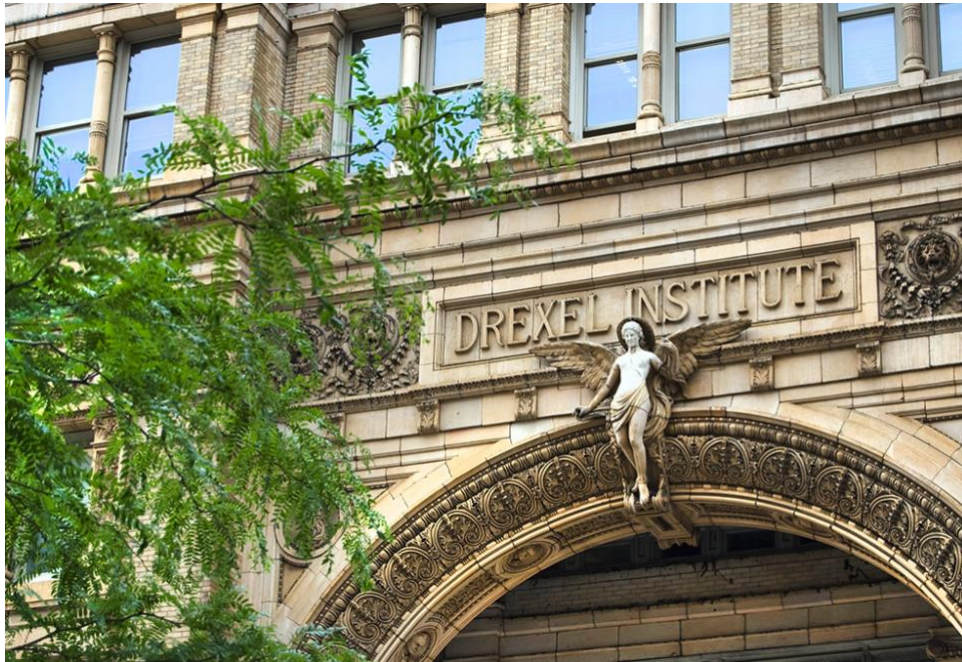




DREXEL UNIVERSITY

Department of

**Environmental  
Health & Safety**



## **Chemical Hygiene Plan**

**2017**

**“Safety is a Personal Decision that Impacts other on a Daily Basis”**

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## I. Mission Statement

Our faculty, staff and students bring a wealth of expertise to our institutions. They are vital to our mission of research, teaching and service to everyone within and outside of our university's community. This expertise requires our institution to demonstrate its leadership in providing health protection and apply safety standards beyond the laws and regulations relating to environment, health and safety.

Our mission is to prevent or minimize injuries and illnesses and control potential hazards from our activities. Our intentions are to continually consult with each of the departments for complete compliance with laws and regulations regarding occupational health and safety and environmental protection. This Chemical Hygiene Plan is intended to inform our researchers of the policies and procedures of the university in an effort to provide protection to university employees, students, research subjects and our community. The plan details carefully developed compliance strategies, which include training, periodic inspections, sanitation, hazardous material handling, hazardous waste management, occupational health, and emergency response.

We must all remember that good environmental health and safety practices are a responsibility of each faculty member, staff member, student and visitor. Our participation and adherence to regulatory compliance is essential to smooth and effective operation of an environmental health and safety program. Achievement of these goals is critical for the growth of our university. The Office of Research and the Department of Environmental Health and Safety (EH&S) welcome your suggestions and cooperation in making our university the safest place to work.

Important Contact Numbers

| Department                          | Center City Campus | University Campus | Queen Lane Campus |
|-------------------------------------|--------------------|-------------------|-------------------|
| Public Safety Call Center           | 215-762-7111       | 215-895-2222      | 215-895-2222      |
| EH&S                                | 215-895-5919       | 215-895-5919      | 215-895-5919      |
| Office of Research                  | 215-895-5849       | 215-895-6091      | 215-895-5849      |
| Facilities Management               | 215-762-3000       | 215-895-1700      | 215-991-8484      |
| Employee Health                     | 215-762-8590       | 215-762-8590      | 215-762-8590      |
| Student Health                      | 215-895-5800       | 215-895-5800      | 215-895-5800      |
| Radiation Safety                    | 215-762-4050       | 215-762-4050      | 215-762-4050      |
| University Biosafety Officer        | 215-895-5891       | 215-895-5891      | 215-895-5891      |
| University Chemical Hygiene Officer | 215-895-5892       | 215-895-5892      | 215-895-5892      |
| Recombinant DNA Officer             | 215-762-7398       | 215-762-7398      | 215-762-7398      |
| Laser Safety Officer                | 215-895-5913       | 215-895-5913      | 215-895-5913      |

## II. Introduction

The Occupational Safety and Health Administration (OSHA) promulgated a final rule on January 31, 1990 for occupational exposure to hazardous chemicals in laboratories (The Lab Standard –

29CFR1910.1450). The basis for this standard is that laboratories typically differ from industrial operations in their use and handling of hazardous chemicals and that a different approach from the Hazard Communication Standard of 1987 is warranted.

The final OSHA standard, commonly known as the "Chemical Hygiene Plan for Laboratories," applies to all laboratories that use hazardous chemicals in accordance with the definition of laboratory use and laboratory scale as provided in the OSHA standard.

Drexel University is committed to providing a safe working environment and believes employees have a right to know about health hazards associated with their work. This [Chemical Hygiene Plan \(CHP\)](#) introduces policies, procedures and responsibilities designed to develop in employees an awareness of potentially hazardous chemicals in the work place as well as the need to maintain appropriate and safe working areas and conditions. It is designed to assist employees in making knowledgeable decisions about any personal risks associated with employment at this institution. A copy of the CHP must be located in a visible area of each laboratory and be familiarized by all lab personnel. Copies are available on the [EH&S website](#). This website also has additional information on other important subjects, such as the Hazardous Waste Management, Emergency Spill Response, Lab Safety, Bloodborne Pathogens, and Chemical Fume Hood/Biological Safety Cabinet safety.

EH&S provides training for employees, students and visitors. The training communicates the hazards of the work place and procedures to follow to avoid accidents. This training is provided online and can be accessed thru the [Safety Training](#) link on the [EH&S website](#). Additional site-specific training may be necessary to fully educate employees and students on the hazards associated with different work practices, protocols and procedures. It is the responsibility of the Principal Investigator or Laboratory Safety Liaison to provide this site-specific training. In any event, however, training activities must be properly documented and copies of all syllabi and sign-in sheets must be uploaded to the BioRAFT platform.

### III. Right to Know Guidelines

Research often requires the use of hazardous materials including radioisotopes, infectious agents, and hazardous chemicals. While working at Drexel University it is likely that you will be required to handle such materials. In this regard, it will be your specific right and obligation to know, before using a hazardous material in an experiment, what is the nature of the material, its specific hazard and the proper procedures for its use.

If you are ever in doubt or have a problem with the use of any material or have a complaint about experiments done by others, here are the procedures to follow.

1. Discuss the problem with your immediate supervisor.
2. If you are not satisfied, discuss with the department chair.
3. If you are not satisfied, then discuss the problem with EH&S.
4. If still unsatisfied, contact the Laboratory Safety Committee.
5. If still unsatisfied, request a meeting with the Senior Associate Vice-Provost for Research compliance.
6. If still unsatisfied, request a meeting with Senior Vice-Provost for Research.
7. Drexel University has also established a [compliance hotline](#) to make it easy for anyone to report conduct that might violate the law, University policy or the University Code of Conduct.

## A. Information for Laboratory Workers

It is essential that laboratory employees have access to information on the hazards of chemicals and procedures for working safely. Supervisors must ensure that laboratory employees are informed about and have access to the following information sources:

1. **The contents of the OSHA Laboratory Safety Standard** "Occupational Exposure to Hazardous Chemicals in Laboratories" and its appendices ([29 CFR 1910.1450](#)).
2. **The Drexel University Laboratory Safety Manual** is available to all employees on the EH&S's website. Individual department Laboratory Safety Plans are available within those departments.
3. **[The Permissible Exposure Limits \(PELs\)](#)**. The Occupational Safety and Health Administration (OSHA) developed PELs for specific regulated substances. These are the legal limit for exposure of an employee to a chemical substance or physical agent such as loud noise.
4. **Signs and symptoms associated with exposures to hazardous chemicals.** [Laboratory Chemical Safety Summaries \(LCSSs\)](#) are similar to Material Safety Data Sheets (MSDS), but are tailored to the hazards of laboratory use of those chemicals. The LCSSs include toxicity information, and signs and symptoms of exposure to the chemicals. In addition, the National Institute of Occupation Safety and Health (NIOSH) publishes a [pocket guide to chemical hazards](#). This guide provides information about the chemical, the exposure limits, exposure routes, and the symptoms associated with exposure.
5. [Safety Data Sheets \(SDSs\)](#) are available online through links from the [EH&S website](#). Individual researchers are encouraged to keep hard copies in an easily accessible location for materials that are used in large quantities, which are used frequently, or which are particularly toxic.
6. Information on chemical waste disposal and spill response is located in Part XII of this manual. Additional, information regarding proper disposal of hazardous waste can be found in the [Hazardous Waste Management Plan](#) on [EH&S website](#).
7. Information and resources for new PIs and Laboratory workers can found on the [EH&S website](#).

## IV. Roles and Responsibilities

Implementation of laboratory safety standards at the university is a shared responsibility of employees, supervisors, department heads, deans, senior administrative staff and EH&S.

### A. President, Provost and Senior Vice Provost for Research

- The responsibility to promote the importance of safety.
- Promoting the attitude and culture of safety among the university employees.
- Supporting the safety program that will protect employees from the effects of chemical agents.
- Ensuring that the deans, directors, department heads provide adequate time and recognition for the employees who carry safety responsibilities.
- Review annual EH&S reports of the level of compliance within each of the reporting units.

## **B. Deans, Directors and Department Heads**

- Identifying a technically-qualified Laboratory Safety Liaisons (LSL) for the unit.
- Large departments may have more than one laboratory safety liaison.
- Ensuring that these safety liaisons are properly trained.
- Ensuring that the safety liaisons has adequate time to conduct periodic safety checks.
- Evaluating the performance of Chemical Hygiene Plan (CHP).
- Taking appropriate measures to assure that the college/department/division activities comply with University and federal, state and local safety policies.

