Chemical Hygiene Plan

Purpose and Scope

Laboratories typically work with a variety of chemicals that present health and/or physical hazards. The Chemical Safety Plan establishes procedures, work practices, and control measures to protect West Chester University personnel working with chemicals in research and teaching laboratories.

This plan applies to the use of hazardous chemicals in all laboratories at West Chester University.

This plan is based on the Occupational Safety and Health Administration (OSHA) Occupational Exposure to Hazardous Chemicals in Laboratories standard (29 CFR 1910.1450) and the National Academies Press Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards.

Responsibilities

Environmental Health and Safety

The Chemical Hygiene Officer resides within EHS, and is responsible for:

- Establishing and maintaining the Chemical Hygiene Plan.
- Assessing laboratory hazards and recommending appropriate controls.
- Overseeing the fume hood testing and certification program.
- Arranging for and/or conducting Chemical Hygiene training.

Principal Investigator/Faculty/Instructors

Principal investigators, faculty, and instructors are responsible for:

- Implementing all aspects of the Chemical Hygiene plan in their laboratory.
- Establishing, communicating, and enforcing safe work practices and laboratory rules.
- Notifying EHS of lab-related incidents.

Laboratory Personnel

All laboratory personnel, including employees and students, are responsible for:

- Complying with all aspects of the Chemical Hygiene Plan and laboratory safety rules.
- Completing all required training.
- Immediately notifying principal investigator/faculty/instructor of all lab-related incidents.

Procedures

1. Identifying and Communicating Chemical Hazards

There are three primary ways that chemical hazards are identified and communicated:

- Chemical labels
- Safety Data Sheets (SDSs)
- Signage

Chemical manufacturers and importers are required to evaluate the chemicals they produce or import and convey hazard and precautionary information on the chemical label and in the SDS.

Since 2015, all chemical labels and SDSs are required to comply with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS). GHS defines chemical hazard classifications and uses standardized pictograms, signal words, hazard statements, and precautionary statements to convey hazard information. See Appendix A for a more detailed description of the GHS elements, labels, and SDSs.

Chemical Labels

All containers of hazardous chemicals must be clearly labeled with the identity of the substance and the applicable hazard warning statements. Labeling requirements include:

- For chemicals in the original container:
  - Do not remove or deface the manufacturer's label
  - If the label becomes damaged, relabel the container with the chemical name and hazard warning statements
- For chemicals transferred to a secondary container in the laboratory (i.e., squirt bottle, chemical bath):
  - Label the secondary container with the chemical name and hazard warning statements
  - Labels must be legible and in English
  - Chemical names must be spelled out, do not use abbreviations or chemical formulas
  - Small sample vials may be labeled with a sample number provided there is a key readily available identifying the chemical contents and hazard information.

Safety Data Sheets (SDSs)

Safety Data Sheets (SDSs), formerly called Material Safety Data Sheets (MSDSs), provide detailed information about the chemical, including the properties, hazards, safe handling and storage practices, and emergency information. SDSs must be maintained for hazardous chemicals present in the laboratory. SDSs may be maintained electronically or in paper format, provided all laboratory personnel have access to them.

Signage

Signs posted at the entrance of laboratories provide information about the type of hazards found in the laboratory and emergency contact information.

2. Controlling Chemical Hazards

Control measures must be implemented to prevent or minimize exposure to hazardous chemicals and are selected based on the principle of hierarchy of controls. The hierarchy of controls recognizes that not all controls are equally effective. The hierarchy of controls include, in order of effectiveness:

- Elimination or substitution: Remove the hazard or use a less hazardous material or process in place of a more hazardous material or process.
- Engineering controls: Isolate people from the hazard. Engineering controls are built into the design of the laboratory, equipment, or process, and include ventilation, enclosures, guards, and interlocks.
- Administrative controls: Minimize exposures through work practices. Administrative controls include safe work procedures, training, housekeeping, signage, and alarms.

- Personal Protective Equipment (PPE): Provide specific protection for individuals. Examples include safety glasses, gloves, and respirators. PPE is considered the last line of defense.

Implement the most effective controls feasible. Often, more than one type of control is implemented to provide maximum protection from hazards, for example wearing PPE while working in a fume hood.

Engineering Controls

The most common engineering control for protection from exposure to hazardous chemicals in laboratories is ventilation. There are two types of laboratory ventilation, local exhaust ventilation (LEV) and general exhaust ventilation.

