Hygiene Plan, the Laboratory Safety Manual, SDSs, OSHA Permissible Exposure Limits, and specific topical information from employee

requests. EHS personnel are available to answer questions and provide information to employees about chemical safety in laboratories. A physical copy of SDSs should be available from the chemical manufacturer. Physical copies of SDSs received with incoming shipments of hazardous chemicals are maintained by EHS at the Oak Creek Building. OSU EHS provides employees and students with an online SDS service for easy access to all online SDSs via SciShield homepage (oregonstate.scishield.com). You must have internet or Wi-Fi and an ONID to login. Contact EHS for additional assistance with obtaining an SDS or an ONID so you can access SDSs.

SDSs have a standardized format consisting of the following sections:

12.1 Section 1 - Identification

This section provides the following information:

- Product identified used on the label
- Other means of identification
- Recommended use of the chemical and restrictions of use
- Name, address, and information telephone number of the chemical manufacturer, importer, or other responsible party
- Emergency telephone number

The information telephone number is provided to allow the user to obtain information about the substance. The emergency telephone number is intended for use by emergency response and medical personnel.

12.2 Section 2 – Hazard Identification

This section provides the following information:

- Classification of the chemical in accordance with paragraph (d) or §1910.1200
- Signal word, hazard statement(s), symbol(s) and precautionary statement(s) in accordance with paragraph (f) of §1910.1200
- Describe any hazards not otherwise classified that have been identified during the classification process

12.3 Section 3 – Composition/Information on Ingredients

This section provides the following information for substances:

- Chemical name
- Common name and synonyms
- CAS number and unique identifiers
- Impurities and stabilizing additives

This section provides the following information for mixtures:

- The information listed for substances
- The chemical name and concentration (exact percentage unless trade secret) or concentration ranges of all ingredients

12.4 Section 4 – First Aid Measures

This section contains the following:

- Description of necessary measures, subdivided according to the first aid instructions for different routes of exposure (*i.e.*, inhalation, skin and eye contact and ingestion)
- Most important symptoms/effects, acute and delayed
- Indication of immediate medical attention and special treatment needed, if necessary

12.5 Section 5 – Fire Fighting Measures

This section contains the following information:

- Suitable (and unsuitable) extinguishing media
- Specific hazards arising from the chemical (*e.g.*, nature of any hazardous combustion products)
- Precautions to be observed when fighting the fire
- Appropriate protective equipment for fire-fighters

12.6 Section 6 – Accidental Releases Measures

This section contains the following information:

- Personal precautions, protective equipment, and emergency procedures
- Methods and materials for containment and cleaning up

12.7 Section 7 – Handling and Storage

This section contains the following information:

- Precautions for safe handling
- Conditions for safe storage including any incompatibilities

12.8 Section 8 – Exposure Controls/Personal Protection

This section provides the following information:

- OSHA permissible exposure limit (PEL)
- American Conference of Government Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available
- Appropriate engineering controls
- Individual protection measures such as personal protective equipment
- Recommended work and personal hygiene practices

12.9 Section 9 – Physical and Chemical Properties

This section contains the following information:

- Appearance
- Odor and odor threshold
- pH
- Melting point/freezing point
- Initial boiling point and boiling range
- Flash point
- Evaporation rate
- Flammability (solid, gas)

- Upper/lower flammability or explosive limits
- Vapor pressure
- Vapor density
- Solubility(ies)
- Partition coefficient: n-octanol/water
- Auto-ignition temperature
- Decomposition temperature
- Viscosity

12.10 Section 10 – Stability and Reactivity

This section contains the following information:

- Reactivity
- Chemical stability (under normal conditions)
- Possibility of hazardous reactions
- Conditions to avoid (e.g., static discharge, shock or vibration)
- Incompatible materials
- Hazardous decomposition products

12.11 Section 11 – Toxicological Information

This section contains the following description of the various toxicological (health) effects and the available data used to identify those effects, including:

- Information on the likely routes of exposure
- Symptoms related to the physical, chemical, and toxicological characteristics
- Delayed and immediate effects and also chronic effects from short – and long-term exposure
- Numerical measures of toxicity (such as acute toxicity estimates)
- Carcinogenic data: Whether the hazardous chemical is listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition) or by OSHA.

12.12 Section 12 – Ecological Information

This section contains the following information:

- Ecotoxicity (aquatic and terrestrial, where available)
- Persistence and degradability
- Bioaccumulative potential
- Mobility in soil
- Other adverse effects (e.g., hazardous to the ozone layer)

12.13 Section 13 – Disposal Considerations

Description of waste residue and information on their safe handling and methods of disposal, including the disposal of any containment packaging.

12.14 Section 14 – Transport Information

This section contains the following information:

- UN number and proper shipping name
- Transport hazard class(es)

- Packing group, if applicable
- Special precautions a user needs to be aware of, or needs to comply with, in connection with transport or conveyance either within or outside their premises

13.0 Additional Sources of Chemical Hazard Information

13.1 Various Texts

There are several toxicology texts available that are helpful in the evaluation of health hazards of chemicals, including the following:

- Annual Report on Carcinogens: Published by The National Toxicology Program (NTP), U.S Public Health Service.
- IARC Working Group Monographs: Published by The International Agency for Research on Cancer (IARC) covering specific agents, groups of agents or selected industries in which cancer has been caused or suspected.
- The Merck Index: A compendium of chemical information.
- The Chemical Abstracts: A serial collection providing detailed bibliographies and abstracts on research papers on hazards, toxicity, and related topics. These citations are based on the Chemical Abstracts Services registry number (CAS number).

13.2 Manufacturers/Suppliers

In addition to providing the SDS, many manufacturers/suppliers have telephone numbers that access customer service or technical representatives of the company, who may be able to provide additional information about the product. Additionally, many manufacturers/suppliers have websites that will allow you to access information regarding their chemicals.

13.3 NIOSH and Other Governmental Sources

The National Institute of Occupational Safety and Health (NIOSH), the Centers for Disease Control and Prevention (CDC), and OSHA all have published information related to chemical hazards/exposures which are available on their websites or can be requested there.

14.0 General Laboratory Safety Information

14.1 Laboratory Design

General laboratory design considerations for maintaining a positive safety culture and meeting the safety and comfort needs of the laboratory personnel:

- Wherever possible, separate wet chemical areas, or those with a higher degree of hazard, from other areas with a physical barrier, such as a wall or divider.
- Locate offices outside of the laboratory environment to allow for a safer workspace where food can be consumed, and quiet work can be done.
- Follow the BMBL requirements for BSL-2 spaces
- Laboratories who plan to use hazardous chemicals must ensure the proper chemical fume hood(s), safety shower, and eyewash are part of the lab design.

Additional recommendations available from *Prudent Practices in the Laboratory*, Chapter 9. OSU Capital Planning and Development works with EHS and has additional requirements and recommendations for laboratory design.

14.2 Chemical Exposure

Report all chemical exposures and near misses, spills, and fires to the laboratory supervisor and/or Principal Investigator and to EHS.

14.2.1 Eye Exposures

Immediately flush your eyes with tepid, potable water, such as an eyewash, for at least 15 minutes. Move eyes up and down and sideways to wash thoroughly behind the eyelids. Afterwards, seek medical attention and send an SDS of the chemical with the victim.

14.2.2 Skin Exposures

Immediately flush skin with flowing water for no less than 15 minutes; remove any jewelry or clothing as necessary. If there is no visible burn, wash with warm water and soap. Check the SDS to see if there are any additional precautions that should be taken or delayed effects. Seek medical attention and send an SDS of the chemical with the victim. Do not use creams, lotions, or salves, unless the SDS specifically calls for it.

14.3 Avoidance of "Routine" Exposure

Develop and encourage safe habits. Avoid unnecessary exposure to chemicals by any route. Do not smell or taste chemicals for any reason. Vent apparatus' that may discharge toxic chemicals (e.g., vacuum pumps, distillation columns, etc.) into local exhaust devices, such as chemical hoods. Do not allow release of toxic substances in climate-controlled rooms with re-circulated air to prevent building of vapors or gases. Avoid contamination by removing gloves and washing hands before touching door handles and cell phones.

14.4 Food and Drink

Do not eat, drink, or chew gum in areas where laboratory chemicals are present, per EHS Food and Drink Guidelines. Wash hands before conducting any of these activities outside of the laboratory. Do not store food or beverages in areas or refrigerators where chemicals or laboratory glassware are used for laboratory operations.

14.5 Use of Chemical Hoods

Use of chemical hood for all operations that might result in a release of toxic chemical gases, vapors or dust. As a general rule, use a hood or other local ventilation device when working with volatile substance with a Permissible Exposure Limit (PEL) or Threshold Limit Value (TLV) of less than 50 ppm. Consult the SDS for PEL or TLV. Confirm adequate hood performance before use; call EHS if you suspect your fume hood is not working properly.

- Do not use a hood with flow less than 90 linear feet per minute. EHS certifies fume hoods yearly and as needed. Contact EHS if you would like to verify your chemical fume hood performance.
- Hood sash height should not exceed 18 inches.
- As a best practice, keep the hood sash at a 2-inch opening at all times (e.g., while you are working and when you are not using the hood) except when adjustments within the hood are being made.
- Keep materials stored in hoods to a minimum and do not allow them to block vents or air flow.
- Refer to Section 10.0 for additional chemical hood guidelines.

14.6 Laboratory Dress Code

Wear shoes that fully cover your feet in the laboratory. Do not wear sandals, open toe, or perforated shoes or sneakers. Only closed-toed shoes should be worn in the laboratory in order to protect feet from potential spills.

Long pants that extend from the waist to the top of the shoes are recommended to protect legs from an accidental spill.

Application of contacts, cosmetics, and lotions is prohibited in the labs with chemicals. Confine dangling jewelry, long hair and loose clothing.

Special lab dress considerations for women who wear an *abaya*, *Shayla*, or *Hijab* and men who wear a *ghutra*: For women, one's *abaya* should be removed so that its long sleeves do not drag on the lab bench and its length does not drag on the floor. One's *shayla* or *hijab* must be tucked into the laboratory coat so that it will not hang or drop into open flames. If possible, use a cotton *shayla* or *hijab* rather than one made from polyester. A face veil cannot be worn due to potential dangers from chemicals or open flames. A surgical mask may be worn in place of the veil. For men, one's *ghutra* must be removed so that there is no danger of it dropping into an open flame. Any student or employee who is concerned about this approach should let your instructor or supervisor know. You can also reach out the Equal Opportunity and Access to request accommodation.

Laboratory coats, gloves and protective eyewear are required to be worn while working with or in the vicinity of hazardous materials that pose a potential hazard to the employee. Additional details on appropriate PPE is available in Section 22.0.

14.7 Personal Housekeeping

Keep the work area and all fume hoods clean and uncluttered, with chemicals and equipment properly labeled and stored. Clean up the work area at the end of an operation or each day.

14.8 Exiting the Laboratory

Wash hands and areas of exposed skin before leaving the laboratory. Remove laboratory coats and gloves prior to leaving the laboratory.