## **C. University Chemical Hygiene Officer**

The University Chemical Hygiene Officer (CHO) is charged with the responsibility of implementing and monitoring the chemical hygiene plan. The Chemical Hygiene Officer at Drexel University is Martin W. Bell. The Drexel University CHO can be reached at [safeheal@drexel.edu](mailto:safeheal@drexel.edu).

The CHO's functions include, but are not limited to the following responsibilities:

- The development of chemical hygiene policies and procedures.
- Conduct laboratory safety inspections of all university laboratories.
- Assist PI's in complying with federal and state regulatory agencies and developing a healthy workplace environment.
- Conduct implementation and monitoring procedures in accordance with approved policies and procedures.
- Certify the performance of protective equipment.
- Monitor procurement, use, and disposal of chemicals used in the lab
- See that appropriate audits are maintained.
- Help supervisors develop precautions and adequate facilities.
- Know the current legal requirements concerning regulated substances.
- Provide general training.

## **D. Department Chemical Hygiene Officers**

- Ensuring all activities related to the use of hazardous chemicals in laboratories is conducted in a safe manner as well as in compliance with OSHA regulations as specified in 29 CFR Part 1910.1450.
- Providing reports at the department Safety Committee meetings on chemical hygiene activities performed.
- Working with principal investigator's (PI's) to develop, review and approve Job Hazard Analysis, Risk Assessments, and Standard Operating Procedures detailing all aspects of proposed research activities that involve hazardous materials.
- Working with the PI's on the approval process for the purchase of highly toxic, reactive, or carcinogenic or other inherently hazardous materials.
- Investigating and completing a report for chemical related incidents and exposures in their department.
- Providing guidance with personal protective equipment selection based on the findings in the job hazard analysis and risk assessment.



- Working as a liaison with the University Chemical Hygiene Officer and the Department of Environmental Health & Safety to ensure compliance.
- Disseminating chemical safety information throughout their department through emails, posting, and other forms of communications.
- Providing general chemical safety guidance to department staff, students and faculty.
- Making copies of the approved Chemical Hygiene Plan available to the program and support staff.
- Facilitating the use of the Laboratory Management Program by the Principal Investigators.
- Facilitating Chemical Hygiene Plan training for all laboratory workers in the department.

### **E. Laboratory Safety Liaisons**

- Acting as a liaison between the employing unit and EH&S.
- Knowing the rules to assist the researchers in complying with safety requirements.
- Assisting the investigators in developing a safety plan for their laboratories.
- Coordinating and tracking training.

### **F. PI or Instructor in the teaching laboratory**

- PI or Instructor in the teaching laboratory has responsibility for the health and safety of all laboratory personnel working in their laboratory.
- The PI or Instructor may delegate the safety duties for which they are responsible, but must ensure delegated safety duties are adequately performed by periodically checking the performance.
- Knowing all applicable health and safety rules and regulations, training and reporting requirements and standard operating procedures associated with laboratory safety.
- Identifying hazardous conditions or operations in the lab, determining safe procedures and controls, and implementing and enforcing standard safety procedures.
- Establishing standard safety operating procedures (general and protocol specific) and performing literature searches relevant to health and safety that is appropriate for the work.
- Consulting with EH&S on use of high risk materials (not routine) such as use of particularly hazardous chemicals, biologics, toxins, select agents or conducting high risk experimental procedures so that special safety precautions may be taken.
- Maintaining an updated chemical and hazardous material inventory and MSDS sheets for the laboratory.
- Ensuring laboratory personnel under his/her supervision have access to and are familiar with the appropriate safety manuals and plans.
- Training all laboratory personnel, he/she supervises to work safely with hazardous materials and maintain records of laboratory specific training in the BioRAFT Compliance Platform. Training must include informing laboratory personnel of the location and availability of Hazard Information.
- Promptly notifying EH&S and/or Facilities Management should he/she become aware that work place engineering controls (e.g., fume hoods) and safety equipment (e.g., emergency showers/eyewashes, fire extinguishers, etc.) become nonoperational.
- Ensuring the provision and maintaining in functional working order all appropriate personal protective equipment (PPE) (e.g., lab coats, gloves, eye protection, etc.).
- Conducting monthly self-inspections of laboratory and maintaining records of inspections, as required.
- Prompt reporting of laboratory accidents and injuries to Risk Management and EH&S. Serious injuries MUST be immediately reported to EH&S.
- Informing EH&S and facilities personnel, of potential lab-related hazards.

- Identifying and minimizing potential hazards to provide a safe environment for repairs and renovations.
- Maintaining an accurate lab member and hazard list in BioRAFT.

## **G. Personnel responsibilities**

- Reviewing and following relevant laboratory safety policies and plans.
- Following oral and written laboratory safety rules, regulations, and standard operating procedures required for the tasks assigned.
- Keeping the work areas safe and uncluttered.
- Reviewing and understanding the hazards of materials and processes in their laboratory research or experiment prior to initiating work.
- Utilizing appropriate measures to control identified hazards, including consistent and proper use of engineering controls, personal protective equipment, and administrative controls.
- Understanding the capabilities and limitations of PPE issued to them.
- Gaining prior approval from the PI/Laboratory Supervisor for the use of restricted chemicals and other materials.
- Consulting with PI/Laboratory Supervisors before using highly hazardous materials or conducting certain high risk experimental procedures.
- Promptly reporting accidents and unsafe conditions to the PI/Laboratory Supervisor or Faculty.
- Completing all required health, safety and environmental training specific to the laboratory and providing written documentation to their supervisor.
- Participating in the Occupational Safety and Health Program, when required.
- Informing the PI/ Laboratory Supervisor of any work modifications ordered by a physician as a result of medical surveillance, occupational injury or exposure.
- Laboratory personnel working autonomously or performing independent research are also responsible for:
  - Reviewing the plan or scope of work for their proposed research with the PI/Laboratory Supervisor or Faculty;
  - Notifying in writing and consulting with the PI/Laboratory Supervisor or Faculty, in advance, if they intend to deviate from their scope or scale of work;
  - Preparing SOPs and performing literature searches relevant to safety and health that are appropriate for their work and
  - Providing appropriate oversight, training and safety information to laboratory personnel they supervise or direct.

## **H. Environmental Health and Safety**

- EH&S staff will participate in providing resources for departments in the development of their individual health and safety programs.
- Identifying and assessing potentially hazardous operations.
- Developing risk management strategies.
- Preparing and updating the University's Chemical Hygiene Plan (CHP).
- Distributing the CHP to departments and other units and assisting them in tailoring and implementing the plan.
- Training LSLs regarding their responsibilities for safety and compliance with regulations in their respective units.

- Providing safety training and awareness information to laboratory work force including students on laboratory safe practices.
- Monitoring and conducting semi-annual and unannounced safety audits toward achieving compliant safety practices.
- Serving as the primary liaison to environmental health and safety regulatory agencies.
- Assisting the university in responding to regulatory agencies in matters of investigations, employee complaints, or potential or actual regulatory enforcement actions.
- Consulting with colleges, schools, departments and affiliated units and the office of the general counsel to ensure a unified and consistent University response to a governmental inquiry, complaint or law suit
- EH&S may also provide specialized, or dedicated operational services to schools and departments through expense recovery arrangements.

## **I. Students**

- Comply with university health and safety practices by maintaining class, work, and laboratory areas safe and free from hazards.
- Wear appropriate laboratory personnel protective equipment (lab coats, safety goggles and other required equipment) when working in the laboratory.
- Complete required health and safety training prior to working in a laboratory.
- Inform a supervisor or instructor of any safety hazards in the workplace, classroom, or laboratory.

## **J. Incident Reporting**

Any time an employee is injured at work, it is critical that the incident be reported, recorded and investigated properly. Recording and investigating the incident is necessary for developing strategies to prevent a similar incident from reoccurring.

- The University has the responsibility to investigate and appropriately report environmental health and safety incidents.
- Employees, students, and others affiliated with the University have the responsibility to disclose any activity that may be, or may result in, a violation of any environmental health and safety regulation.
- All personnel should immediately notify appropriate emergency responders (e.g. University Public Safety department, fire department and EH&S) of any situation that may result in an imminent hazard to persons, property or the environment.
- EH&S provides regulatory liaison, technical assistance and operational guidance as requested or required, and works with the school and emergency responders to establish safety and other criteria for resumption of normal operations.
- All employees, students and others affiliated with the University are expected to fully cooperate, and participate as appropriate, in the investigation and remediation of any incidents.
- Employees and students who report incidents in accordance with law and University procedures, or who raise questions or concerns about the University's environmental health and safety procedures, will not be penalized, and such action will not be recorded in the employee's or student's record.

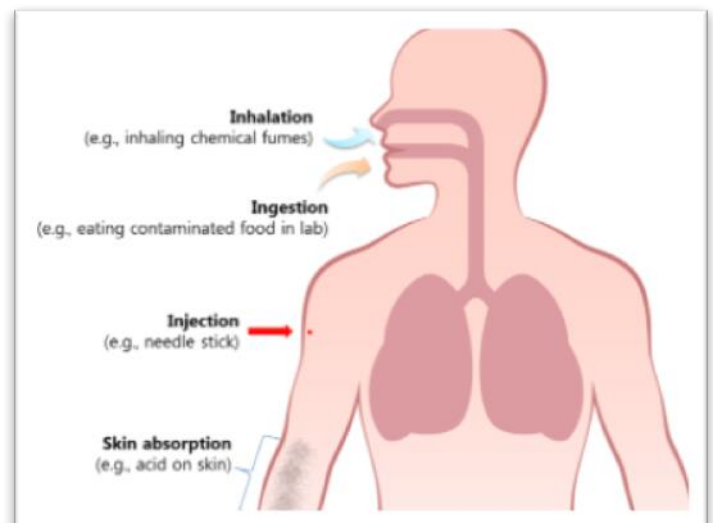
- Drexel University has also implemented an emergency notification system called DrexelAlert, which is designed to disseminate critical information to the Drexel community via email, voicemail and text messaging.

Drexel University views compliance with all laws, regulations, and University policies as conditions of employment, and of academic eligibility. Violation of such requirements shall be considered grounds for disciplinary action, including termination of employment and/or enrollment status. Governmental agencies have established strict policies to ensure compliance with environmental health and safety regulations, including civil penalties and individual criminal penalties leading to possible prosecution, imprisonment and substantial fines. Accordingly, the University expects all faculty, staff, postdoctoral scholars, and students and University affiliates to be vigilant in complying with all environmental health and safety requirements, and to acquire the information they need to properly conduct their activities at the University.