Fume Hoods

Fume hoods are the most common type of LEV and are the primary control for work with hazardous chemicals in the laboratory. Fume hoods work by drawing air from the laboratory into the hood and exhausting the air, along with hazardous vapors, gases, and aerosols generated in the hood, to the outside through ductwork. Fume hoods must be properly used and maintained to provide protection. See Appendix B for safe fume hood work practices.

- Fume hoods are tested annually by a third-party testing and certification company. The fume hood testing process is managed by EHS and the test includes:
  - Face velocity profile
  - Airflow visualization test
  - Cross draft airflow test
- Fume hoods that do not pass are repaired and retested before being put back into service.
- ASHRAE 110 tests are performed by a third-party testing and certification company when:
  - Fume hood is installed
  - Fume hood is moved
  - Significant changes have been made to the air handling system

Other Local Exhaust Ventilation

- Other types of LEV found in laboratories include snorkel hoods, canopy hoods, glove boxes, and ventilated gas cabinets. Each of these types of LEV are used for specific purposes:
- Snorkel hoods are small hoods connected to moveable ductwork. Use snorkel hoods for benchtop processes or equipment that generate small quantities of low hazard contaminants. To be effective, snorkel hoods must be positioned very close to the source of the contaminants, typically within 6 inches.
- Canopy hoods are fixed hoods positioned above a process or equipment. Use canopy hoods to exhaust heat or other non-hazardous contaminants. Canopy hoods draw air up through the breathing zone, so they are not appropriate for exhausting hazardous materials.

- Glove boxes provide a leak-tight environment to perform work under vacuum or in an inert atmosphere. Use glove boxes for work with pyrophoric, air sensitive, or highly toxic materials.
- Use ventilated gas cabinets for hazardous compressed gases that are larger than a lecture bottle. Ventilated gas cabinets are required by NFPA for gases with an NFPA health rating of 3 or 4, or a health rating of 2 for gases with no warning properties.

General Laboratory Ventilation

The general laboratory ventilation system is not a substitute for LEV, but serves two important roles in controlling hazardous materials in the laboratory:

- Provide dilution for contaminants that are not captured by LEV and for unexpected situations, such as chemical spills.
- Maintain laboratory spaces under negative pressure to prevent contaminants from migrating to other occupied spaces, such as corridors.
- Keep laboratory doors closed to maintain negative pressure.

Other Engineering Controls

Other common engineering controls for protection from hazardous chemicals in laboratories include flammable liquid storage cabinets, flammable materials refrigerators, and gas cylinder restraints.

Administrative Controls

Standard Operating Procedures

Standard Operating Procedures (SOPs) provide instructions on how to safely carry out work with hazardous chemicals and are a key component of laboratory safety. SOPs include both general and laboratory-specific procedures.

- EHS provides general SOPs, which are found in Appendix F.
- The principal investigator (PI) is responsible for developing laboratory-specific SOPs for hazardous materials, processes, or equipment not addressed by the general SOPs.

At a minimum, the following information must be included in SOPs:

- Description of hazard(s)
  - Health hazards, such as chronic or acute toxin, carcinogen, reproductive or developmental toxin, corrosive, sensitizer, or irritant
  - Physical hazards, such as flammable, reactive, corrosive, or oxygen displacement
  - Routes of exposure, such as inhalation, skin absorption, mucous membrane absorption, skin contact, injection, or ingestion
- Controls
  - Engineering controls, such as ventilation, enclosures, barriers, and interlocks
  - Administrative controls, such as training, signage/labeling, housekeeping, and safe work practices
  - Personal protective equipment, such as gloves, eye protection, lab coat, and appropriate lab attire

- Storage
  - Specialized storage needs, such as a flammable cabinet, corrosive cabinet, or flammable materials refrigerator
  - Incompatibles
  - Storage limits, such as time limitations for peroxide formers or quantity limitations due to codes or regulations
- Waste determination
- Emergency procedures
  - Spill or release
  - Exposure or injury

Training

- All laboratory personnel must be provided with laboratory safety training that includes:
- Health and physical hazards associated with the chemicals they work with
- Control measures to protect from the hazards, including engineering controls, administrative controls, and PPE
- Methods for detecting the presence or release of a hazardous chemical, such as visual appearance, odor, or monitoring devices
- Emergency procedures

Laboratory personnel must also receive in-lab training on the specific equipment and processes they work with, specific laboratory rules and safety practices, and the location of emergency equipment. (See Appendix C for a lab-specific training template.)