14.9 Equipment and Glassware

Handle and store laboratory glassware with care to avoid damage. Do not use damaged glassware. Use extra care with Dewar Flasks and other evacuated glass apparatus. Shield or wrap them to contain chemicals and fragments, should an implosion occur. Use equipment only for its designated purpose.

14.10 Horseplay

Avoid practical jokes or other behavior which may confuse or distract another worker (e.g., dancing in the lab).

14.11 Mouth Suction and Pipetting

Do not use mouth suction for pipetting or stating a siphon. Use a squeeze bulb, house vacuum, or Bernoulli device for these functions.

14.12 Photography and Videotaping the Laboratory

If photos or videos are being taken in the laboratory, ensure no photos are taken of individuals without proper PPE. Benches should be clean and not cluttered. Ensure all labeling, chemical containment, and lids are on all chemical bottles. It is important to remember that the person viewing your photos may not fully understand the work requirements of your lab, so always carefully plan out photos and videos with this in mind.

14.13 Hazard Planning

Seek information and advice about hazards, plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation. Obtain SDSs and collect them in a central location in the laboratory. Develop a standard operating procedure covering use, storage, and disposal of chemicals associated with the procedure. Ensure all equipment is maintained and inspected before use.

14.14 Standard Operating Procedures (SOPs)

A standard operating procedure, or SOP, is a set of written instructions that describe in detail how to safely perform work involving hazardous materials, hazardous equipment or hazardous processes. SOPs are required when operating procedures set forth by this CHP, are not sufficient in keeping employees safe. SOPs should have the following information:

- The specific procedure for using the equipment, process, or chemical;
- Hazards associated;
- Engineering controls and administrative controls;
- PPE requirements;
- Any maintenance or calibration requirements;
- Special handling and safe storage;
- First aid and spill procedures;
- Waste procedures; and
- Training requirements.

There should be documentation that employees have read, understood, and trained on the use of the chemical, equipment, or process. EHS provides template SOPs and can review your SOP upon request.

14.15 Unattended Operation

An unattended procedure is a process or piece of equipment which is left operating when no one is in the lab. If possible, avoid this practice.

Take these basic steps when running any unattended operation:

- Design these experiments to prevent the release of hazardous substances in the event of interruptions in utility services such as electricity, cooling water, and inert gas.
- Provide the containment of toxic substances in the event of failure of a utility service to an unattended operation.
- Equipment such as power stirrers, hot plates, heating mantles, and water condensers should not be run unattended without fail-safe provisions.
- If a piece of equipment is likely to be left unattended for long periods of time, electrical overload-protection devices should be used.
- Leave lights on in the area of unattended laboratory operations.
- Use an [Overnight or Unattended Lab Reaction](#) form that briefly describes the nature of the unattended operation, a list of the potential hazards (*i.e.*, flammable, toxic), and a name and telephone number of the person(s) to be contacted in an emergency. Ensure the form is near the experiment (*e.g.*, on the fume hood sash or on the bench next to the experiment).
- Open flames must never be left unattended.

14.16 Vigilance

Maintain situational awareness. Be aware of the hazards posed by the work of others in the lab and any additional hazards that may result from contact between materials and chemicals from

different work areas. Make others in the laboratory aware of any special hazards associated with laboratory work.

Be alert to unsafe conditions and see that they are corrected when detected. Watch for overcrowding or over storage of hazardous chemicals. Do not store incompatibilities together. Do not store corrosives and poisons above eye level.

14.17 Working Alone

Avoid working alone on a project. Do not work alone in a laboratory if the procedures being conducted are hazardous. Do not work late nights or weekends with toxic or hazardous chemicals unless the procedure is standard practice and poses no exceptional risks to personnel. Here are some tips to help ensure the safety of employees that must work alone on non-hazardous routine tasks:

- Check-in and check-out: have employees check in with their PI or Lab Manager as they are coming or going to ensure that employees have safely exited the lab.
- Ensure employees are familiar with what to do in an emergency and where emergency safety equipment is located.
- Continue to stress the importance of PPE with employees, especially when they are working alone as there is no one to help in the immediate area if an accident occurs.
- Ensure employees are aware of what tasks can and cannot be done if working alone. A lab policy should be written and reviewed/signed by employees on the lab's requirements for working alone.

14.18 Transportation of Materials

Use secondary containment such as tubs, buckets, trays, etc. when transporting chemicals between floors and buildings. Cap and label chemicals properly when transporting. The preferred method of transport is to use designated freight elevators and a cart rather than using a stairway. Transport chemicals directly to the lab that the materials are being transported to, do not stop at the bathroom, kitchen, or any other location. Avoid high-traffic areas. Contact EHS if you are transporting materials in a vehicle, including but not limited to, transporting between buildings, transport to off-site laboratory or farm, or for field work purposes as special precautions may be required.

14.19 Shipping Hazardous Materials

Hazardous materials or Dangerous Goods are substances or materials that have been determined by the Department of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce. Violations can lead to civil penalties and large fines.

Hazardous materials/dangerous goods include any substances that are flammable, corrosive, reactive, oxidizing, explosive, or toxic as well as radioactive and biologically infectious materials and compressed gases.

Some commonly shipped examples are:

- Batteries
- Specimens preserved in a solvent (alcohol, formaldehyde)
- Lab chemicals/samples
- Cylinders
- Dry ice
- Common household items such as spray paint, cleaners, perfume, etc.

Only trained and certified personnel are authorized to package and ship hazardous materials from OSU's main campus. Never ship material you suspect is hazardous without going through EHS Hazardous Material Shipping Office. Off-campus operations who are unable to ship from the main campus must use a freight forwarder (this includes FedEx/UPS if they will accept the shipment) with the appropriate certifications.

If your lab commonly ships hazardous materials, the PI or their designee must take the Hazardous Materials Shipping and Receiving Awareness Training via SciShield, so that they can ensure that the materials are shipped properly.

15.0 High Hazard Operating Procedures (HHOP)

This plan represents the standard operating procedures for all laboratories. However, additional High Hazard Operating Procedures (HHOPs) may be required if this CHP does not adequately account for the health and safety in a particular lab. This section complies with 29CFR 1910.1450(e)(3)(i), 29CFR 1910.1450(e)(3)(v) and 29CFR 1910.1450(e)(3)(viii).

Principal Investigators:

- Identify all Highly Hazardous Substance(s) (HHS) present in their laboratories.
- Establish a High Hazard Operating Procedure for each HHS.
- Submit a Chemical Safety Form to EHS, via SciShield, for review and approval for each HHOP or HHS.
- Ensure all laboratory personnel handling HHSs review and become familiar with the HHOP(s) prior to use.

Laboratory personnel who work with HHSs:

- Be familiar with HHOP established for each process and/or substance as well as the types of hazards associated.
- Competent in following the HHOP which includes the safe handling and use of the HHS.
- Receive specific hands-on training from the Principal Investigator or other experienced laboratory staff on the use of handling HHSs. Document all training received.
- Obtain prior approval from the PI and EHS before implementation of the process can be carried out.

The Principal Investigator is required to complete a Chemical Safety Form via SciShield for review from EHS for procedures involving:

- Select Carcinogens
- Reproductive Toxins
- High Acute and Chronic Toxicity Chemicals and Gases
- Explosive and Reactive (Unstable) Chemicals

15.1 Highly Hazardous Substances Requiring HHOP

15.1.1 Select Carcinogens

Carcinogens are any substances that are:

- Regulated by OSHA as a carcinogen
- Listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) latest edition.
- Listed under Group 1, "carcinogenic to humans" by the International Agency for Research on Cancer Monographs (IARC) latest edition.

- Listed in either Group 2A or 2B by IARC or under the category, “reasonably anticipated to be carcinogens” by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(a) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m³;

(b) After repeated skin application of less than 300 (mg/kg of body weight) per week; or

(c) After oral dosages of less than 50 mg/kg of body weight per day.

15.1.1.1 Examples of Carcinogenic Substances

- | | | |
|--|--|--|
| • 2-Acetylaminofluorene | • Acrylamide | • Acrylonitrile |
| • Aflatoxins | • 4-Aminobiphenyl | • Arsenic & Arsenic Compounds |
| • Asbestos | • Azathioprine | • Barium Chromate |
| • Benzene | • Benzidine | • Bis (chloromethyl) ether |
| • 1,4-Butylenedimethylsulfonate | • Chlorambucil | • Chloromethyl methyl ether |
| • Chromium and Chromium Compounds | • Cyclophosphamide | • Diethylstilbestrol |
| • 1,2-Dibromo-3-chloropropane | • 3',3'-Dichlorobenzidine | • Ethylene Dibromide |
| • 4-Dimethylaminoazobenzene | • Dimethyl Sulfate | • Formaldehyde |
| • Ethylene Oxide | • Ethylenimine | • Melphalan |
| • Hexamethylphosphoramide | • Hydrazine | • N,N-Bis(2-chloroethyl)-2-naphthylamine |
| • 4',4'-Methylene-bis(2-chloroaniline) | • Mustard gas (bis(2-chloroethyl) sulfide) | • Naphylamine |
| • Nickel carbonyl | • N-Nitrosodimethylamine | • Propiolactone |
| • 4-Nitrobiphenyl | • Thorium Dioxide | • Treosulfan |
| • Vinyl Chloride | • Ethylene Dibromide | • Ethylene Oxide |
| | | • Ethylenimine |

15.1.1.2 Handling and Use Requirements

Handle and use known, or suspected, carcinogens as follows:

- Follow procedures for work with chemicals of high acute toxicity.
- Conduct all transfers and work with these substances in a “controlled area” which may include a restricted access fume hood or glove box designated for use of highly toxic substances for which all people with access are aware of the substance used and necessary precautions.
- Protect vacuum pumps and other equipment from contamination by using containment methods or disposal covers. Decontaminate all equipment and glassware in the hood before removing them from the controlled area.
- Protect the work area by using readily disposable covers.
- Cover all areas that may be affected by splashes or aerosols.
- Decontaminate the controlled area before normal work is resumed.
- Users should always wear safety goggles, lab coat, and appropriate gloves. If the substance is used outside of a fume hood or glove box, special respiratory protection may be required.
- Remove all used PPE (placing it in an appropriate, labeled container) and thoroughly wash hands, forearms, face, and neck before leaving a controlled area.
- Keep accurate records of the amounts of these substances stored and used, the dates of use, and names of users.

- Assure that the controlled area is conspicuously marked with warning and restricted access signs and that all containers of these substances are appropriately labeled with identity and warning labels.
- Safe removal of contaminated waste must be established prior to working with the material.

15.1.1.3 Animal Work with High Chronic Toxicity or Known/Suspect Carcinogens

It is extremely important to exercise great caution when working with animals. The researcher should become familiar with chemicals or substances to be used during the procedure. In addition, consideration should be given to those who work directly with animals during transport or while animals are used in general laboratory areas. Always follow IACUC research protocols when administering hazardous materials to animals.