## V. Controlling Exposures

Working with hazardous chemicals require a carefully considered, multi-tiered approach to ensure the safety and health of the laboratory personnel. There are four primary routes of exposure for chemicals:

- Inhalation;
- Absorption (through the skin or eyes);
- Ingestion; and
- Injection (skin being punctured by a contaminated sharp object or uptake through an existing open wound).

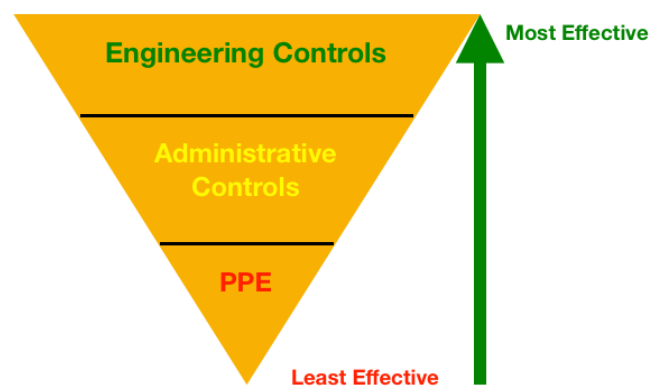


Inhalation is the most likely route of exposure. Many hazardous chemicals may affect people through more than one of these exposure modes, so it is critical that protective control measures are in place for each of these exposure routes.

There are three main control measures used to reduce chemical exposures in the work environment:

- Engineering Controls;
- Administrative Controls;
- Personal Protection Equipment and Apparel.

Elements of these three classes are used in a layered approach to create a safe working environment.



## VI. Engineering Controls

### A. Laboratory Ventilation

All laboratories are designed with mechanically generated supply and exhaust air. All laboratory exhaust air is ducted and exhausted to the outside. The system does not return contaminated air back to the laboratory.

Most Laboratories have minimum of eight (8) to ten (10) air changes per hour during occupied times and six (6) air changes per hour during unoccupied times. The control to determine occupied versus unoccupied is determined by occupancy sensors not time. Some laboratories do not have the ability to reduce the airflow. In these spaces, the number of air changes per hour remains the same during occupied and unoccupied times.

Laboratories are maintained under negative pressure in relation to the corridor or other less hazardous areas. In general, the laboratory supply is ten (10) to twenty (20) percent less than the exhaust. This creates the negative pressure in the space in relation to the corridor. The reason for the negative pressure is to contain any hazardous materials or fires in the space. Clean rooms and tissue culture rooms requiring positive pressure have a positive pressure entry vestibule which allows the main laboratory to have negative pressure in relation to the vestibule.

Propping open the laboratory entrance doors will disrupt the pressure inside the laboratory. As such, all laboratory doors must remain closed at all times.

Newly renovated laboratories are equipped with pressure monitors. These monitors are installed at the entrance to the laboratory. The monitor displays the pressure reading in the laboratory. The monitor will alarm if the pressure in the laboratory goes from negative to positive pressure. Laboratory members must stop all activities if the pressure monitor is alarming.

### B. Chemical Fume Hoods

A well-designed chemical fume hood, when properly installed and maintained, offers a substantial degree of protection to the user, provided that it is used correctly and its limitations are understood. Work involving chemicals with high vapor pressures or low threshold limit values (TLVS) must always be done within a chemical fume hood.

The required face velocity for chemical fumes hoods at Drexel University ranges from 80-120 feet per minute (fpm) with an optimum face velocity of 100 fpm at a sash position of 18 inches. During use, the sash should be opened to 18 inches or less; each chemical fume hood is labeled to indicate this position. In the event that the face velocity of a chemical fume hood is below 80 fpm or above 120 fpm or the airflow monitor is alarming, contact Drexel EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu). In this situation, the chemical fume hood must not be used until it is repaired and retested. The same guidelines apply to low-flow chemical fume hoods which have an acceptable range of 60 – 100 fpm.

An audible and visual air flow alarm is present on the face of each chemical fume hood. This alarm indicates whether or not the chemical fume hood has sufficient exhaust. The alarm will provide an audible signal and a red light when the exhaust is not sufficient. In addition, some chemical fume hoods have sash



position alarms to prevent the personnel from working with the fume hood sash in the full open position. The sash must be returned to the eighteen (18) inch mark to clear the audible and visual alarm.

Work must immediately stop if the air flow alarm is activated. Contact EH&S at 215-895-5919 or via email at [safeheal@drexel.edu](mailto:safeheal@drexel.edu).

## **1. Chemical Fume Hood Limitations**

A chemical fume hood is not designed to contain explosions unless specifically designed for this function. A chemical fume hood is not a pollution control device. All contaminants that are removed by the exhaust system are released directly into the atmosphere. Apparatus used in hoods must be fitted with condensers, traps, or scrubbers to contain and collect waste solvents or toxic vapors or dusts. A chemical fume hood must not be used for waste disposal. It is a violation of environmental regulations to intentionally evaporate hazardous chemicals in the chemical fume hood.

Ductless chemical fume hoods are prohibited at the university. These types of hoods use chemical absorbent filters to capture the vapors generated during the experiment and recirculate the air back into the laboratory. These filters are only designed for specific chemicals. The hood will not capture the vapor of chemicals outside the specification. The result is contaminated air recirculated into the laboratory space. In addition, the filters in the hood become saturated at some point depending on the hood usage. This requires the user to change the filters when this occurs. In most cases, the user never changes the filter and keeps using the hood. It is for these reasons ductless hoods are strictly prohibited.

## **2. Chemical Fume Hood Evaluations**

Chemical fume hood performance evaluations are conducted annually by an outside contractor contracted through EH&S. Each chemical fume hood is labeled with an inspection sticker that displays the date that the hood was inspected, the measured face velocity, and the name of the inspector who conducted the test. Chemical fume hoods failing to pass the certification test are tagged out of service until repair and recertification. Laboratory personnel are instructed by EH&S not to use the chemical fume until the unit is recertified.

## **3. Using Chemical Fume Hoods**

Good laboratory practices must be employed while performing work in a chemical fume hood to facilitate adequate protection. Recommended practices are listed below.

- Use a chemical fume hood or other local ventilation device when working with hazardous chemicals. All work involving chemicals with high vapor pressure or low exposure limits must be always performed in a chemical fume hood.
- Design experiments in consideration of chemical fume hood space, air flow and the properties of the chemicals. Before beginning work, verify that the type of chemical fume hood to be used and the face velocity are appropriate for the chemicals involved and the procedure to be performed.
- Know the properties of the chemicals with which you work. Be able to identify signs and symptoms of overexposure.
- Prior to performing work in a chemical fume hood be sure the hood is exhausting properly. Verify that the reading from the continuous air flow monitoring device is no less than 80 fpm, no greater than 120 fpm, and within 20% of the face velocity value listed on the inspection sticker. If the reading differs significantly from that on the sticker, or if the unit is in alarm, the chemical fume hood

may not be operating properly. If hood is not working properly immediately stop work and notify EH&S at 215-895-5919 or by email at safeheal@drexel.edu.

- Check areas around the chemical fume hood for sources of cross drafts that may cause turbulence and result in leaks from the hood into the laboratory.
- Ensure that the inspection sticker is current (within one year).
- Laboratory personnel must not lean into the hood so that his/her head is inside the plane of the hood face. The only exception is during experimental setup or hood maintenance.
- Do not block baffles. Visually inspect the baffles to be sure the slots are open and unobstructed.
- Avoid opening and closing the fume hood sash rapidly, and avoid swift arm and body movements in front of or inside the hood. These actions may increase turbulence and reduce the effectiveness of fume hood containment.
- Place equipment as far to the back of the hood as practical without blocking the bottom baffle. Separate and elevate each instrument by using blocks or racks so that air can flow easily around all apparatus.
- Do not use large pieces of equipment in a hood, because they tend to cause dead spaces in the airflow and reduce the efficiency of the hood. If large pieces of equipment emit fumes or heat then have a special purpose hood designed and installed to ventilate that particular device.
- Keep sash completely lowered anytime no “hands-on” part of an experiment is in progress. Close sash when finished with hood work or when leaving experiments or chemicals unattended. The hood sash must not be removed or left completely open except for setup work.
- Keep sash clean and clear.
- The hood sash must be closed to the lowest position possible while still allowing comfortable working conditions. EHS recommends the sash height be maintained at a distance from the bench top between **15” (fifteen inches)** and **18” (eighteen inches)**. This distance shall reduce the possibility of chemicals splashing eyes and face.
- Fume hoods must not be used for storage space with the exception of chemical waste containers ready for pick-up for disposal.
- All chemicals not being used for an experiment must be removed from the hood and placed in their proper storage area until needed.
- Drip pads in the hood must be replaced with new pads daily.
- Laboratory personnel must clean up all minor spills in the hood immediately. In the case of a major spill contact the Public Safety 24 Hour Call Center at 215-895-2222.
- All materials used to clean up spills must be discarded as hazardous waste.
- Clean all chemical residues from the hood chamber when finished with work.
- All electrical devices must be connected outside the hood to avoid sparks, which may ignite a flammable or explosive chemical.
- **Do not use a hood for any other function for which it was not intended.** Certain chemicals or reactions require specially constructed hoods. Do not manipulate any portion (e.g. alarm, side walls, sash, pressure sensor, baffles, etc.) of the chemical fume hood. Do not drill holes in to the side walls of the hood. **Do not disable the airflow monitor on the chemical fume hood.**
- The hood sash is not a substitute for personal protective equipment. Laboratory personnel must wear safety glasses, laboratory coat, and gloves at all times when working with chemicals in the hood.
- Do not **heat** perchloric acid in a conventional chemical fume hood. Perchloric acid is a very dangerous corrosive and oxidizing agent at high concentrations greater than 70% and at elevated temperatures. Heating perchloric acid generates concentrated vapors that will accumulate in ductwork and form perchlorate crystals that have the potential to explode, causing serious injury to personnel and damage to property. Room temperature concentrations of 70% or less are not significant oxidizers and tend not to generate perchloric acid crystals.

- Never turn off the chemical fume hood exhaust. The exhaust of the chemical fume hood is integral to the overall laboratory ventilation system. Shutting off the exhaust will drastically impact the ventilation efficiency and containment of the laboratory. If the desire is to save energy then closing the sash on the hood is a good place to start.