Laboratory Rules

Laboratory rules for working safely with or around hazardous materials, processes, and/or equipment are established at the laboratory level based on the specific hazards that are present. The purpose of the safety rules is to prevent exposures or injuries to personnel and students and damage to equipment and facilities. The principal investigator (PI), instructor, or laboratory manger is responsible for establishing, communicating, and consistently enforcing safety rules that address the following: (See Appendix D for a laboratory rules template.)

- Laboratory attire
- Personal protective equipment (PPE)
- Eating and drinking
- Laboratory housekeeping
- Use of controls
- Waste disposal

Prior Approval

There are two levels of approval that are established prior to beginning new laboratory work, lab-level and institutional approval. Prior approval provides the opportunity for a review of new hazardous materials, processes, or equipment to ensure that the necessary controls are in place prior to starting work.

- Prior approval at the lab level is defined by the principal investigator, instructor, or lab manager. Examples include prior approval before purchasing hazardous chemicals, scaling up experiments involving hazardous materials, and diverging from established standard operating procedures.
- Prior approval at the institutional level includes:
    - Purchase of chemicals from DEA Chemical Lists I and II (precursor chemicals). Vendors require a signed declaration before they will sell these chemicals. The department chair or college dean should serve as the signatory for the purchase.
    - Purchase of radioactive materials. Contact Radiation Safety Officer prior to purchase.
    - Use of ductless fume hood for hazardous chemicals. Contact EHS for evaluation of ductless fume hood use.

Designated Area

A "designated area" is an area where particularly hazardous substances, including carcinogens, reproductive hazards, and acute toxins, are used. Depending on the amount and type of work being conducted with particularly hazardous, a designated area may encompass an entire laboratory, a section of a laboratory, or a particular fume hood. Confining work with these substances to designated areas limits where contamination may occur.

- Demarcate designated areas using tape, labels, and/or signs, and identify what type of hazard is present in that area.

Personal Protective Equipment (PPE)

PPE is an important part of chemical safety in the laboratory. PPE is required when other controls cannot completely eliminate exposure to hazards and to protect from unexpected occurrences such as chemical splashes or spills. Minimum PPE for working with or near hazardous materials includes:

Safety glasses

Disposable nitrile gloves

Lab coat

Additional or specialized PPE may be required for work with higher hazard materials, processes, or equipment. See Appendix E for a guide to selecting PPE.

3. Evaluating and Responding to Chemical Exposures

Utilizing proper controls minimizes the risk of chemical exposures. However, exposures may still occur if controls are not properly implemented, controls fail, or a chemical is spilled.

Signs and Symptoms of Exposure

It is important to understand how exposures can occur, such as through inhalation and/or skin absorption, and the symptoms of over-exposure. General signs and symptoms associated with chemical exposures include:

- Tearing or burning of eyes

- Burning sensation of skin, nose, or throat
- Cough, headache, dizziness, or nausea
- Dry, itchy, red, swollen, blistered, or whitened skin
- Rash
- Chemical odor or taste

If any of these symptoms develop while working with a chemical, leave the laboratory and seek medical attention as needed. Review the SDS for the specific symptoms associated with the chemical(s), first aid measures, and routes of entry.

Report all chemical exposures to your supervisor and EHS.

Exposure Monitoring

Many chemicals have established exposure limits. An exposure limit is the maximum allowable concentration in air, typically over a period of time, such as an 8-hour exposure limit. Exposure monitoring is not routinely conducted in laboratories because it is expected that the proper use of controls, such as a fume hood, maintains exposures well below exposure limits. Contact EHS if you have a concern about chemical exposures in a laboratory.

If exposure monitoring is performed, EHS will provide the results to the employee within 15 days.

Medical Exams and Consultation

Lab personnel who work with hazardous materials will be provided with medical examinations or consultations under the following circumstances:

- Lab personnel develop signs or symptoms associated with a chemical exposure
- Exposure monitoring indicates routine exposure to chemicals above an established exposure limit
- A spill or release occurs that results in an exposure
- Lab personnel have an existing health condition that may put them at greater risk

Medical examinations and consultations provided to laboratory personnel as a result of their exposure to hazardous chemicals must:

- Be provided at no cost
- Be offered during the workday at a time convenient for the employee
- Maintain confidentiality of employee's medical records and health status