15.1.2 Reproductive Toxins (Embryotoxins)

Reproductive toxins are defined by the OSHA Laboratory Standard as substances that cause chromosomal damage (mutagens) and substances with lethal or teratogenic effects on the developing fetus. Many developmental toxins are chronic and cause damage after repeated or prolonged exposures with effects that become evident only after long latency periods. Reproductive toxins can affect both men and women but for women, exposure to reproductive toxins during pregnancy can cause adverse effects on the fetus.

15.1.2.1 Examples of Embryotoxins

- Arsenic and certain Arsenic compounds
- Lead Compounds
- Cadmium and certain Cadmium compounds
- Mercury compounds
- Carbon Disulfide
- Toluene
- Ethylene Glycol Monomethyl and ethyl ethers
- Vinyl Chloride
- Ethylene Oxide
- Xylene

15.1.2.2 Handling and Use Requirements

Pregnant women and women intending to become pregnant should seek advice from knowledgeable sources prior to working with substances that are expected to be reproductive toxins.

- Consult EHS for information on reproductive toxins or obtain an SDS.
- Handle these substances only in a properly functioning chemical hood and wear appropriate PPE (e.g., gloves, lab coat, safety goggles) to prevent skin contact.
- Review the SOP for the use of the reproductive toxin with the research supervisor or PI on an annual basis or when a procedural change occurs.
- Properly label and store these substances within a secondary container in an adequately ventilated area.
- Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.

- When appropriate, ensure that a controlled area is conspicuously marked with warning and restricted access signs and that all containers of these substances are appropriately labeled with identity and warning labels.
- Safe removal of contaminated waste must be established prior to working with the material.

15.1.3 High Acute and Chronic Toxicity Chemicals

These precautions are appropriate for substances with high toxicity which is defined as chemical having a probable lethal oral dose in humans of around 50-500 mg/kg (between a teaspoon and an ounce) for toxic, 5-50 mg/kg (between 7 drops and 1 teaspoon) for extremely toxic and <5 mg/kg (a taste, less than 7 drops) for supertoxic.

15.1.3.1 Examples of High Acute or Chronic Toxicity Compounds

- | | | |
|---------------------|--|--------------------|
| • Acrolein | • Arsine | • Chlorine |
| • Diazomethane | • Diborane | • Hydrogen Cyanide |
| • Hydrogen Fluoride | • Methyl Fluorosulfonate | • Nickel Carbonyl |
| • Osmium Tetroxide | • Sodium Azide | • Ozone |
| • Phosgene | • Sodium Cyanide (and other Cyanide Salts) | |

15.1.3.2 Handling and Use Requirements

Handle and use highly acute and chronic toxicity chemicals as follows:

- Obtain the smallest quantity needed to execute your experiments since excess storage may attribute to a hazard.
- Read the SDS prior to beginning work with the chemical. Note all hazards and recommendations for safe use including PPE requirements.
- Use and store these substances in areas of restricted access with special warning signs and storage containers.
- Work in a chemical hood or glove box. Use a clean and clear hood and ensure the hood is working properly before proceeding.
- Know the hazards prior to beginning and wear the appropriate PPE before beginning work to include gloves, goggles, face shield, lab coat, and a respirator, if required.
- Appropriate spill material must be available in the event of a release.
- Wash hands immediately after removing gloves.
- Limit access to the work area by other members of the laboratory.
- Do not work alone when using these materials.
- Assure that a controlled area is conspicuously marked with warning and restricted access signs and that all containers of these substances are appropriately labeled with identity and warning labels.
- Establish procedures to safely remove contaminated wastes prior to working with the material.

15.1.3.3 Toxicity Hazard Level - Table

Hazard Level	Toxicity Level	Oral LD ₅₀ (rats, per kg)	Skin Contact LD ₅₀ (Rabbits, per kg)	Inhalation LC ₅₀ (Rats, ppm/1hr)	Inhalation LC ₅₀ (Rats, mg/m/1hr)
High	High	<50 mg	<200 mg	<200	<2,000
Medium	Moderate	50 - 500 mg	200 mg – 1 g	200 - 2,000	2,000 – 20,000
Low	Slight	500 mg – 5 g	1 – 5 g	2,000 – 20,000	20,000 – 200,000

15.1.3.4 Probable Lethal Dose for Humans – Table

Toxicity Rating	Animal LD ₅₀	Lethal Dose (Ingestion by 70kg (150lb) Human)
Extremely toxic	Less than 5mg	A taste (less than 7 drops)
Highly toxic	5 to 50mg	7 drops to a teaspoon
Moderately toxic	50 to 500mg	1 teaspoon to 1 ounce
Slightly toxic	500mg to 5g	1 ounce to 1 pint
Practically nontoxic	Above 5g	Above 1 pint

15.1.4 Explosive and Reactive (Unstable) Chemicals

Any substance that falls into these categories:

- Explosives (GHS #H200, H201, H202, H203, H304, H205)**
 An explosive substance (or mixture) is a solid or liquid 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 Gases (GHS #H220, H221)**
 Flammable gas means a gas having a flammable range in air at 20° C and a standard pressure of 101.3 kPa.
- Self-Reactive Substances (Type A) (GHS #H251)**
 Self-reactive substances are thermally unstable liquids or solids liable to undergo a strongly exothermic thermal decomposition even without participation of oxygen (air).
- Pyrophoric Liquids and Solids (GHS #H250)**
 A pyrophoric is a material which, even in small quantities, is liable to ignite within five minutes after coming in contact with air.
- Water Reactive Chemicals (which emit flammable gases on contact with water) (Category 1) (GHS #H260)**
 Substances that, in contact with water, emit flammable gases. Solids or liquids which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

15.1.4.1 Examples of Explosive and Reactive (Unstable) Chemicals

- | | | |
|---------------------------|-------------------------|--------------------------|
| • Alkali Metals | • Alkali Metal Hydrides | • Alkali Metal Nitrides |
| • Anhydrous Metal Halides | • Calcium Hydride | • Dinitrophenylhydrazine |
| | • Hydrazine | • Inorganic acid halides |

- Lithium Aluminum Hydride
- Perchloric & Picric Acid
- Zinc & Zinc Nitrate
- Metal & Non-Metal Hydrides
- Sodium Borohydride
- T-Butyllithium
- Metal Azides
- Non-Metal Halides
- Sodium Hydride
- White Phosphorous

15.1.4.2 Handling and Use Requirements

Handle and use explosive and reactive (unstable) chemicals as follows:

- Wear appropriate PPE (e.g., face shield, safety goggles, leather outer gloves, flame-resistant lab coat).
- Date containers upon receipt and when opened. Dispose of expired explosives through EHS hazardous waste program.
- Purchase materials in small, usable amounts and keep minimum amounts on hand. Conduct a risk assessment when scaling up.
- If there is a chance of explosion, use protective barriers (e.g., fume hood sash and explosion safety shield or other methods for isolating the material or process).
- Store explosives in a cool, dry and protected area.
- Contact EHS if you need to transport any explosive or reactive materials.
- Use tongs when manipulating hazardous items at a safe distance in order to prevent exposure of any part of the body to injury.
- Segregate highly reactive chemicals from materials that might interact with them to create a risk of explosion. Do not use past expiration date.
- Assure that a controlled area is conspicuously marked with warning and restricted access signs and that all containers of these substances are appropriately labeled with identity and warning labels.
- Safe removal of contaminated waste must be established prior to working with the material.

15.2 Chemical Safety Form

The Chemical Safety Form serves as a tool to coordinate information and resources into a succinct procedure and facilitate review with lab staff. The Chemical Safety Form is available via SciShield.

EHS will review and assist in the development and implementation of the HHOP and associated exposure control strategies for highly hazardous substances, as needed or required. EHS will refer certain SOPs or protocols to the Chemical Safety Committee based on their high hazard nature and the need for further procedural review.

15.3 Elements of the HHOP

The HHOP establishes and documents all work that involves the use of Highly Hazardous Substances and identifies and consolidates related documents and procedures. HHOP ensures a process is in place so that a hazard assessment is conducted and exposure control strategies are identified and implemented prior to conducting the experiment. Include the following information in HHOP via the Chemical Safety Form:

- Name of PI and location of laboratory(s) that work will be conducted in.
- High Hazard Substance Information: The name, physical state/concentration, and all hazards of the High Hazardous Substances used in the laboratory must be listed. Review the SDS or container label for information on hazards.

- Significant Route(s) of Exposure: Review and understand the hazards of High Hazardous Substances and processes in the laboratory research prior to conducting work so that all potential hazardous route(s) of exposure are addressed.
- Exposure Controls: Utilize appropriate measures to control the hazards, including consistent and proper use of Engineering Controls and Personal Protective Equipment. Section 20 has more information regarding appropriate PPE. Engineering controls include Chemical Fume Hoods and Glove Boxes, more information on these is available in Section 10.
- Use and Storage:
 - Only laboratory personnel who are fully trained in use and handling are aware of the hazard(s) that are associated with the HHS are allowed to use it. Document training.
 - Persons handling the HHS should never work alone.
 - Provide a brief description of the part of the experiment that involves the substance and how it may be manipulated (if applicable).
 - If HHSs are administered to or expose to animals, make sure to note that you have already obtained IACUC approval.
 - Ensure to note the “designated area(s)” in which employees will work with the HHS. Establish “designated area” to work with select carcinogens, reproductive toxins or acute toxicity. Ensure this area is marked with a hazard warning.
 - Refer to the SDS to determine if specific precautions are needed for the HHS.
- Medical Attention and First-Aid: Some HHS may require specific first-aid/emergency procedures (e.g., administration of an antitoxin) to be followed in the event of an accident/exposure. Include information on the appropriate first-aid medical consultations or examinations. Contact EHS for assistance on what may need to be included if you are unsure.
- Decontamination:
 - Good housekeeping is essential to the health and well-being of laboratory personnel. All equipment and work surfaces used for handling HHS should be decontaminated after use. Ensure that a decontamination method effective for your HHS is used.
 - When leaving a designated area, remove any PPE to avoid cross contamination.
 - Ensure a hand wash facility is available and is used before leaving the lab when working with a HHS.
- Emergency Procedures and Spill Response:
 - Ensure individuals working with hazardous substances have immediate access to an eyewash station, safety shower, and appropriate fire extinguisher (if needed). Contact EHS if the appropriate safety equipment is not readily available.
 - Some substances may require special clean-up or neutralization material. Ensure this is easily accessible.
 - In the event of a chemical spill emergency, call Public Safety 9-1-1 or 541-737-7000. Call EHS at 541-713-SAFE (7233) for spill response assistance. Do not attempt to handle a spill of an HHS. Turn off all ignition sources and evacuate the laboratory immediately.
- Waste Management and Disposal: If waste disposal requires any specialized waste procedures, ensure that these are included in your HHOP. For example, some waste materials may require neutralization or deactivation prior to disposal. EHS can also assist with the proper procedure and help make a waste determination.
- Training: Employees who work with hazardous chemicals or have access to the designated areas must complete the Laboratory Safety Training provided by EHS. The PI or other experienced senior staff that are familiar with the safe handling of the HHS must provide staff with hands-on HHOP training prior to the start of any work with these chemicals. Staff must be trained in all components of the HHOP. New users of the HHS must work under the close supervision of an experienced user. Document all training.