### **C. Glove Boxes**

A glove box is a sealed box used to manipulate materials where a separate atmosphere is desired. They are commonly used to protect laboratory personnel from hazardous materials or to protect chemicals or materials that are sensitive to air or water vapor.

Glove boxes may be used as positive pressure or negative pressure containment devices. Boxes operated under positive pressure usually contain materials sensitive to outside contaminants such as air or water vapor. Exposure to the outside atmosphere may lead to degradation or a violent reaction. Most positive pressurized glove boxes operate under an inert gas atmosphere. The gas used to create this atmosphere is usually nitrogen or argon. Negative pressure glove boxes are used to protect the laboratory personnel and are used for hazardous materials such as toxic gases or pathogens.

Laboratory personnel must adhere to the following measures when working with glove boxes:

- The PI must ensure all laboratory personnel are trained on the proper operation of the glove box. The training must be documented and uploaded to BioRAFT.
- Positive pressure glove boxes must have local exhaust ventilation for the box purge vent and the vacuum pump exhaust.
- Negative pressure glove boxes must have airflow alarms to ensure the box has exhaust airflow.
- Inspect the condition of the gloves on a daily basis. Check for holes, areas of discoloration, and the connection to the exterior.
- Inspect the condition of the windows on a daily basis. Pay specific attention to the areas where the window connects to the metal frame.
- Inspect the vacuum pump to ensure all lines are in good condition, the oil-mist filter is good and the oil has been changed recently. Keep a log of the oil and filter changes.
- Inspect all pressure gauges and indicators to ensure proper function. Keep a log of the gauge settings for both positive and negative pressure glove boxes.
- If the glove box is equipped a solvent scrubber or solvent delivery system, ensure these components are working as designed.
- Maintain the maintenance schedule to ensure proper operation as per the manufacturer's specifications. EH&S recommends having a vendor under contract to provide this service.
- Ensure proper backup measures are in place for loss of power or loss of atmosphere.

Contact EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) for additional information concerning glove box operations.

### **D. Local Exhaust Systems**

Many laboratories use equipment that can generate airborne contaminants, but cannot be used within a chemical fume hood. Examples include gas chromatographs, ovens, and vacuum pumps. Other types of local exhaust ventilation systems may be required to control contaminants generated by these operations. Such systems must have a separate exhaust duct and must not be installed without approval from EH&S.



Consult EH&S before installing, modifying, or purchasing laboratory ventilation equipment to verify that it conforms to all relevant safety, building, and fire code regulations.

## E. Eyewash Station and Safety Shower

Eyewash stations and safety showers are essential in every laboratory. These stations must be located within 25 feet and/or 10 seconds of unobstructed path of the laboratory operation. Eyewash stations and showers should be located within the laboratory, especially if corrosive or injurious chemicals, strong irritants, or toxins that can be absorbed through the skin are present, or if the lab is subject to BSL-2 (or higher) regulations.

Regulatory standards insist that the eyewash station be hands-free or automatically operated. Drench hoses, sink faucets or showers are not acceptable eyewash substitutes. Facility limitations may affect these requirements. Locations of emergency eyewash stations and safety showers shall be identified with a highly visible sign.

Eyewash stations must be inspected once a week by the laboratory personnel. The weekly test must be documented and the record must be maintained by the Principal Investigator/Faculty Member/Laboratory Supervisor. EH&S recommends keeping the record near the eyewash station. Inspection forms can be obtained by contacting EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu).

EH&S certifies eyewash stations and safety showers annually. The certification record is uploaded to BioRAFT and associated with the specific space.

## VII. Administrative Controls

The safe operation and compliance of each laboratory is the responsibility of the respective PI/Faculty Member/Laboratory Supervisor, while the overall responsibility for the enforcement of the chemical hygiene plan rests with the EH&S. Policy and implementation procedures pertaining to the CHP require approval by the EH&S.

The administrative controls enforced at the university include, but are not limited to:

- Restricted access and proper signage on all entrances leading to areas containing agents that may be immediately dangerous to life or health.
- Proper labeling on laboratory doors, cabinets and containers containing potentially hazardous materials.
- The observation of Standard Universal Precautions when working with blood and bodily fluids of humans and animals, recombinant DNA or potentially pathogenic bacterial or viral agents.
- The contents of the lab safety manual and the radiation safety manual and all applicable federal and state regulations established to protect human health and the environment.
- If a chemical is produced for another user at Drexel University or at another facility, the researcher shall comply with the [Hazard Communication Standard 29 CFR 1910.1200](#), including the requirements for preparation of material safety data sheets and labeling.
- Environmental monitoring is required in all laboratories using the chemicals listed in [Table Z-1 and Z-2 \(29 CFR 1910.1000\)](#) that would generate anticipated exposures in excess of the permissible exposure limit (PEL) or the threshold limit value (TLV).
- Chemical spill response must be performed in accordance with this manual. Laboratory personnel are responsible for cleaning up spills of materials that are not acutely hazardous or in quantities of less

than 500 ml. Laboratory personnel are responsible for containing and reporting larger spills and/or spills of acutely hazardous materials such as phenol, mercury, etc.

- Procedures for containing and/or cleaning chemical spills have been developed in accordance with OSHA guidelines and are described in [Section XVI](#).
- All chemical spills greater than 100 milliliters must be reported to EH&S immediately at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) or at 215-895-5919.
- Appropriate spill kits must be maintained in each lab or in centralized common areas accessible by all lab personnel. It is the responsibility of the PI/Faculty Member/Laboratory Supervisor to ensure that ample spill materials are available and that laboratory personnel are familiar with locations and use of these materials.

## A. Laboratory Safety Training

All laboratory researchers must be trained according to the requirements of the Laboratory Safety Standard. Colleges and non-academic departments that engage in the laboratory use of hazardous chemical, physical or biological agents are responsible for identifying such employees. The employees must be informed about their roles and responsibilities as outlined in this Part, as well as hazards associated with their work and how to work safely and mitigate those hazards.

EH&S has prepared several web-based training programs that provides basic information for working safely with chemicals, biologics, toxins and carcinogenic agents. The required training depends upon the work and materials involved, including use of radioactive materials, biological materials, lasers, irradiators and use of respirators or self-contained breathing apparatus. The training courses are available on line as well as classroom training courses as needed. The on-line training courses are available at the following link: [www.drexel.bioraft.com](http://www.drexel.bioraft.com) using your Drexel Credentials. The laboratory safety training curriculum includes:

- Biological Safety
- Chemical Hygiene
- Compressed Gas Safety
- Electrical Safety
- Emergency Response
- Fire and Life Safety
- Hazard Communication
- Hazardous Waste Management
- Hydrofluoric Acid Safety
- Laboratory Equipment Safety
- Laser Safety
- Mercury Safety
- Needle Stick and Needle Safety
- Personal Protection Equipment
- Reactive Chemicals and Pyrophoric Safety
- Radiation Safety
- Recombinant DNA Materials
- Respiratory Protection
- Shipping Biological Materials

Training courses are assigned to each lab member based on a job activity assessment. The Principal investigator is responsible for conducting the job activity assessment. The [BioRAFT](#) platform will notify all lab members when training is due. Notifications will be sent to the PI and Department Head when an individual's training is overdue. The notification time line is as follows:

- **1 month Warning Message** – This message is sent to inform the user that a training course is due in one month.
- **2-week Warning Message** – This message is sent to inform the user that a training course is due in two weeks.
- **3-day Warning Message** – This message is sent to inform the user that a training course is due in three days.
- **Digest Style Message** – This message is sent to inform the user that their training is overdue. This message is sent on a weekly basis until the user completes the training.
- **Overdue Message to Supervisor** – This message is sent to a supervisor to inform them that one of their lab members has overdue training. This message is sent on a weekly basis until the training is completed.
- **Overdue Digest Message to EHS** – This message is sent to EHS to inform them that a researcher has overdue training. This message is sent on a weekly basis until the training is completed.

In addition, each laboratory LSL is responsible for ensuring that laboratory employees are provided with training about the specific hazards present in their laboratory work area, and methods to control such hazards. Such training must be provided at the time of an employee's initial assignment to a work area and prior to assignments involving new potential exposures, and must be documented. Refresher training must be provided at least annually. The specific training must be documented and upload into the BioRAFT Compliance Platform.

## **B. Laboratory Closure Timeline for Training Non-Compliance**

EHS will send a closure notice to the PI if any lab member has one or more training courses overdue for two weeks or more. The notice will provide the names of the lab member who are delinquent and a deadline date to complete. The deadline to complete will be no more than 24 hours. The lab will be closed if the training is not completed prior to the deadline. The lab will remain closed until all training is completed.

## **C. Suspension of Laboratory Access for Research Operations**

EHS will send an access suspension notice to the PI if any lab member has one or more training courses overdue. The notice will provide the name of the lab member who is delinquent. This lab member may not access the lab until the training is completed.

## **D. Refresher training**

Refresher training is required for all laboratory researchers, graduate students and principal investigators (PI's) at least annually. Departmental LSLs are responsible for coordinating and tracking updated training. Often, LSLs may arrange for departmental-wide update-training sessions, focusing on results of laboratory audits, and highlight issues that may need improvement. LSLs may invite EH&S to supplement these training sessions. Individual PI's may conduct research-group-specific safety reviews to

supplement or even stand in place of departmental update sessions. Documentation of all safety training must be maintained and upload to [BioRAFT](#) using the Document’s tab on the PIs profile page.

## E. Process Hazard Assessment

### 1. Laboratory Standard Operating Procedures

Standard Operating Procedures (SOPs) are written instructions that detail the steps that will be performed during a given experimental procedure and include information about potential hazards and how these hazards will be mitigated. SOPs should be written by laboratory personnel who are most knowledgeable and involved with the experimental process. The development and implementation of SOPs is a core component of promoting a strong safety culture in the laboratory and helps ensure a safe work environment. PIs/LSL is required to develop and implement laboratory-specific SOPs for certain processes that involve hazardous chemicals and “particularly hazardous substances”. The SOP must include a [Process Risk Assessment](#) to determine the level of risk associated with the specific



experiment or process. The assessment evaluates the hazards associated with each task and corresponding safety controls to assist in determining whether or not the risk is acceptable.

The SOPs must be submitted and reviewed by the EH&S prior to implementation. For certain hazardous chemicals and hazardous substances, or specialized practices, consideration must be given to whether additional consultation with safety professionals is warranted or required. Circumstances requiring prior approval from the PI/LSL must also be addressed in laboratory-specific SOPs. SOPs must be upload to [BioRAFT](#) using the Document’s tab on the PIs profile page. Contact [EH&S](#) to obtain a SOP template.