15.4 Review of HHOP by Chemical Safety Committee (CSC)

In cases where significant chemical hazards are identified as part of the HHOP, such as high hazardous chemicals with unique or special hazards that pose an unreasonable risk to personnel, property, or the environment, EHS will refer that HHOP to the CSC for further review and approval.

16.0 Chemical Procurement and Receiving

OSHA Lab Standard states that “before a substance is received, information on proper handling, storage and disposal should be known to those who will be involved.”

16.1 Chemical Procurement

When preparing to order chemicals, keep the following in mind:

- What is the minimum amount of this chemical needed to perform the experiment? Try to avoid ordering more than you need. Prudent purchasing will save storage space, money, and disposal costs.
- Is the proper PPE available in the lab to handle the chemicals?
- Are there any special handling, storage, or disposal considerations?
- Do you know the spill and injury precautions or equipment you may need?

16.2 Receiving Chemicals

Inspect chemicals received by the laboratory prior to unpacking. It should be noted if there appears to be any leakage on the outside of the box or on the packaging material. If contents appear to be damaged, contact EHS and the company from whom the chemical was ordered. All damaged chemical containers must be considered as spilled material and disposed of as chemical waste.

Additionally, ensure the following:

- SciShield chemical inventory is updated to include the chemical received.
- SDS is available and added to the SDS binder (if you use one). If you use online SDSs, ensure employees are aware of how to find it.
- Chemical label is legible and secure on the container of the chemical. If the container label has been defaced, it should be properly relabeled.

17.0 Chemical Inventory

All laboratories are required to maintain an up-to-date complete inventory of all hazardous materials including both chemicals and compressed gases as well as the quantity of these materials. Chemical inventories are used to ensure compliance with storage limits and other regulations and can be used in an emergency to identify potential hazards for emergency response. On an annual basis, EHS submits inventory reports to the Oregon State Fire Marshall's office. Information reported to external agencies is generalized by building and does not contain any personal information. More detailed information is kept in the EHS office and made available during an incident requiring an emergency response or as needed during a regulatory visit.

17.1 Electronic Chemical Inventory

OSU provides access to SciShield, our chemical inventory management system. SciShield is a web-based database application which allows authorized users to access and update their chemical inventory via the internet. Lab members can view or edit the chemical inventory unless the PI or Lab Manager remove access. For additional information on what is required to be included in the chemical inventory, review the [Chemical Inventory Use Guide](#).

17.2 Updating the Chemical Inventory

The inventory is a yearly average of what is in the lab at any one time. If the quantity of a chemical is continuously fluctuating due to use, estimate on the higher end to ensure it is not underestimated. Chemical inventory reviews should be conducted on at least a yearly basis; however, it should be updated as new chemicals are introduced to the laboratory.

18.0 Chemical Labeling Requirements

18.1 Manufacturer Labeling Requirements

All chemical containers must be properly labeled. Incoming, original containers from chemical manufacturers are required under the Federal OSHA Hazard Communication Standard to provide the following information:

- Common name of chemical
- Chemical manufacturer's name, address and emergency telephone number
- Health and safety hazard warnings (e.g., flammable, corrosive, etc.)

18.2 Laboratory Labeling Requirements

Laboratory personnel are responsible for ensuring all secondary chemical containers produced in the laboratory are properly labeled as follows:

- Legible and easy to read in English, no chemical structures.
- Chemicals in containers over 2 liters must be labeled with their full name, no abbreviations.
- If abbreviations are used for chemicals under 2 liters in size, an abbreviations cross-reference sheet must be posted near the entrance(s) to the laboratory (e.g., EtBr = Ethidium Bromide).
- Hazards, if possible, should also be listed.
- If the chemical is a byproduct whose composition is not known, the employee shall assume that the substance is hazardous.

18.3 Date Labeling Requirements for Reactive Chemicals

Dates of receipt and date of opening should be noted on the bottle for each of the following groups. Chemicals should not be held past their recommended expiration date or in the specified amount of time from the date of their receipt.

- Picrics
- Perchlorates
- Peroxides
- Peroxide forming materials (e.g., aldehydes, ethers and compounds containing benzylic hydrogen atoms). See Section 19 for more information.
- Chemicals with polymerization hazards
- Other unstable or reactive chemicals










18.4 Unlabeled Chemicals

Dispose of unlabeled/unknown chemicals via EHS in accordance with OSU's Waste Disposal Procedures (Section 27).

18.5 Global Harmonized System (GHS) Pictograms

GHS Pictograms are graphic images that show the user of a hazardous product what type of hazard is present.

GHS Pictograms and Hazards

HEALTH HAZARD  <ul style="list-style-type: none">• Carcinogen• Mutagenicity• Reproductive Toxicity• Respiratory Sensitizer• Target Organ Toxicity• Aspiration Toxicity	FLAME  <ul style="list-style-type: none">• Flammables• Pyrophorics• Self-Heating• Emits Flammable Gas• Self-Reactives• Organic Peroxides	EXCLAMATION MARK  <ul style="list-style-type: none">• Irritant (skin & eye)• Skin Sensitizer• Acute Toxicity (harmful)• Narcotic Effects• Respiratory Tract Irritant• Hazardous to Ozone Layer (Non-Mandatory)	CORROSION  <ul style="list-style-type: none">• Skin Corrosion/Burns• Eye Damage• Corrosive to Metals	
EXPLODING BOMB  <ul style="list-style-type: none">• Explosives• Self-Reactives• Organic Peroxides	GAS CYLINDER  <ul style="list-style-type: none">• Gases Under Pressure	FLAME OVER CIRCLE  <ul style="list-style-type: none">• Oxidizers	ENVIRONMENT (Non-Mandatory)  <ul style="list-style-type: none">• Aquatic Toxicity	SKULL AND CROSSBONES  <ul style="list-style-type: none">• Acute Toxicity (fatal or toxic)

19.0 Chemical Storage Limits and Requirements

Chemical storage areas in the laboratory setting include chemical storerooms, laboratory work areas (shelves and bench cabinets), storage cabinets, refrigerators, and freezers.

19.1 Permitted Laboratories and Chemical Storage Rooms

Hazardous chemicals may only be used and/or stored in laboratories or chemical storage rooms which have been permitted by EHS and OSU. Storage of hazardous materials in an office are prohibited, unless said office has been converted into a laboratory.

19.2 Chemical Storage Limits

Hazardous chemicals may only be used and/or stored in laboratories or chemical storage rooms which have been permitted by EHS and OSU. Laboratories must comply with the [2019 Oregon Fire Code Chapter 38: Higher Education Laboratories](#) which limits the amount of flammable liquids that can be used and stored in a laboratory or laboratory "suite". Contact EHS Fire/Life Safety Team to review the storage and use limits for your laboratory or space.

19.3 General Storage Requirements

19.3.1 Storage Locations

- No storage within 18 inches of the ceiling.
- No storage of chemicals, excluding standard detergents, under sinks.
- Shelves should be secured firmly to walls.
- Provide anti-roll lip on all shelves that is about 1 inch in height.
- Avoid storing chemicals in alphabetical order due to the possibility of incompatibilities being stored near one another.
- Store acids and corrosives in dedicated cabinets, while keeping bases separate. Nitric acid can be stored with other acids if kept in a separate secondary container.

- Store flammables in a vented flammables cabinet when possible.
- Flammable liquids in excess of 10 gallons must be stored in a flammable storage cabinet.
- Store those chemicals with special storage requirements separately. Examples include, nitrates, perchlorates, perchloric acids, peroxides, peroxide formers, air or water reactive materials (e.g., sodium, lithium), pyrophoric materials, toxic gases, and strong oxidizers.
- Every chemical should have a storage location and should be returned to that location after use.
- Chemical storage on bench tops should be minimized in order to reduce the amounts of chemicals unprotected from a potential fire and to prevent them from being easily knocked over.
- Chemicals should not be stored above eye level. Store larger containers on lower levels, if possible.
- Chemical storage in hoods should be minimized to less than one third of the hood space. Avoid blocking rear baffles with any hood storage. Storing containers inside the hood interferes with airflow, reduces, and clutters up the workspace and may involve the stored materials in a spill, fire, or explosion.
- Stored chemicals must not be exposed to direct sunlight or heat.
- Secondary containment should be used when storing chemicals close to a water source, segregating those chemicals that need secondary containment for incompatibility reasons, when storing acids on bare metal, highly toxic or hazardous materials, or storing chemicals in a refrigerator or freezer.
- Label chemical storage cabinets according to the type of chemical family or hazard classification found there (e.g., acid storage).

19.3.2 Laboratory Refrigerators and Freezers

- Laboratory refrigerators or freezers cannot be used to store food.
- Utilize explosion proof or flammable-proof refrigerators/freezers when flammable liquids must be refrigerated. The use of standard refrigerators to store large quantities of flammable liquids is prohibited.
- Label all refrigerators/freezers as to their intended use (e.g., for research purposes only, no food and drink allowed).
- Frequently inventory materials stored in refrigerators/freezers and defrost occasionally to prevent chemicals from becoming trapped in ice formations.

19.3.3 Water-Reactive Chemicals

Water-reactive chemicals must be stored in a manner to prevent direct contact from water and fire sprinkler systems. Label the storage area for water-reactive chemicals (e.g., "Water-Reactive Chemicals").

19.3.4 Compressed Gases

- The name of the gas must be marked on the cylinder.
- Flammable gas cylinders should be stored in a separate area from oxidizing compressed gases. A minimum of 20 feet must be maintained between oxidizers and flammable gases and other combustible materials, such as oil and grease. A firewall (partition) with a half-hour rating can be substituted.
- Cylinders of incompatible gases must be segregated by distance. Group cylinders by the type of gas (e.g., toxic, corrosive, etc.).
- Empty cylinders should be separated from full cylinders and labeled as "Empty" or "MT."
- Never use a valve wrench that is not specifically meant for gas cylinders.

- All compressed gases must be stored away from direct or localized heat (including radiators, steam pipes, or boilers) in well-ventilated and dry areas, and away from areas where heavy items may strike them (e.g., service corridors or near forklift traffic).
- All compressed gases, including empty cylinders, must be secured in an upright position with a chain, strap, or stand and must be capped when stored or moved.
- Use a hand truck when transporting gas cylinders to and from storage location. Never drag, slide, or lift a cylinder by the cap. Only transport with the valve cover in place.
- Gas cylinders must be hydrostatically tested by the vendor every 5 to 10 years. The last testing date is embossed in the metal near the head of the cylinder.
- Highly toxic or corrosive gas cylinders (including lecture bottle size) should be stored upright and inside a vented cabinet or fume hood.
- Inert gases or gases that deplete oxygen in the room may require oxygen sensors nearby in order to ensure the atmosphere does not deplete oxygen. EHS can help evaluate if this is necessary for your laboratory.

19.3.5 Segregation of Incompatible Chemicals

- Do not arrange chemicals alphabetically or haphazardly either in stockrooms or in the laboratory work areas.
- Segregate chemicals to prevent mixing of incompatible chemical vapors or liquids in the event that containers break or leak.
- Review a chemical's SDS for incompatible materials. Contact EHS if you are uncertain of incompatibles of your chemicals.


STORAGE GROUPS

Store chemicals in separate secondary containment and cabinets

A	Compatible Organic Bases
B	Compatible Pyrophoric & Water Reactive Materials
C	Compatible Inorganic Bases
D	Compatible Organic Acids
E	Compatible Oxidizers including Peroxides
F	Compatible Inorganic Acids not including Oxidizers or Combustible
G	Not Intrinsically Reactive or Flammable or Combustible
J*	Poison Compressed Gases
K*	Compatible Explosive or other highly Unstable Material
L	Non-Reactive Flammable and Combustible, including solvents
X*	Incompatible with ALL other storage groups

*Storage Groups J, K and X: Consult EHS Department For specific storage - consult manufacturer's MSDS

If space does not allow Storage Groups to be kept in separate cabinets the following scheme can be used with extra care taken to provide stable, uncrowded, and carefully monitored conditions.



Storage Group X must be segregated from all other chemicals.

Storage Group B is not compatible with any other storage group.

Table 19.1 Hazard Class Segregation:

Hazard Class	Keep Out of Contact with:
Flammables	Oxidizers
Acids	Bases
Organic Acids	Inorganic Acids
Water Reactive Chemicals	Water and Aqueous Solutions

Table 19.2 Incompatible Chemicals:

Chemical	Keep Out of Contact with:
Acetic Acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, and permanganates.
Acetone	Bromine, chlorine, nitric acid, sulfuric acid, and hydrogen peroxide
Acetylene	Chlorine, bromine, copper, fluorine, silver, and mercury
Alkaline metals (e.g., powdered aluminum, magnesium, sodium, potassium, etc.)	Carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide and water.
Aluminum and it's Alloys (powders)	Acid or alkaline solutions, ammonium persulfate and water, chlorates, chlorinated compounds, nitrates, and organic compounds in nitrate/nitrate salt baths.
Ammonia (anhydrous)	Bromine, chlorine, calcium hypochlorite, hydrofluoric acid, iodine, mercury, and silver.
Ammonium Nitrate	Acids, metal powders, flammable liquids, chlorates, nitrates, sulfur and finely divided organics or other combustibles.
Aniline	Hydrogen peroxide or nitric acid
Azides (inorganic)	Acids, heavy metals and their salts, oxidizing agents
Bromine	Acetone acetylene, ammonia, benzene, butadiene, butane and other petroleum gases, hydrogen, finely divided metals, sodium carbide, turpentine.
Calcium Oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Caustic (soda)	Acids (organic and inorganic)
Chlorates or Perchlorates	Acids, aluminum, ammonium salts, cyanides, phosphorous, metal powders, oxidizable organics or other combustibles, sugar, sulfides, and sugar.

Chemical	Keep Out of Contact with:
Chlorine	Acetone, acetylene, ammonia, benzene butadiene, butane and other petroleum gases, hydrogen, finely divided metals, sodium carbide, turpentine.
Chlorine Dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Chromic Acid	Acetic acid, naphthalene, camphor, ethyl alcohol, glycerin, turpentine, alcohol, and flammable liquids
Copper	Acetylene, hydrogen peroxide.
Cumene Hydroperoxide	Acids
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, bromine, chlorine, fluorine, iodine.
Fluorine	Isolate from everything
Hydrazine	Hydrogen peroxide, nitric acid, and other oxidizing agents
Hydrocarbons	Bromine, chlorine, chromic acid, fluorine, hydrogen peroxide, and sodium peroxide.
Hydrocyanic Acid	Nitric acid, alkali
Hydrofluoric Acid	Ammonia (aqueous or anhydrous)
Hydrogen Peroxide (anhydrous)	Chromium, copper, iron, most metals or their salts, aniline, any flammable liquids, combustible materials, nitromethane, and all other organic material.
Hydrogen Sulfide	Fuming nitric acid, oxidizing gases
Iodine	Acetylene, ammonia (aqueous or anhydrous), and hydrogen
Mercury	Acetylene, alkali metals, ammonia, fulminic acids, nitric acid with ethanol, hydrogen, oxalic acid
Nitrates	Combustible materials, esters, phosphorous, sodium acetate, stannous chloride, water, zinc powder.
Nitric Acid	Acetic acid, acetone, alcohol, aniline, chromic acid, flammable gases and liquids, hydrocyanic acid, hydrogen sulfide and nitratable substances.
Nitrites	Potassium or sodium cyanide
Nitrocellulose (wet, dry)	Phosphorous
Nitroparaffins	Inorganic bases, amines
Oxalic Acid	Silver, mercury, and their salts

Chemical	Keep Out of Contact with:
Oxidizing Agents (e.g., chlorates, chromates, dichromates, chromium trioxide, halogens, halogenating agents, hydrogen peroxide, nitric acid, nitrates, perchlorates, peroxides, permanganates, persulfates)	Reducing agents, ammonia (anhydrous and aqueous), carbon, metals, metal hydrides, nitrites, organic compounds, phosphorus, silicon, sulfur
Oxygen (liquid or enriched air)	Flammable gases, liquids, or solids such as acetone, acetylene, hydrogen.
Perchloric Acid	Acetic anhydride, alcohols, bismuth and its alloys, paper, wood, grease, oils or any organic materials and reducing agents.
Peroxides (organic)	Acid (inorganic or organic).
Phosphorus (white)	Air, oxygen
Phosphorus Pentoxide	Alcohols, strong bases, water
Potassium	Air (moisture or oxygen), water, carbon tetrachloride, carbon dioxide
Potassium Chlorate	Sulfuric and other acids
Potassium Perchlorate	Acids
Potassium Permanganate	Benzaldehyde, ethylene glycol, glycerol, sulfuric acid
Reducing Agents	Oxidizing agents, arsenates, arsenites, phosphorus, selenites, selenates, tellurium salts and oxides
Silver and Silver Salts	Acetylene, oxalic acid, tartaric acid, fulminic acid, ammonium compounds.
Sodium	Chloroform, aqueous solutions, also see alkali metals
Sodium Chlorate	Acids, ammonium salts, oxidizable materials and sulfur
Sodium Nitrite	Ammonia compounds, ammonium nitrate, or other ammonium salts
Sodium Peroxide	Any oxidizable substances, such as ethanol, methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerol, ethylene glycol, ethyl acetate, methyl acetate, furfural, etc.
Sulfides	Acids
Sulfur	Any oxidizing materials
Sulfuric Acid	Chlorates, perchlorates, permanganates, compounds with light metals such as sodium, lithium, and potassium.
Water	Acetyl chloride, alkaline and alkaline earth metals, their hydrides and oxides, barium peroxide, carbides, chromic acid, phosphorous oxychloride, phosphorous pentachloride, phosphorous pentoxide, sulfuric acid, sulfuric trioxide.

20.0 Security of Hazardous Materials in Labs

Laboratories need to take specific actions in order to provide security against theft of highly hazardous materials, controlled substances, syringes and needles, radioactive materials, and biological materials, and to ensure compliance with federal regulations. EHS urges each unit to review and develop procedures to ensure the security of all hazardous materials in their area of responsibility.

Follow these guidelines to minimize opportunities for intentional removal of any potentially hazardous materials from your laboratory:

20.1 Laboratory Security Versus Safety

Laboratory security is preventing intrusion into the laboratory and the theft of equipment or materials from the laboratory.

20.2 Developing a Security Policy

- Assess your laboratory area for hazardous materials and particular security issues.
- Develop, implement, and train laboratory group members on security procedures and assign responsibilities.

20.3 Control Access

Control access to areas where hazardous materials are used and stored.

- Limit laboratory access to only those individuals who need to be in the laboratory.
- Restrict off-hours access to individuals unless authorized by the PI.
- Lock freezers, refrigerators, storage cabinets, and other containers where stocks of biological agents, hazardous chemicals, or radioactive materials are stored when they are not in direct view of workers.
- Do not leave hazardous materials unattended or unsecured at any time.
- Close and lock laboratory doors when no one is present.

20.4 Know Who is in the Laboratory Area

Know who is in the laboratory area at any given time. Approach anyone who you do not recognize or who appears to be wandering in the laboratory areas and ask if you can help direct them. Be cautious about wearing earbuds in the laboratory since you may not be able to hear others enter.

20.5 Secure Highly Hazardous Materials

- Use a log to sign highly hazardous materials in and out of secure storage.
- Take a periodic inventory (e.g., check that no material is missing) of all highly hazardous chemicals, biological agents/toxins, radioactive materials, and DEA controlled substances.
- Be aware of what materials are being ordered as well as being removed or disposed of via EHS.
- Visually screen packages before bringing them to the laboratory.

20.6 Agents of Concern

Laboratory researchers should be aware of any agents of concern that they have.

- For lists of biological diseases and agents, go to the CDC website:
<https://emergency.cdc.gov/agent/agentlist-category.asp>,
<https://emergency.cdc.gov/agent/agentlist.asp>

- For a list of agents of concerns from the Department of Homeland Security:
<https://www.cisa.gov/publication/cfats-coi-list>

20.7 Emergency Plan

- Have a protocol for reporting incidents. PIs/Lab Managers, in cooperation with building managers and public safety, should have policies and procedures in place for the reporting and investigation of incidents or possible incidents, such as undocumented visitors, missing chemicals, or unusual or threatening phone calls.
- Review and update the laboratory's emergency contact information on or near your laboratory door as needed.

21.0 Special Safety Precautions

21.1 Allergen Safety

Some chemicals or substances are known to cause an allergic reaction via skin or respiratory contact.

- Wear suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity. Lab coats can also help prevent skin contact. Wear long pants and closed-toed shoes to prevent materials from coming in contact with legs or feet.
- Allergic reactions can be immediate, occurring within minutes after exposure, or can have a delayed effect after the initial chemical exposure.

21.2 Bunsen Burner Safety

Bunsen burners present fire hazards. They produce an open flame, burn at a high temperature and, as a result, there is potential for an accident to occur. For the safety and convenience of everyone working in the laboratory, it is important that the guidelines below be observed.

Bunsen burner safety guidelines:

- Place the Bunsen burner away from any overhead shelving equipment or light fixtures.
- Remove all papers, notebooks, combustible materials, and excess chemicals from the area.
- Tie back any long hair, dangling jewelry, or loose clothing.
- Inspect the burner hose for cracks, holes, pinched points, or any other defect and ensure that the hose fits securely on the gas valve and the Bunsen burner.
- Replace all hoses found to have a defect before use.
- Notify others in the laboratory that the burner will be in use.
- Utilize a sparker / lighter with an extended nozzle to ignite the Bunsen burner. Never use a match to ignite a Bunsen burner.
- Have the sparker / lighter available before turning on the gas.
- Adjust the flame by turning the collar to regulate airflow and produce an appropriate flame for the experiment (typically a medium blue flame).
- Do not leave open flames unattended and never leave the laboratory while the burner is on.
- Shut off the gas when finished using the burner. Ensure that the main gas valve is off before leaving the laboratory.
- Ensure the burner has cooled before handling.