### 2. Process Hazard Assessment

Laboratory personnel must perform a risk assessment for all experiments that utilize hazardous materials. The assessment is utilized to determine the level of risk associated with a specific experiment. The assessment evaluates the hazards associated with each task and corresponding safety controls to assist in determining whether or not the risk is acceptable.

The risk assessment compares the severity of the hazard to the likelihood an incident could occur. This comparison identifies the level of risk associated with the experimental process. The evaluation is performed using the following risk assessment matrix.

| Severity   | Likelihood   |              |            |
|------------|--------------|--------------|------------|
|            | Unlikely (1) | Possible (2) | Likely (3) |
| Low (1)    | 1            | 2            | 3          |
| Medium (2) | 2            | 4            | 6          |
| High (3)   | 3            | 6            | 9          |

**Severity Levels are defined as:**

| Level      | Impact to Physical Being  |
|------------|---|
| (1) Low    | No injury, injury or ill-health requiring first aid treatment only - includes minor cuts and bruises, irritation, ill-health with temporary discomfort.                                 |
| (2) Medium | Injury requiring medical treatment or ill-health leading to disability, includes lacerations, burns, sprains, minor fractures, dermatitis, deafness, work-related upper limb disorders. |
| (3) High   | Fatal, serious injury or life-threatening, occupational disease, includes amputations, major fractures, multiple injuries, occupational cancer, acute and fatal diseases.               |

**Likelihood levels are defined as:**

| Level        | Event Frequency  |
|--------------|--|
| (1) Unlikely | Not likely to occur. The event has not occurred in the PI's lab or similar lab setup. The event has not be documented in literature or safety bulletins.                   |
| (2) Possible | Possible or known to occur. The event has occurred in the PI's lab or similar lab setup. The event has been documented in literature or safety bulletins.                  |
| (3) Likely   | Common or repeating occurrence. The event has occurred repetitively in the PI's lab or similar lab setup. The event has been documented in literature or safety bulletins. |

**Risk Level and Acceptable Criteria**

| Risk Score | Risk Level  | Acceptability of Risk | Recommended Actions   |
|------------|-------------|-----------------------|---|
| < 3        | Low Risk    | Acceptable            | No additional risk control measures required. Continue to monitor to ensure the risk does not escalate to a higher level.   |
| 3 - 4      | Medium Risk | Moderately Acceptable | Acceptable to carry out the work activity; however, tasks need to be reviewed to bring risk level to As Low As Reasonably Achievable (ALARA).<br><br>Control measures must be implemented to reduce the risk. Supervisory oversight is required.  |
| > 4        | High Risk   | Not Acceptable        | Experiment cannot be performed until the risk level is reduced to the medium risk level.<br><br>Control measures must be implemented to reduce the risk. Control measures must focus on elimination, substitution and engineering controls. Personal Protective equipment cannot be the sole risk control strategy.<br><br>Immediate management intervention is required to ensure the risk is reduced to at least medium level prior to initiating the experiment. |

Research personnel must complete the [Process Risk Assessment](#) form using the above matrix to determine the initial risk level. Medium and high risk levels must be re-evaluated to reduce the risk to an acceptable level. The form must be approved by the PI or Supervisor of the laboratory and sent to the EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) for final approval. The experiment cannot be initiated until final approval is provided. The assessment must be upload to [BioRAFT](#) using the Document's tab on the PIs profile page.

### 3. Chemical Safety Summary (CSS)

The Department of Environmental Health and Safety developed a database of Chemical Safety Summaries (CSS). The summaries can be used to complete the required process risk assessment and standard operating procedures. The CSS contain the following information:

- Chemical Name
- Hazard Rating
- Hazards
- Label Requirements
- Permissible Exposure Limits
- Personal Protection Equipment Requirements
- Precautionary Statements

The database of CSS is located on the EH&S Share Point site. As a member of the site, you can edit any CSS or add a CSS for other researchers to use. The format of any new CSS must follow the same format as the EH&S developed CSS. The CSS template can be downloaded going the CSS section of the [EH&S website](#). Contact [EH&S](#) to obtain access to the site.

## F. Laboratory Inspections

EH&S has instituted a laboratory safety inspection program for all laboratories in the science, engineering and technology areas. Laboratories are currently inspected on a biannual basis by EH&S to ensure compliance with federal, state and university requirements. EH&S conduct inspections, issue reports, conduct re-inspections when deficiencies are noted, and provide training and coaching on safety and compliance in laboratories. Strong compliance is a critical part of an effective safety program.

The Laboratory Safety Technician will send the laboratories the proposed schedule for inspections. The laboratory may specify a date and time for the inspection to ensure someone is available to present during the inspection. EH&S strongly recommends scheduling a date and time with the Laboratory Safety Technician.

Inspection reports will be sent electronically through the [BioRAFT Compliance Platform](#). PIs have the ability to comment on each finding and receive responses concerning the finding from EH&S. All of the comments and responses are recorded in the platform. The platform allows the PI to review the compliance level of his or her laboratory.

Follow-up inspections are performed when the PI or LSL indicates all findings are corrected in the compliance platform or when the findings are overdue.

In addition to the scheduled biannual inspections, EH&S conducts spot inspections throughout the year to ensure the PIs are maintaining compliance with federal, state and university requirements. These spot inspections are unannounced. The report will be sent through [BioRAFT Compliance Platform](#).

The finding due dates are determined by the severity level. Findings noted during an inspection are classified using a 4-point severity scale, with Level 4 indicating the greatest severity. The severity levels are included with the description of any finding during the inspection.

### **1. Severity Level 1 – Notice**

- Situation is a minor departure from Standard Operating Procedures (SOPs), common sense, best practices and/or housekeeping standards.
- Action – All findings will be noted on the inspection. The supervisor must address the inspection findings and update the inspection platform within thirty (30) days. Failure to address the findings within the thirty (30) day period will result in laboratory closure.

### **2. Severity Level 2 – Moderate**

- Situation is not life threatening, and does not pose risk of serious illness or injury, and/or significant damage to property. The violation may also be an infraction of EPA, OSHA, and/or local (state, city, institutional) regulations.
- Action – All findings will be noted on the inspection. The supervisor must address the inspection findings and update the inspection platform within fifteen (15) days. Failure to address the findings within the fifteen (15) day period will result in laboratory closure.

### **3. Severity Level 3 – Important**

- Situation is potentially life threatening, with an associated danger that may pose a risk of serious illness or injury, and/or significant damage to property. The violation may also be an infraction of EPA, OSHA and/or local (state, city, institutional) regulations.
- Action – Operations may be discontinued and the occupants evacuated from the room until the situation is resolved. All findings will be noted on the inspection. The supervisor must address the inspection findings inside the laboratory within five (5) days and update the inspection platform within ten (10) days. Failure to address the findings within the five (5) day period will result in laboratory closure.

### **4. Severity Level 4 – Critical**

- Situation is life threatening with an imminent danger that poses an immediate risk of serious illness or injury, and/or significant damage to property.
- Action - Operations will be discontinued and the occupants evacuated from the room until the situation is resolved. All findings will be noted on the inspections. The supervisor must immediately address the inspection findings and update the inspection platform within five (5) days. The laboratory will remain closed until all findings are addressed.

## 5. Repeat Finding

EH&S will send a closure notice to the PI if any laboratory has a finding that is recorded three (3) or more times in 18 months. The closure notice will include the finding and a deadline to address. The deadline will be no longer than 24 for hours. The laboratory will be closed if the finding is not addressed prior to the deadline. The laboratory will remain closed until the finding is addressed.

## VIII. Personal Protection Equipment

OSHA's new final standard on personal protection equipment, 29CFR 1910 132, Subpart I, imposes several new and important requirements relating to basic safety and health programs. The standard adds new general requirements for the selection and use of personal protection equipment (PPE).

A variety of laboratory personal protection equipment is commercially available and commonly used in laboratories. However, for the equipment to perform the desired function it must be used and managed properly. Principal Investigators and/or Laboratory supervisors must conduct a risk assessment to determine the need for such equipment, monitor its effectiveness, train the employees, and monitor and enforce the proper use of such equipment.

When selecting PPE, consider three key things:

- First is the type of anticipated exposure, which is determined by the potential for exposure by such factors as absorption, inhalation, injection or ingestion. PPE selection, in particular the combination of PPE, also is determined by the category of hazard exposure and handling.
- Second, and very much linked to the first, is the durability and appropriateness of the PPE for the task. This will affect, for example, whether a gown or apron is selected for PPE, or, if a gown is selected, whether it needs to be fluid resistant, fluid proof, or neither.
- Third is fit. PPE must fit the individual user, and ensure that all PPE are available in sizes appropriate for the workforce that must be protected.

There are three key rules to remember when using PPE:

- Don PPE before you have any contact with the hazardous materials.
- Remove the PPE carefully when you have completed your tasks. Disposable contaminated PPE shall be discarded in the appropriate hazardous waste container. Non-Disposable contaminated PPE shall remain in the contaminated area.
- Immediately perform hand hygiene before going on to your routine needs.

### A. Required Personal Protection Equipment and Personal Attire for Laboratory Access

All laboratory personnel and visitors must wear the required PPE. You will be removed from the laboratory if you are not wearing the required PPE. Laboratories that continually disregard the required PPE may be closed for a time period determined by EH&S.





Know the locations of PPE and how to obtain additional materials when necessary. If appropriate PPE is not readily available do not initiate experiments involving hazardous chemicals.

The Principle Investigator shall provide proper personal protection equipment for all personal in the research laboratory. The PI must provide the training on appropriate use and limitations as well as the locations of all PPE.

Faculty Members/Laboratory Supervisors shall require students to obtain the appropriate PPE prior to commencing any laboratory activities. If proper PPE is not available, no lab activity can proceed. For proper PPE selection contact the EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu).

## 1. Eye Protection

Appropriate eye protection is worn at all times by all persons in laboratory. Eye protection consists of safety glasses with side shields, splash goggles or face shield, or full-face respirator. Chin length face shields are to be worn to prevent splashes or sprays of blood, infectious materials, or hazardous chemicals when there is a potential for eye, nose, or mouth contamination.