21.3 Heating Devices (i.e., hot plates, drying ovens, furnaces, etc.)

Heating devices, such as drying ovens and hot plates are commonly used in the laboratory. Regardless of the type of heating device used, never heat a sealed container and always use the device as intended, especially when used with or near flammable or combustible solvents or materials. Heating devices must be rated/approved for the use and the environment in which it will be used. Follow these additional tips for safe use of specific heating devices.

21.3.1 Drying Ovens and Furnaces

- Do not use mercury thermometers to monitor oven temperatures. Accidental breakage of the thermometer will cause a serious hazard since uncontained mercury will volatilize very rapidly.
- Know your sample's combustible/flammable temperature limit and do not exceed this temperature.
- If possible, use a high temperature shut-off set point at a temperature that does not meet or exceed your material's combustion point.
- If there is a possibility of generating fumes, the oven must be connected to an approved ventilation system.
- Ensure there are a few inches of clearance around the oven or furnace and that there are no combustibles stored on or directly adjacent to it.
- Do not leave drying ovens or furnaces on all of the time. They should be turned off when not in use.
- Use thermal gloves or tongs to remove items from their heating units.
- OSU requires all drying ovens to have an SOP that states the maximum temperature and time the drying oven should be on for each particular process. A user log is also recommended. Both documents are available on the EHS website: https://ehs.oregonstate.edu/sites/ehs.oregonstate.edu/files/pdf/si/drying_ovens_si.pdf

21.3.1 Heating Mantles, Hot Plates, Heated Stir Plates

- Unattended heating devices must be protected with a temperature-sensing device that will turn the power off in the event of overheating.
- Allow the hot plate to cool before handling.
- Ensure there are a few inches of clearance around the heating unit and ensure that there are no combustibles stored on or directly adjacent to it, including chemicals.
- If water or other liquid has been spilled onto the element, have the equipment serviced before using again.
- Always turn off a hot plate when it is not in use.

21.4 Hydrofluoric Acid (HF)

Hydrogen fluoride/hydrofluoric acid (HF) is an extremely corrosive acid and a systemic poison due to the fluoride ion it readily releases. This fluoride ion causes tissue necrosis, hypocalcemia. Affected areas with visible damage can remain symptom free for up to 24 hours, especially with dilute solutions of < 20%. Concentrated solutions of > 40% generally elicit symptoms more quickly. Burns are extremely painful and should receive immediate attention as exposures to HF may be fatal. HF is a respiratory, dermal and ingestion hazard.

If your laboratory utilizes HF, the Principal Investigator must develop a High Hazard Operating Procedure for its use in accordance with Section 15.0 – High Hazard Operating Procedures. All personnel working in the laboratory must be familiar with the HHOP. In addition to basic laboratory procedures, the procedure below must be followed:

- HF must only be stored in approved poly containers. HF etches glass and corrodes

- metal.
- Work with as small quantities as possible. It is also advised to purchase already diluted 10% (or less) HF.
- Review the Safety Data Sheet (SDS) prior to working with HF. Know the hazards.
- Restrict access to the work area and post that HF is being used. Put up a sign on the fume hood if experiments with HF are being conducted.
- PPE is essential: goggles, double gloves (adequate for strong acids), clothing cover (lab coat) and, if there is a splash hazard, a full faceshield, and sleeve covers.
- All PPE remains in the lab near where you are working. Contaminated PPE must be disposed of as hazardous waste.
- Full length pants and closed shoes must be worn.
- Work should be done in a hood to minimize inhalation and to minimize hazards in the event of an accidental release.
- A hydrofluoric acid (HF) spill control or universal spill kit that is good for HF is required in all areas using or storing hydrofluoric acid.
- Maintain a supply of 2.5% Calcium Gluconate ointment in the work area in the event of skin contact. Ensure it has not expired.
- Know first aid procedures before you begin working and know where the nearest eye wash and safety shower are located.
- All employees must participate in EHS' online HF training.

21.5 Cryogenic Liquid Safety

Cryogenic liquids are liquefied gases that are kept in their liquid state at very low temperatures. Cryogenic liquids pose hazards such as: thermal cold burns and frostbite to delicate tissues, asphyxiation due to displacement of oxygen, toxicity (if applicable), and explosion (if pressure relief devices do not work properly).

Examples of common cryogenic liquids are: Nitrogen, Argon, Hydrogen, Methane and Helium.

If your laboratory utilizes a cryogenic liquid, employees must use proper personal protective equipment including, splash resistant goggles, special cryogen gloves that are insulated, closed-toed shoes and long sleeves, and respiratory protection where there is a chance of an oxygen-deficient atmosphere.

Safe use, handling, storage, and transfer procedures are as follows:

- Cryogenic systems must be equipped with pressure-relief devices
- In an area where the ventilation does not meet 1 cubic feet per minute (CFM) per sq. ft. of lab space, an oxygen sensor is required to be installed.
- Always wear proper PPE while handling any cryogenics.
- Use only approved storage vessels.
- Do not store in a confined space.
- Use only freight elevators with no other passengers during transport.
- Do not transport in the closed cab of a vehicle.
- Never pour cryogenic liquids down a sink.

22.0 Peroxide Forming Chemicals

Peroxide forming chemicals are a class of compounds that have the ability to form shock-sensitive explosive peroxide crystals. Some organic solvents commonly used in OSU laboratories have the potential to form explosive peroxide crystals. Diethyl ether and tetrahydrofuran are two of the more common peroxide-forming chemicals used at OSU. The risk associated with peroxide formation increases if the peroxide crystallizes or becomes concentrated by evaporation or distillation. Factors that affect the rate of peroxide formation include exposure to air, light and heat, moisture, and contamination from

metals. Therefore, it is extremely important that this procedure be followed regarding the identification, handling, storage, and disposal of peroxide-forming chemicals.

22.1 Purchasing Considerations

- When possible, purchase only peroxide-forming chemicals which contain a peroxide formation inhibitor (e.g., tetrahydrofuran or diethyl ether inhibited with butylated hydroxytoluene, BHT).
- Only purchase quantities of peroxide-forming chemicals that you expect to use within expiration and disposal timeframes. Buying in bulk is not recommended.

22.2 Labeling Requirements

Label bottles of peroxide-forming chemicals with date received and date opened marked on each container. If you refill your peroxide bottle from a central location, you must use the dates that are relevant to the original container. There should also be an expiration date on the label, designated by the manufacturer.

22.3 Storage and Use Requirements

- Do not touch or attempt to open a container of a peroxide-forming chemical if there are any white or clear crystals around the cap and/or in the bottle. The friction of screwing the cap may detonate the bottle. Contact EHS immediately.
- If the peroxide-forming chemical is flammable and requires refrigeration, then an explosion-proof refrigerator must be used.
- Do not distill, evaporate, or concentrate a peroxide-forming chemical unless a High Hazard Operating Procedure has been evaluated by EHS in accordance with Section 12 of this plan.
- If the date opened or received is past the time-frames listed below in the disposal requirements section, do not use the chemical until you have tested it with a peroxide test strip. If there are crystals forming, or if the container is more than a couple years old, do not test it with a strip, call EHS for immediate removal.

22.4 Disposal Requirements

- There are four classes of peroxide-forming chemicals based upon the peroxide formation hazard:
 - Class A** – Severe Peroxide Hazard
 - Class B** – Concentration Hazard
 - Class C** – Shock and Heat Sensitive
 - Class D** – Potential Peroxide-Forming Chemical
- Peroxide-forming chemicals must be disposed by the earlier of the two dates/timeframes specified in the table below regardless if the container is unopened.

	Class A	Class B	Class C	Class D
Date Opened	3 months	6 months	6 months	Only if peroxide crystals are present
Date Received	1 year	1 year	1 year	

- Contact EHS to request the disposal of a peroxide-forming chemical. If the peroxide-forming chemical has a visible peroxide formation or is greater than one year old, do not move the chemical, leave it and let EHS know where it is located. Never move or handle these containers. EHS will have to find qualified contractors to test and, if necessary, stabilize peroxide forming chemicals.

22.5 Peroxide-Forming Chemical Lists

22.5.1 Class A – Severe Peroxide Hazard

- | | | |
|--|--------------------------------|---------------------------|
| • Butadiene (liquid monomer) | • Chloroprene (liquid monomer) | • Divinyl acetylene |
| • Tetrafluoroethylene (liquid monomer) | • Isopropyl ether | • Vinylidene chloride |
| • Potassium amide | • Potassium metal | • Sodium amide (sodamide) |

22.5.2 Class B – Concentration Hazard

Require external energy for spontaneous decomposition. Form explosive peroxides when distilled, evaporated or otherwise concentrated.

- | | | |
|------------------------|------------------------------------|----------------------------|
| • Acetal | • Diethylene glycol dimethyl ether | • Methyl isobutyl ketones |
| • Acetaldehyde | • Diethyl ether | • 4-Methyl-2-pentanol |
| • Benzyl alcohol | • Dioxanes | • 2-Pentanol |
| • 2-Butanol | • Ethylene glycol dimethyl ether | • 4-Penten-1-ol |
| • Cumene | • Furan | • 1-Phenylethanol |
| • Cyclohexanol | • 4-Heptanol | • 2-Phenylethanol |
| • Cyclohexene | • 2-Hexanol | • 2-Propanol |
| • 2-Cyclohexen-1-ol | • Methylacetylene | • Tetrahydrofuran |
| • Decahydronaphthalene | • 3-Methyl-1-butanol | • Tetrahydronaphthalene |
| • Diacetylene | • Methylcyclopentane | • Vinyl ethers |
| • Dicyclopentadiene | | • Other secondary alcohols |

22.5.3 Class C – Shock and Heat Sensitive

Highly reactive and can auto-polymerize as a result of internal peroxide accumulation. The peroxides formed in these reactions are extremely shock and heat sensitive.

- | | | |
|-------------------|-----------------------------|------------------------|
| • Acrylic acid | • Chlorotrifluoroethylene | • Vinyl acetate |
| • Acrylonitrile | • Methyl methacrylate | • Vinylacetylene (gas) |
| • Butadiene (gas) | • Styrene vinylpyridine | • Vinyladiene chloride |
| • Chloroprene | • Tetrafluoroethylene (gas) | • Vinyl chloride (gas) |

22.5.2 Class D – Potential Peroxide Forming Chemicals

May form peroxides but cannot be clearly categorized in Class A, B, or C.