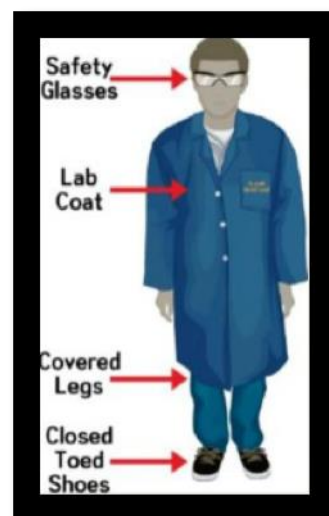
Eye protection is required whether or not one is actually performing experimental operations and must be worn by all lab personnel and visitors. Prescription eyeglasses and contact lenses are not appropriate protection.

Laboratory personnel may remove the eye protection if work involves viewing samples or specimens through a microscope.

## 2. Body Protection

Appropriate body protection is worn at all times by all persons in the laboratory. Body protection consists of a laboratory coat, pants, shirt, and closed top/toed shoes. Clothing that exposes large areas of skin is not permitted. Shorts, skirts, and short pants that expose large areas of skin are prohibited from being worn in the laboratory. Open top/toed shoes, flip flops, perforated shoes, sandals, and cloth shoes do not provide protection from hazardous materials and are prohibited from being worn in the laboratory. Shoes must cover the entire foot.

Personnel working with flammable, pyrophoric or reactive chemicals must wear flame-resistant laboratory coats (e.g. Nomex®). Laboratory coats must not be worn in the hallways or common spaces outside the lab.



## 3. Other Personal Protective Equipment

### a. Gloves

Laboratory personnel are required to wear appropriate gloves when there is a potential for direct contact with blood, hazardous chemicals, infectious agents, or other hazardous materials.

Select gloves appropriate for the task. Gloves protect differently for each chemical. Wearing the wrong type of glove can be more hazardous than wearing no gloves at all. If the chemical seeps through, the

glove can hold it in prolonged contact with the wearer's skin. For more information concerning glove selection contact EH&S. The [EH&S website](#) has a link to the [AnsellGuardian glove selection chart](#). This can be used to identify the appropriate gloves for the task.

- Use disposable gloves when dexterity is needed and the contamination warrants one time use.
- Use heavy duty gloves when the hazard requires it. For example, use butyl gloves (picture to the right) to handle 70% nitric acid. The permeation breakthrough time for this butyl glove is greater than 480 minutes.
- Use puncture or cut resistant gloves when handling sharp objects.
- Use insulated gloves when handling cryogenic or hot materials.
- Wash hands prior to wearing gloves.
- Double glove to provide multiple lines of defense when working with highly toxic or multiple hazard materials.
- Inspect and change gloves frequently to avoid exposure. Wash hands with soap and water immediately after removing gloves.



Gloves must only be worn in the lab and taken off before leaving, especially when handling infectious material. If transporting hazardous materials from one area to another, glove one hand to hold the product/apparatus or push the cart and use a clean, ungloved hand to open doors, press buttons, etc.

## b. Respiratory Protection

Use appropriate respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls. The Principal Investigator must perform a risk assessment to determine the need for respiratory protection. Assistance with this assessment can be obtained by contacting EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu).

The odor threshold for many chemicals is much lower than the permissible exposure limit, and in many circumstances, is a great indicator of exposure. Refer to the Odor Threshold Chart below and the [OSHA PEL list](#) to determine if a respirator is required.

| Odor As An Aid to Chemical Safety |   |  |
|-----------------------------------|---|--|
| Chemical                          | Threshold Limit Value (Parts Per Million) | Air Odor Threshold (Parts Per Million) |
| Acetone                           | 750                                       | 13                                     |
| Ammonia                           | 25  | 5.2                                    |
| Arsine                            | 0.05                                      | 0.5                                    |
| Carbon Monoxide                   | 50  | 100,000                                |
| Chlorine                          | 1   | 0.31                                   |
| Chloroform                        | 10  | 85                                     |
| P-Dichlorobenzene                 | 75  | 0.18                                   |
| Ethyl Alcohol                     | 1000                                      | 84                                     |
| Ethyl Ether                       | 400                                       | 8.9                                    |
| Hydrogen Sulfide                  | 10  | 0.008                                  |
| Methyl Alcohol                    | 200                                       | 100                                    |
| Methylene Chloride                | 100                                       | 250                                    |
| Naphthalene                       | 10  | 0.084                                  |
| Ozone                             | 0.1                                       | 0.045                                  |

|                |     |      |
|----------------|-----|------|
| Phenol         | 5   | 0.04 |
| Toluene        | 100 | 2.9  |
| Vinyl Chloride | 5   | 3000 |
| M-Xylene       | 100 | 1.1  |

*\*Extracted from the Journal of Applied Toxicology. Vol3(6), 1983*

When the use of respirators, in research laboratories, is necessary to maintain exposure below the permissible exposure limit (PEL), the respirator will be provided by the PI at no cost to the employee. EH&S will provide students, at no cost, with respirators when the use is necessary to maintain exposure below the permissible exposure limit (PEL).

The proper respiratory equipment can be obtained contacting EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu). The respirators shall be selected and used in accordance with the requirement of 29 CFR 1910.134 and ANSI Z88.2-1969. Training, an annual physical and pulmonary function test will be required for all individuals requiring the use of respirators in accordance with OSHA's standards on respiratory protection 29 CFR 1910.134. Proper respiratory equipment includes the following types:

- Air Purifying Respirators (APR)
  - Tight fitting dust/mist - N95, R95, P95, N100, R100, P100
  - Tight fitting Half-Faced
  - Tight fitting Full-Faced
  - Powered Air Purifying Respirator (PAPR)
- Supplied Air Respirators (SAR)
  - Self-Contained Breathing Apparatus (SCBA)

The requirements set forth in the University's Respirator Protection Policy must be fulfilled prior to performing work with a respirator. Contact EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) to enroll in the program. Do not go to the local hardware store to purchase a respirator for use. You may purchase a respirator that is inappropriate for the hazard.

## IX. General Work Precautions

Keeping laboratories clean and organized helps provide a safer laboratory. The following items are steps to take to ensure the up keep of a laboratory.

- Keep all work areas clean and free of clutter. Clean up the work area on completion of an operation or at the end of each work shift or class.
- Keep chemicals and equipment properly labeled and stored appropriately. Segregate chemicals as noted in Part 11 of this section. (For more information on compatible storage, refer to EH&S website).
- Eating, drinking, smoking, chewing gum or applying cosmetics in the laboratory is strictly forbidden. Lunches are not to be stored in laboratory refrigerators, but may be kept in the designated refrigerators outside the laboratory.
- Seek information and advice about hazards, review SDS plan appropriate protective procedures, and plan positioning of equipment before beginning new operation.
- Leave lights on during work hours.

- Provide for containment of toxic substances in the event of failure of a utility service in an unattended operation.
- Beware of any unsafe conditions and see that they are corrected when detected. Contact the EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) for advice.
- Absorbent pads should be discarded and counter tops wiped down at least once a day.
- Keep drawers and cabinet doors closed and electrical cords off the floor to avoid tripping hazards.
- Keep aisles clear of obstacles such as boxes, chemical containers, and other storage items that might be put there even temporarily.
- Avoid slipping hazards by cleaning up spilled liquids promptly and keeping the floor free of stirring rods, glass beads, stoppers, and other such items.
- Never block or even partially block the path to an exit or to safety equipment such as a fire extinguishers, safety showers or eyewash stations.
- Make sure that supplies and equipment on shelves provide sufficient clearance so that fire sprinkler heads operate correctly. There shall not be any storage within 18 inches of a sprinkler head.
- Put ordinary wastepaper in regular trash.
- Broken glass shall be disposed in the approved sharp containers.
- Mouth suction for pipetting or starting a siphon is strictly forbidden.
- Do not smell or taste chemicals.
- Apparatus that can discharge toxic chemicals (vacuum pumps, distillation columns, etc.) must be vented into local exhaust devices or chemical fume hoods.
- 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 in the event that implosion might occur.
- Use equipment only for its designed purpose.
- Remove laboratory coats immediately upon significant contamination.
- When in the lab, appropriate footwear that completely covers the foot must be worn. Sandals, flip-flops, perforated shoes, any shoes made of canvas, or any other open-top or open-toed shoes are prohibited.
- When in the lab, pants and dresses must come down to the ankle. Shorts, short skirts and other clothing that leave sufficient skin exposed are prohibited in the lab. Shorts and short skirts may only be worn in the lab when wearing an ankle-length lab coat that covers all exposed skin.
- Disposable or special gloves, chemical aprons, goggles or eye shields must be used whenever appropriate.
- Disposable gloves must never be worn in hallways, elevators, or public areas of the university. If hazardous materials must be transported from one area to another, glove one hand to hold the product / apparatus or push cart and use a clean ungloved hand to open doors, press buttons, etc.
- Inspect all gloves before each use. Wash them before removal. Dispose of them appropriately.
- Reusable gloves should be washed and inspected before and after each use. Gloves that might be contaminated with chemicals must not be removed from the immediate area in which the chemicals are located.
- Wash areas of exposed skin thoroughly before leaving the laboratory.
- Confine long hair and loose clothing.
- Avoid practical jokes or other behavior that might confuse, startle or distract another worker.

## X. Procedural Precautions

### A. Highly Toxic and Reactive Precautions

- Review the Safety Data Sheets prior to working with any toxic or reactive chemicals. Safety Data Sheets can be accessed on the [EH&S website](#).
- Preparations for handling highly toxic and/or reactive substances must include sound and thorough planning of the experiment, understanding the intrinsic hazards of the substances and the risks of exposure inherent in the planned process, selecting additional precautions that may be necessary to minimize or eliminate these risks, and reviewing all emergency procedures to ensure appropriate response to unexpected spills or accidents.
- Do not allow release of toxic substances in cold rooms or warm rooms, since these areas have contained re-circulated atmospheres.
- Do not use any chemicals that require ventilation in excess of your lab's capabilities. Most labs have between 6 and 12 air changes per hour. Chemicals requiring additional ventilation must be used only in hoods and glove boxes.
- Procedures involving highly toxic chemicals that can generate dust, vapors, or aerosols must be conducted in a hood, glove box, or other suitable containment device. Refer to [EH&S website](#) for hazardous chemical lists.
- When working with toxic liquids or solids, it is critical that gloves be worn to protect the hands and forearms. These gloves must be carefully selected to ensure that they are impervious to the chemicals being used and are of appropriate thickness to allow reasonable dexterity while also ensuring adequate barrier protection. Contact the EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) for assistance on glove selection. Or refer to the [Ansell Guardian Glove](#) Selection website for assistance with selecting the appropriate glove.
- Always inspect all personal protective equipment prior to starting any experiment and never work alone.
- When using toxic substances that could generate vapors, aerosols, or dusts, additional levels of protection, including full-face shields and respirators, are appropriate, depending on the degree of the hazard represented.
- Equipment used for the handling of high toxic chemicals must be isolated from the general laboratory environment.
- After using toxic materials laboratory personnel shall wash his or her face, hands, neck and arms prior to leaving the laboratory.
- Laboratory personnel must be specifically trained on the use of certain highly toxic and/or reactive materials. EH&S provides additional training to anyone working with any of the highly toxic or reactive materials any on the [OSHA regulated materials](#) Table Z list.



### B. Perchloric Acid

- Perchloric acid is a very dangerous corrosive and oxidizing agent at high concentrations and elevated temperatures. Room temperature concentrations of 70% or less are not significant oxidizers, but are still highly corrosive.
- Always review the Material Safety Data Sheet before using perchloric acid.
- Always wear appropriate personal protective equipment when using perchloric acid.



- Do not store perchloric acid with organic materials. Upon contact with perchloric acid, organic materials such as wood or cloth may ignite. Perchloric acid also must not be stored with bases, organic acids, or flammables.
- Perchloric acid spills must not be allowed to dry as they become more unstable as the acid concentrated. Also, do not leave containers uncovered. Neutralize any spill with soda ash or similar and use an inorganic absorbent to clean up the material. Do not use rags or paper towels unless wetted. Seal any cleaning materials to be discarded in a plastic bag and contact the EH&S for disposal.
- Salts of perchloric acid are also oxidizers and may be explosive.
- Any experiment involving the heating of perchloric acid **MUST** be done in a chemical fume hood specially designed as a perchloric acid hood. Do not use direct flame heating or oil baths. Perchloric Acid Hoods are made of stainless steel and have wash-down water spray systems.
- EH&S requires any lab using perchloric acid to write the receive and open dates on the container's label.

### C. Hydrofluoric Acid (HF)

- Hydrofluoric acid is an extremely dangerous material and all forms, including vapors and solutions, can cause severe, slow-healing burns to tissue. At concentrations of less than 50%, the burns may not be felt immediately and at 20% the effects may not be noticed for several hours. At higher concentrations, the burning sensations will become noticeable much more quickly, in a matter of minutes or less. HF burns pose unique dangers distinct from other acids, it readily penetrates skin, damaging underlying tissue. The fluoride ion can then cause destruction of soft tissues and decalcification of the bones. HF can cause severe burns to the eyes, which may lead to permanent damage and blindness. The Hydrofluoric Acid Standard Operating Procedure, which is available from the Department of Environmental Health and Safety, and its MSDS must be posted prominently.
- Review the MSDS before working with this material.
- Do not work alone when using hydrofluoric acid.
- For skin contact, a 2.5% calcium gluconate gel is recommended. For eye contact, a sterile solution of 1% calcium gluconate or dropper bottle of 0.5 % pontocaine hydrochloride is required to be made available. EH&S can supply any lab using HF the calcium gluconate gel.



### D. Pyrophoric Organometallic Materials

- Always read the relevant [Safety Data Sheet](#) before using these materials.
- Pyrophoric chemical users must be thoroughly trained in the proper lab techniques.
- Never work alone when using these materials.
- Set up work in a laboratory fume hood or glove box and **ALWAYS** wear the appropriate personal protective equipment. Portable shields might be acceptable. Glove boxes are recommended when an inert or dry atmosphere are required.
- A face shield is required at any time there is a risk of explosion, large splash hazard or a highly exothermic reaction.
- Lab coats or aprons, not made of easily ignited materials such as nylon or polyester, must be worn. **Fire-resistant lab coats made from materials such as Nomex are required.**
- Minimize the quantity of pyrophoric reagents used or stored.

- Pyrophoric chemicals must be stored under an atmosphere of inert gases or under kerosene, as appropriate.
- Avoid working or storing these materials in areas near heat/flames sources, oxidizers, and water sources.
- A container with any pyrophoric residue must never be left open to the air.
- The use of smaller syringes is encouraged. If handling more than 20 ml of sample, one should use a cannula for transfer or use a 20-ml syringe repeatedly.
- The Aldrich Sure/Seal Packaging system provides a convenient method for storing and dispensing air sensitive reagents. Replace the plastic cap after each use, particularly for long term storage. The Sure/Seal septum-inlet transfer adapter must be used when repeated dispensing is necessary.

## E. Piranha Solution

Piranha Solution, also known as Piranha Etch, is primarily used to remove organic residues from substrates. Because the mixture is a strong oxidizer, it will remove most organic matter, and it will also hydroxylate most surfaces (add OH groups), making them extremely hydrophilic (water compatible). Piranha solution is used frequently in the microelectronics industry, e.g. to clean photoresist residue from silicon wafers. Sometimes it is used to clean glassware, but this is discouraged, with the possible exception of sintered, or fritted, glassware.

Piranha solution is very dangerous, being both strongly acidic and a strong oxidizer. Before using Piranha, a laboratory personnel should attempt more stable methods of removing stains, tars or clogs. Often, glassware will "clean itself" if simply left with a rinse of a cleaning solution present. An immediate example for a suitable substitute, prior to using Piranha, is 98% sulfuric acid.

Piranha solution be extremely energetic and may result in explosion or injury resulting from chemical and thermal burns if not handled with extreme caution. Mixing the solution is exothermic and the resulting heat can bring the solution up to 120°C, which can result in violent boiling and splashing of the acidic solution.

One must allow the solution to cool before applying any heat. Exposure to sufficient fuel, primarily organic compounds such as photoresist and isopropyl alcohol, will generate large quantities of heat and gas. If accidentally inhaled, piranha vapor may irritate the respiratory tract. Both acid and base piranha are equally dangerous when hot, although while the reaction for acid piranha is self-starting, base piranha must be heated to 60°C before the reaction takes off. Explosions may occur if the peroxide solution concentration is more than 50%. Keep the peroxide concentration under 30%.

**All Piranha solution containers including waste containers must be equipped with pressure relief caps to prevent the containers from rupturing since Piranha solutions release gas.** [EH&S](#) can supply laboratories with pressure relief caps upon request, but, at this time, only size 38/439, which should fit most standard 0.05 to 4L bottles. Please make sure the caps fit the selected containment vessel before its use. These caps can be purchased from [PSI](#).

- All manipulations with Piranha solution must be done in a chemical fume hood.
- Glass or Pyrex bottles must only be used to hold Piranha solutions.
- Heavy duty neoprene or rubber gloves must be worn when handling this solution.
- Laboratory personnel must have specific training on the appropriate handling of this solution.

## F. Radioactive Material Precautions

- Prior to working with any radioactive material contact the Radiation Safety Department (215-762-4050) for the current regulations concerning radioactive materials.
- Know the characteristics of the radioisotopes that are being used, including half-life, types and energies of emitted radiations, the potential for exposure, how to detect contamination, and the annual limit on intake.
- Dispose of waste radionuclides and their solutions in accordance with the University's Hazardous Waste Management Plan. Contact the Radiation Safety Department at [radiationsafety@drexel.edu](mailto:radiationsafety@drexel.edu) or the EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) concerning proper disposal procedures.
- Plan experiments so as to minimize exposure by reducing the time of exposure, using shielding against exposure, increasing your distance from the radiation, and paying attention to monitoring and decontamination.
- Keep an accurate inventory of radioisotopes.
- Place only materials with known or suspected radioactive contamination in appropriate radioactive waste containers.



## G. Flammable Material Precautions

- Handle flammable substances only in areas free of ignition sources. Besides open flames, ignition sources include electrical equipment (especially motors), static electricity, and, for some materials (e.g., carbon disulfide), even hot surfaces. Solvent vapors can travel in air to open flames or electrical equipment.
- Check the work area for flames or ignition sources prior to using a flammable substance.
- Never heat a flammable substance with an open flame. Preferred heat sources include steam baths, water baths, oil and wax baths, salt and sand baths, heating mantles, and hot air.
- Keep containers of flammable substances tightly closed at all times when not in use.
- Use only refrigeration equipment certified for storage of flammable materials.
- Always use a chemical fume hood when using flammable solvents.



## H. Nano Material Precautions

- The PI must complete a comprehensive risk assessment prior to working with any nanomaterial. The assessment must identify the tasks that may expose laboratory members to nanomaterials. The task must be inventoried and prioritized according to the potential for occupational exposure. Determinants of potential exposure may include dustiness, type of process, quantity of material handled, and duration and frequency of employee exposure.
- Handle nanomaterials in dry powder form with care to minimize the generation of airborne dust and to minimize dermal contact.
- Nanomaterials suspended in a liquid present less risk for becoming airborne than dry powder forms. However, these suspensions may present a dermal risk, especially if the nanomaterial is suspended in a solvent.



- Nanomaterials suspended in a liquid may be aerosolized during certain handling procedures (e.g. sonication).
- Nanomaterials incorporated into a solid matrix are least likely to become airborne but may pose a risk under certain circumstances like cutting, drilling, sawing or sanding the solid matrix.
- Nanomaterial experiments must be done in a manner that involves the minimum quantity for the particular experiment or process.
- Avoid handling dry nano powders on the bench top or any other open system.
- Keep nanomaterials bound in a matrix, suspend in a liquid, or sealed in a container.
- Use appropriate engineering controls. For larger processes that cannot fit in a fume hood or glovebox control emissions with properly designed local exhaust ventilation.
- Transfer nanomaterial samples in sealed, unbreakable, and labeled containers.
- Avoid generating aerosols on bench tops. Use appropriate laboratory exhaust and containment systems.
- Designate a specific space in the laboratory for nanomaterial work. This space should be isolated from other work areas and a relatively low traffic area.
- Keep laboratory doors closed at all times to prevent aerosolizing the material.
- Wear appropriate PPE when handling nanomaterials. Foot covers and chemically resistant suits may be necessary depending on the type of work. Gloves appropriate for the work must be worn. Glove selection must be determined by the type of chemicals used in the process. Refer to the [Ansell Guardian Glove](#) Selection website for assistance with selecting the appropriate glove.
- Clean all working surfaces potentially contaminated with nanomaterials at the end of each day with a HEPA vacuum and/or wet wiping. Do not dry sweep or use compressed air.
- Wash hands and arms prior to leaving the laboratory for breaks.