- | | | |
|----------------------------------|---------------------------------|------------------------------|
| • Acrolein | • P-Chlorophenetole | • 4,5-Hexadien-2-yn-1-ol |
| • Allyl ether | • Cyclooctene | • n-Hexyl ether |
| • Allyl ethyl ether | • Cyclopropyl methyl ether | • o,p-Iodophenetole |
| • Allyl phenyl ether | • Diallyl ether | • Isoamyl benzyl ether |
| • P-(n-Amyloxy) benzoyl chloride | • p-Di-n-butoxybenzene | • Isoamyl ether |
| • N-Amyl ether | • 1,2-Dibenzoyloxyethane | • Isoamyl vinyl ether |
| • Benzyl n-butyl ether | • p-Dibenzoyloxybenzene | • Isophorone |
| • Benzyl ether | • 1,2-Dichloroethyl ethyl ether | • b-Isopropocycpropionitrile |
| • Benzyl ethyl ether | • 2,4-Dichlorophenetole | |

- Benzyl methyl ether
- Benzyl-1-naphthyl ether
- 1,2-Bis(2-chloroethoxy) ethane
- Bis(2-ethoxyethyl) ether
- Bis(2-(methoxyethoxy) ethyl) ether
- Bis(2-chloroethyl) ether
- Bis(2-ethoxyethyl) adipate
- Bis(2-methoxyethyl) carbonate
- Bis(2-methoxyethyl) phthalate
- Bis(2-methoxymethyl) adipate
- Bis(2-n-butoxyethyl) phthalate
- Bis(2-phenoxyethyl) ether
- Bis(4-chlorobutyl) ether
- Bis (chloromethyl) ether
- 2-Bromomethyl ethyl ether
- Beta-Bromophenetole
- o-Bromophenetole
- p-Bromophenetole
- 3-Bromopropyl phenyl ether
- tert-Butyl phenyl ether
- Butyl vinyl ether
- Chloroacetaldehyde diethylacetal
- 2-Chlorobutadiene
- 1-(2-Chloroethoxy)-2-phenoxyethane
- Chloroethylene
- Chloromethyl methyl ether
- beta-chloroethoxyphenol
- o-Chorophenetole
- Diethoxymethane
- 2,2-Diethoxypropane
- Diethyl ethoxymethylenemalonate
- Diethyl fumarate
- Diethyl acetal
- Diethylketene
- Diethoxybenzene (m-, o-, p-)
- 1,2-Diethoxyethane
- Dimethoxymethane
- 1,1-Dimethoxyethane
- Di(1-propynyl) ether
- Di(2-propynyl) ether
- Di-n-propoxymethane
- 1,2-Epoxy-3-isopropoxypropaten
- 1,2-Epoxy-3-phenoxypropane
- p-Ethoxyacetophenone
- 1-(2-Ethoxyethoxy) ethyl acetate
- 2-Ethoxyethyl acetate
- (2-Ethoxyethyl)-a-benzoyl benzoate
- 1-Ethoxynaphthalene
- o.p-Ethoxyphenyl isocyanate
- 1-Ethoxy-2-propyne
- 3-Ethoxypropionitrile
- 2-Ethylacryldehyde oxime
- Ethyl-b-ethoxypropionate
- Ethylene glycol monomethyl ether
- 2-Ethylhexanal
- Ethyl vinyl ether
- 2,5-Hexadiyn-1-ol
- Isopropyl-2,4,5-trichlorophenoxy acetate
- n-Methylphenetole
- 2-Methyltetrahydrofuran
- 3-Methoxy-1-butyl acetate
- 2-Methoxyethanol
- 3-Methoxyethyl acetate
- 2-Methoxyethyl vinyl ether
- Methoxy-1,3,5,7-cyclooctatetraene
- b-methoxypropionitrile
- m-Nitrophenetole
- 1-Octene
- Oxybis(2-ethyl acetate)
- Oxybis(2-ethyl benzoate)
- b,b,-oxydipropionitrile
- 1-Pentene
- Phenoxyacetyl chloride
- a-Phenoxypropionyl chloride
- Pehnyl-o-propyl-ether
- p-Phenylphenetone
- n-Propyl ether
- n-Propyl isopropyl ether
- Sodium 8-11-14-eicosatetraenoate
- Sodium ethoxyacetanilide
- Tetrahydropyran
- Triethylene glycol diacetate
- Trietheyle glycol dipropionate
- 1,3,3-Trimethoxypropene
- 1,1,2,3-Tetrachloro-1,3-butadine
- 4-Vinyl cyclohexene
- Vinylene carbonate

23.0 Emergency Equipment

As applies to 29 CFR 1910.1450(e)(3)(iii).

23.1 Emergency Safety Showers

Emergency safety showers are required in laboratories where hazardous corrosive or basic materials (e.g., pH less than 2.5 or greater than 11.0) and materials which are highly toxic by skin absorption are used and stored. Locate showers so they are easily accessible via an unobstructed path and within 10 seconds from the hazard. There should be no obstacles to pass through (e.g., doors) unless there are other employees present. Train lab personnel in

how and when to properly use an emergency safety shower. Valves on the safety showers should be easily turned on in one second or less with one hand.

Safety showers should provide at least 20 gallons of water per minute and operate at a minimum of 15 minutes while valves remain open without the use of hands.

23.1.1 Safety Shower Testing and Maintenance

Safety showers are tested annually by OSU EHS. Maintenance of the showers is conducted through OSU Facilities Services.

23.2 Eyewash Stations

Emergency eyewash are required in laboratories where hazardous corrosive or basic materials (e.g., pH less than 2.5 or greater than 11.0) and materials are used and stored. Locate eyewash stations so they are easily accessible via an unobstructed path and within 10 seconds from the hazard. There should be no obstacles to pass through (e.g., doors) unless there are other employees present. Train lab personnel in how to properly use an eyewash. Valves on the eyewash station should be easily turned on in one second or less with one hand. The water should be tepid and should have a flow of 0.4 gallons per minute for 15 minutes.

Plumbed eyewash stations are preferred when a clean water source is available. Solution/squeeze bottles cannot be used as a substitute for a plumbed eyewash if a water source is available in the lab. If there is no clean water available in the lab, the squeeze solution bottles can be used but require proper maintenance and testing. They are not to be used after their expiration date.

23.2.1 Eyewash Stations and Maintenance

Eyewash stations must be tested and documented weekly by laboratory personnel. Maintenance of the showers is conducted through OSU Facilities Services.

23.3 Fire Extinguishers

Fire Extinguishers are placed in hallways and made accessible within 50-75 feet of travel. If a fire extinguisher is required for a specific procedure or chemical, laboratories may request a fire extinguisher by contacting EHS.

23.2.1 Types and Use of Fire Extinguishers

Type of Fire Extinguisher	Effective Against	Do Not Use On
A Water	Class A Fires Burning paper, wood, rubber, textiles	Electrical, liquid, or metal fires
BC Carbon Dioxide	Class B Fires Petroleum hydrocarbons (flammable solvents, motor oil, grease) Class C Fires Electrical fires in the presence of sensitive	Metal fires (including lithium aluminum hydride)

	equipment, optical systems, computer equipment	
ABC Dry Powder	Burning solvents and chemicals in large quantities	Metal fires, fires involving sensitive equipment
Met-L-X Other Special Extinguishers	Burning metal (e.g., magnesium, lithium, sodium, potassium)	Paper, trash, solvents, electrical
D Granular Formulations	Class D Fires Alloys or reactive metals, metal hydrides, metal alkyls, other organometallics	

23.2.2 Fire Extinguisher Training Requirements

OSU employees should not use a fire extinguisher unless they have been formally trained in the proper operation of extinguisher use. EHS offers online training or in-person training upon request.

23.2.3 Fire Extinguisher Inspections and Maintenance

Fire extinguishers are tested on a monthly and yearly basis. A tag is attached to the fire extinguisher that states the date it was tested and is signed. EHS is responsible for the testing and maintenance of all OSU EHS purchased extinguishers. Individuals should not purchase their own extinguishers without going through EHS.

Replace fire extinguishers if:

- Gauge reads pressure is low and extinguisher needs to be recharged
- Extinguisher needs to be weighed (for compressed CO₂)
- Hydrostatic test date is past due on the extinguisher
- Extinguisher was discharged and needs to be replaced

24.0 Laboratory Emergencies

24.1 Chemical Spills

Laboratory personnel should be able to clean up incidental spills of the materials they use. Large spills, spills released into the environment (near a drain, waterway, or on grass or dirt), or spills of highly hazardous chemicals (e.g., strong acid) may require special cleanup procedures such as special PPE or spill cleanup materials. Contact EHS for spill cleanup assistance via public safety at 541-737-3010.

24.1.1 Small or low hazard spills (less than 1 gallon or 1 pound):

- Assess the magnitude of the spill and associated hazards (e.g., broken glass, toxic fumes, risk of fire, etc.).
- If the hazards can be safely mitigated with available personal protective equipment (PPE), don PPE (goggles, gloves, body protection, etc.).
- Apply absorbent pads (e.g., pig pads) to the spill and give the pads time to absorb the chemical.
- Use gloves to move the used pig pads to the garbage bag.

- Seal the garbage bag with a zip tie and label the bag with a hazardous waste label.
- Place the garbage bag in a secondary container (a cardboard box or plastic tote/bin) for EHS to collect.
- Request a hazardous waste pickup.
- Replenish your spill kit's contents

24.1.2 Large or high-hazard spill (more than 1 gallon or 1 pound):

- Notify all other workers who could be affected by the spill and vacate the laboratory/floor/building, particularly if the chemical produces hazardous fumes or poses other potential health hazards.
- Do not attempt to clean up large and/or hazardous chemical spills.
- Immediately call public safety if on contingent campus and let them know you had a chemical spill and need EHS assistance. If not on Corvallis main campus, consult your spill response guide for your location and report the spill to EHS. Provide the following information:
 - Your name and contact phone number
 - Location of spill (building and room number)
 - Name of chemical
 - Approximate volume spilled
- Wait at the building entrance for emergency responders or EHS personnel to arrive.
- Serve as a point of contact and provide information about the spill, as requested by emergency responders or EHS personnel.

Note: If you are uncomfortable cleaning up a spill, regardless of size, call EHS for assistance.

24.2 Fire

If there is a fire in your laboratory or in your building remember the following:

- **Evacuation:** Either pull the fire alarm and call 911 immediately or if the alarm has been activated, leave the building and gather at the evacuation assembly point for the building. As you leave, close the doors and windows if possible. Don't panic, but move promptly at least 100 feet away from the structure. Avoid using elevators.
- **Recovery:** Do not enter the building until allowed to do so. Once you enter your space again, inspect your work area and report any issues.
- **Mitigation:** Maintain a tidy workplace. Ensure flammable and combustible materials are stored correctly. Participate in required evacuation drills.
- **Preparedness:** Identify the closest exits to your work location as well as fire alarm pull stations, fire extinguishers, and the outside evacuation assembly point for your building.

24.3 Power Outages

24.3.1 Before the Power Fails:

- Consider having a flashlight available in the lab.
- Install appropriately-sized surge protection devices for all sensitive or expensive electronics.
- Put essential equipment on emergency power.
- Make a list of equipment that must be reset, reprogrammed, restarted, or recalibrated once power returns.

- If you have items that must be kept cold, identify an emergency source of dry ice. If you leave a refrigerator or freezer closed, they will maintain their temperature for several hours.

24.3.2 While the Power is Off:

- Shut down experiments that involve hazardous materials.
- Check fume hoods and biosafety cabinets. Stop any operations that may be emitting hazardous vapors, fumes, or infectious agents. Secure all caps to any containers. Close the fume hood sash.
- Check the equipment on emergency power to ensure it is running properly.
- Reduce electrical use and risk of power surges by disconnecting equipment that runs unattended from power sources and turning off unnecessary lights.

24.3.3 When the Power Returns:

- Check equipment. Reset and restart equipment. Recalibrate and reprogram equipment as necessary. Check the fume hood airflow. If building systems, such as fume hoods, fail to restart properly, contact facilities services.
- Keep refrigerators and freezers closed until they are back at a safe working temperature.
- If system or equipment failures create hazardous conditions, immediately notify Public Safety or EHS.

24.4 Other Emergencies

OSU Emergency Preparedness offers response to a multitude of different emergencies. Visit their website (<https://emergency.oregonstate.edu/emergency-preparedness/emergency-procedures>) for more information on the following types of emergencies:

- Lock Down/Shelter in Place
- Active Shooter
- Medical Emergencies
- Criminal Activity
- Bomb Threat
- Poisoning
- Suspicious Object
- Severe Weather
- Earthquake/Tsunami
- Utility Outage
- Transportation Accident
- Hostage Situation
- Suspicious or Disruptive person(s)

25.0 Laboratory Signage

The following signage is required for laboratories and is available from EHS.

25.1 Laboratory Signage Program

The Laboratory Signage Program has been developed to help OSU personnel and potential emergency responders identify the hazards present in an area (e.g., laboratory) prior to entering the room. At a minimum an EHS door sign should be prepared and posted outside each laboratory entryway leading from a public hallway. The sign should be inclusive of all interior rooms. If requested, signs can be made for interior rooms.

Lab signage includes the following hazards if present in the laboratory:

- Biological Materials (BSL-1, BSL-2, BSL-3, ABSL-1, ABSL-2, BL1-P, BL2-P)
- Laser
- Engineered Nanoparticles
- Radioactive Materials
- Carcinogens
- Toxic Gas
- Inert Gas
- Flammable Gas
- Toxic Materials
- Corrosive Materials
- Flammable Liquids
- Oxidizing Materials
- Carcinogens
- Magnetic Field
- UV Light
- Recombinant DNA

Signs are also posted indicating safety showers, eyewash stations, fire extinguishers, fume hoods, biosafety cabinets, autoclaves, -80°C freezers, biosafety cabinet, flammable-rated refrigerator/freezer, entrance requirements, and emergency contact information.

26.0 Laboratory Consultations and Inspections

EHS performs laboratory inspections every 12 – 18 months to ensure compliance with the Standard Operating Procedure of this Plan, the State of Oregon and OSU compliance, and adherence with all Federal U.S. Regulations.

Laboratory inspections will look at issues such as:

- Signage
- Housekeeping
- Required SOPs and other documents
- Personal protective equipment use
- Chemical safety
- Chemical waste
- Chemical storage and labeling
- Fire safety and emergency equipment
- Biological safety
- Training and required records/documents

Laboratory inspections are subject to follow up until all items marked as deficient are completed.

New PIs or Program Directors will receive laboratory consultations prior to work beginning in the lab. Laboratory consultations will also occur upon request of the PIs, Program Director, or Lab Manager.

27.0 Waste Management

EHS coordinates the disposal of all potentially hazardous materials and universal waste. An employee must place an online request for a hazardous or universal waste pickup.

27.1 Hazardous Waste

Label: All waste must be labeled with an appropriate OSU Hazardous Waste label that includes your contact name, building name, and room number where waste was generated, and a list of all the contents and percent volume in English, including water. Chemical abbreviations or nomenclature are not acceptable. Check all appropriate boxes regarding type of waste. If you are going to use an old chemical container as a waste container, you must also deface the old label so there is no confusion.

Lid: Always keep the container closed, except when physically adding waste. All waste containers must have leak tight lids, including process waste from a piece of equipment (e.g., HPLC waste). Solid waste must be in a closed container or in a closed in a zip lock bag. Never leave a funnel in the waste container when you are done putting waste in the bottle.

Leak: All waste containers must be put in a secondary containment and clean on the outside.

Location: Waste must be kept in the room where it was generated. Ensure waste containers are put into an EHS supplied clear or grey tub to help EHS locate your waste during pickups.

27.2 Universal Waste

Universal waste is a subcategory of hazardous waste that poses low risk to human health when handled and transported safely. In Oregon, there are four types of universal wastes:

- Batteries
- Pesticides
- Mercury-containing equipment
- Mercury-containing lamps (e.g., fluorescent light tubes and high-intensity discharge (HID) lamps).
- Aerosols

27.3 Biological Waste

Sharps, animal carcasses infected with pathogens, human tissues or body parts, microbial cultures and associated wastes, as well as organisms genetically modified by introduction of recombinant or synthetic nucleic acids must be collected for treatment prior to disposal. Methods of treatment include incineration and autoclaving prior to disposal. Sharps, which include needles, IV tubing with needles attached, lancets, glass tubes, used microscope slides, and syringes, must be collected into a hard-sided, leak-proof container. The container must be red and have the universal biohazard symbol. The lab is in charge of ensuring waste is removed via incineration or autoclaving. Sharp containers can be purchased through OSU Chemstores or an online vendor. Disposal is done through EHS. More detailed information on biological waste disposal can be found here: <https://ehs.oregonstate.edu/biological-waste-management>.

27.4 Wastewater/drain disposal

To dispose of materials through interior drains, the following criteria must apply:

- Material must not qualify as hazardous waste
- Liquids must have a temperature of less than 150°F
- Liquids must be non-flammable, having a flash-point greater than 140°F
- Materials must not be viscous or solid, which may clog the drain
- Toxic, malodorous, or radioactive substances may not be disposed of down the drain
- No petroleum oils, dyes, heavy metals, or organic solvents
- pH of all discharged liquids must be between 6.0 – 9.5

Prior to drain disposal, you must fill out a waste determination via EHS hazardous waste website.

Note: If you are neutralizing acid baths so that the excess can go down the drain, you must record the pH levels before you pour it down the drain.

27.5 Training

Hazardous Waste Training: Hazardous waste training is required for anyone generating hazardous waste and is available via SciShield.

Universal Waste Training: A large quantity waste handler must ensure that all employees who handle or are responsible for managing universal waste are informed on the proper handling and emergency procedures appropriate to the specific universal waste(s) they handle. An online module is available via SciShield.

28.0 Laboratory Close-Out Procedure

Laboratories within OSU must be left in a state suitable for new occupants or for renovation activities. The vacating PI and department are responsible for ensuring the disinfection of equipment and counters and disposal of all waste materials. Vacating PIs must complete the following procedures before the laboratory space will be cleared by EHS:

Notification and Consult: Notify EHS at least 30-days in advance of the pending move/closure by completing and submitting the Lab Checkout/Intent to Vacate Notification Form. Upon receipt, EHS will schedule a consultation with you or your representative to address any safety concerns, develop a customized lab close-out plan, and target dates of completion. If circumstances do not allow for prior notification, or the PI has already vacated the lab, the Department Head is responsible for designating or directing the lab-closeout procedures.

29.0 Training

Employees and students must have access to information and training to ensure that they are apprised of the hazards of chemicals present in the work area. Such information must be provided at the time of an employee's or student's initial assignment to a work area where hazardous chemicals are present and prior to assignment involving new exposure situations. Employees and students should receive periodic refresher information and training to ensure that they are aware of the risks of exposure to hazardous chemicals. This section complies with 29CFR 1910.1450(f).

29.1 Information

Information provided by the EHS/Units/Pis/Supervisors to employees and students must include:

- The contents of the OSHA Occupational Exposure to Hazardous Chemicals in Laboratories (CFR 1910.1450 Subpart Z).
- The contents, location and availability of the OSU CHP.
- The permissible exposure limits for OSHA regulated substances or published exposure limits for other hazardous chemicals where there is no applicable OSHA standard.
- Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory (available on Safety Data Sheets).
- The location and availability of known reference materials on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory, including, but not limited to, SDSs received from the chemical supplier.

29.2 Method of Training

General training will be provided by EHS via an online module accessible through the EHS website. Lab-specific training will be provided by principal investigators or an appropriate designee.

29.3 General Awareness Training

General awareness training provided by EHS for laboratory employees and students will include:

- Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.).
- General physical and health hazards of chemicals in the work area. This must include an awareness that many factors influence whether a given chemical might constitute a hazard (e.g., dose, exposure time, genetic background, developmental state, mixtures or interactions of chemicals, etc.).
- The measures employees can take to protect themselves from these hazards, including specific procedures the College or department have implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.
- The applicable details of the CHP.

29.4 Lab-Specific Training

Lab-specific training is provided by the PI, Lab Supervisor, or their designee to laboratory employees and students and will include:

- Lab-specific standard operating procedures
- Specific physical and health hazards of chemicals in the work area (available on SDSs)
- In-person training

30.0 Record Retention and Availability

OSU maintains records on file for the following:

- EHS provided safety trainings
- Exposure monitoring: all exposure monitoring records are kept for at least 30 years.
- Spill incidents
- Inspections
- Accidents
- Waste manifests
- Safety Data Sheets
- Employee medical records: employee medical records will be kept and maintained for at least the duration of employment plus 30 years.

Certificates of training are available online via SciShield.

31.0 References

CDC-NIOSH Current Intelligence Bulletin 59 – Contact Lens Use in a Chemical Environment, June

OSHA Code of Federal Regulations Title 29, Part 1910.1000 – Table Z-1 Limits for Air Contaminants

OSHA Code of Federal Regulations Title 29, Part 1910.1450 – Occupational Exposure to Hazardous Chemicals in Laboratories

OSHA Select Carcinogen List:

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10007&p_table=standards

National Toxicology Program (NTP) Carcinogen List:

(<http://ntp.niehs.nih.gov/pubhealth/roc/roc13/index.html>)

International Agency for Research on Cancer (IARC) Carcinogen List:

(<http://monographs.iarc.fr/ENG/Monographs/PDFs/index.php>)

Prudent Practices In the Laboratory: Handling and Management of Chemical Hazards, 2011. *National Research Council of the National Academies.*

Oregon State University Health and Safety Policy:

https://policy.oregonstate.edu/UPSM/07-001_health_safety_policy

Oregon State University, Environmental Health and Safety Website: <https://ehs.oregonstate.edu/>

Document Revision History

Revision Number	Revision Date	Nature of Revision	Approved By:

Documentation of CHP Training (signature of users required)

- Prior to conducting any work within a laboratory, employees must be familiar with the location and availability of this Chemical Hygiene Plan (CHP). Employees should review all applicable information within the Chemical Hygiene Plan (CHP).
- The Supervisor must make available this CHP, as well as any laboratory specific standard operating procedures (SOPs) to all laboratory personnel.

I have been informed of the location and availability of this CHP:

Name	Signature	Date