## **I. Compressed Gas Cylinders**

### **1. Labeling**

- All compressed gas cylinders are required to be clearly labeled as to the contents and any associated hazards. Deteriorated or corroded labels must be replaced.
- All cylinders without adequate labeling to identify contents shall be labeled as "Contents Unknown" and returned to supplier. Color coding is not a reliable method of determining contents.
- Tags marked full, in service or empty will be placed on cylinders. The gas delivery vendor is required to indicate the department the cylinder belongs to.

### **2. General Handling and Storage Procedures**

- Compressed gas cylinders shall be transported on chain equipped hand trucks or carts. Never roll or drag cylinders. This process can damage the cylinder and can possibly cause injury.
- All compressed gas cylinders, empty or full, must be secured individually in the upright position by using an approved single chain or, strap 2/3 of the way up from the floor, to a stationary building support (wall or floor), or to a cylinder cart or stand to prevent falling.
- In circumstances where more than one cylinder needs to be secured with a single chain/strap, no more than six (6) cylinders can be stored with one chain/strap in that event.
- Lecture bottles must be placed in a rack designed for the purpose (resembling an oversize test-tube rack) or be firmly clamped to a ring stand with a heavy base, in an upright position.
- Cylinders shall never be dropped or permitted to strike each other violently.

- Valve safety covers shall be in place until pressure regulators or needle valves are ready to be attached.
- Employees must not attempt to repair cylinders or cylinder valves, or to force stuck or frozen cylinder valves.
- Cylinders not required for current use shall remain in the laboratory at all times unless approved by EHS or be stored in the loading dock gas cylinder cage if available. If stored indoors, cylinders should be stored in well-ventilated areas away from sources of heat and ignition. The area must be secured from unauthorized access with appropriate signage on the outside to inform emergency personnel of potential hazards.
- When stored in the open, cylinders must be protected from direct sunlight.
- Cylinders shall not be stored near corrosive chemicals or fumes.
- Oxygen cylinders and cylinders containing oxidizing gases, such as nitrous oxide, must not be stored within 20 feet of those containing any flammable or highly combustible gas unless the cylinders are separated by a five (5) foot high thirty (30) minute fire wall.
- Flammable gases, whether empty or full, must not be located near an exit or any location which could block and exit in the event of a release or fire.
- Cylinders must not be lifted by machinery unless they are on a safe stand or cradle or are otherwise positively secured against falling or being dropped.
- Special arrangements should be made to secure cylinders while they are being transported. Carrying them loosely on the back of a truck or in a pickup is prohibited. Facilities Management is not permitted to move or transport any gas cylinders.
- Do not store or transport acetylene cylinders on their side, as this causes the acetylene to become less stable and unsafe.
- Close the cylinder valve when the equipment is not in use or unattended overnight.
- Automatic pressure regulators or reducing valves shall be used on all gas cylinders to maintain a uniform gas supply at the correct pressure.
- Only regulators listed by agencies such as Underwriters Laboratories® or Factory Mutual should be used. Use only the appropriate, designated regulator for the specific gas to be used.
- Do not use oil around oxygen gauges, valves or connectors. Follow supplier's recommendations for cleaning of the cylinder outlet fittings and openings.
- When not in use, the regulators must be removed and the gas cylinder must be properly capped.
- Cylinders containing toxic, highly toxic or flammable gases must be stored in an approved storage areas in accordance with the Philadelphia Fire Code. The use of the smallest possible cylinder of toxic or flammable gases is recommended. Toxic, highly toxic, and flammable gas use requires vented gas cabinet and leak detection equipment. All work involving these materials require EH&S approval.
- Gas mixtures that contain >5.5% hydrogen in nitrogen, >2.94% hydrogen in argon, and >3.9% hydrogen in helium are classified as flammable gases. These gas mixtures must be stored and used in a vented gas cabinet with hydrogen detection.
- Smoking or flame is prohibited near oxygen or flammable gas cylinders or outlets.
- Storage areas for compressed gas cylinders, especially flammable gases, must be free of any unnecessary combustible materials or uncontrolled ignition sources.
- Handle and store containers of cryogenic liquid cylinders in an upright position. The containers shall not be dropped, tipped over, or rolled on their sides. Use a four-wheeled hand truck designed to move such containers to move cryogenic liquefied gas containers with a capacity greater than 20 gallons.
- Store and handle cryogenic liquefied gas containers in well-ventilated areas to prevent hazardous concentration of the gas. Cryogenic liquefied gas containers have a tendency to release pressure due to over pressurization.

### 3. Handling and Storage of Cylinders without Regulators

- The valve safety covers must be left on the cylinders at all times when not in use.
- Cylinders must be transferred only by approved carts or hand trucks. They must not be rolled on their sides or dragged.
- The valve safety covers must be in place and the cylinders secured to the carts during transport.

### 4. Acceptance of Cylinders from Vendors

- The contents of cylinders must be identified with decals, stencils, or other markings on the cylinders. Color codes alone or tags hung around the necks of the cylinders are not acceptable. Cylinders lacking proper identification must not be accepted from the vendors.
- Gas delivery vendors are not permitted to leave gas cylinders unsecured in the hallways of any building. The vendor has been instructed to return the cylinder if the responsible party is not available to receive it.
- Cylinders must not be accepted from the vendors unless the valve safety covers are in place and properly tightened.
- Vendors transporting cylinders must use chain equipped hand trucks or carts. Cylinders must not be rolled on their sides or dragged.

### 5. Empty Cylinders

- A small volume of gas is present in the cylinders even when the regulator reads empty or zero.
- Empty cylinders shall be marked "**EMPTY**" or "**MT**" as well as the department they come from.
- Valve safety covers and the labels showing contents must be in place.
- Empty cylinders must be secured at all times so they cannot fall.

### J. Cryogenic Liquid Safety

- Be familiar with hazards associated with cryogen use.
- Review the Safety Data Sheet and the chemical safety summary for cryogenic liquids prior to use.
- Store cryogens in well-ventilated areas to prevent oxygen deficiency. Do not store or use cryogens in walk-in cold rooms, refrigerators, sealed rooms, or basements. They may not have sufficient air exchange and could become hazardously oxygen deficient. **EH&S may require oxygen level detection in certain situations.**
- Do not leave skin exposed. Do not wear metal jewelry or watches as metal can become frozen to the skin (arm, wrist, fingers, etc.).
- Always wear appropriate personal protection equipment including loose fitting insulated gloves made for cryogenic work, face shield used in combination with splash goggles or safety glasses, and appropriate apron, lab coat, or overalls. There should be no pockets exposed that liquid can get trapped inside. Rubber or latex gloves will only become brittle on contact and cotton gloves may wick up the cold liquid. Appropriate laboratory attire must be worn while handling cryogenic liquids (no open-toed shoes, no mesh shoes, no shorts, no exposed skin, etc.).
- Never allow any unprotected part of the body to touch non-insulated pipes or vessels which contain cryogenic liquids. Tissue damage may result.

- Use only approved storage vessels that have pressure relief valves. Examine containers and pressure relief valves for signs of defect, damage, neglect, or unauthorized modifications.
- Never use a container that has defects. Ask the cryogenic vendor for assistance with questions on cryogenic equipment and pressure relief valves.
- Ensure that all equipment and containers are free of oil, grease, dirt, or other materials which may lead to flammability hazard upon contact with liquid oxygen. Dirt may also cause valves to seize up.
- Select working materials carefully. Cold cryogenic liquids may alter the physical characteristics of many materials making them brittle and fail.
- It is the responsibility of the Principal Investigator to ensure lab personnel are properly trained in the safe use of cryogenic materials.
- Use a suitable hand truck for all container movement.
- Do not drop, tip, or roll containers on their sides. All cryogenic systems and Dewars must have pressure relief valves to release excessive pressure. Dewar flasks should have loose fitting lids. The pressure relief valves should be inspected regularly.
- Do not lower warm experiments into Dewars of cryogen.
- Provide proper venting for the Dewars used in experiments.
- Dewars used in experiments involving strong magnetic fields must be non-magnetic.
- Never force (i.e. use a wrench or lubricant) or modify any knob or valve on the container.
- Do not remove or interchange connections. Use only the proper connection. Do not use adapters.
- Discontinue use and contact your supplier if you experience any difficulty in operating a container valve or with the container connections.
- Use only fitted transfer tubes designed for use with the Dewar container. Damaged transfer tubes should be replaced. Do not handle transfer tubes with your bare hands as the fitting is not insulated.
- Select working materials carefully as cryogenic temperatures may alter the physical characteristics of many materials (i.e. make them brittle).
- When transferring to a secondary container, ensure the vessel is dry and do not fill the secondary container to more than 80% of capacity (60% if the room temperature is likely to be above 30°C). Pour into the vessel slowly to minimize splashing, spilling, and thermal shock to the vessel. Avoid shallow and wide-necked vessels to prevent excess evaporation and the possibility of oxygen enrichment. Never use a funnel.
- Immediately re-cap any container to prevent atmospheric moisture from entering and forming an ice plug in the opening.
- Use care in transporting cryogens; do not use fragile containers. Use a hand truck or the lowest shelf of a cart for transport of cryogens.
- When available, use service elevators for transferring unsealed containers of cryogens. Avoid passenger elevators when possible. Keep passengers off the elevator while a cryogenic liquid or gas is transported.
- Use tongs or similar devices when placing objects into or removing them from cryogenic liquids.
- Never adjust, block, or plug a pressure relief valve. The vendor is required to check the pressure relief valve before filling the Dewar.
- Avoid contact of moisture with storage containers to prevent ice plugs in relief devices.
- Periodically check container necks for ice plugs; core out ice plugs if present.
- Keep all heat sources away from cryogenic liquids.
- Cryogenic containers, whether empty or full, must be stored within the lab or an approved storage area where they are accessible to relevant personnel only. They are not to be left in the hallways where passersby may risk exposure. It is a violation of the fire code to store them in egress hallways.
- Stored Liquid Oxygen must be separated from flammables and combustibles by 20 feet or a half-hour fire wall.

- Ignition sources are not permitted near liquid oxygen or flammable cryogenic liquids.
- Keep liquid oxygen and its container clear of grease, oil, asphalt, kerosene, cloth, tar, and dirt that may contain oil or grease. These may react violently with oxygen if ignited by a spark or even a mechanical shock.
- Small amounts of cryogenic liquids may be evaporated in chemical fume hoods or another well-ventilated area.
- NEVER pour cryogenic liquids down the sink. The liquid will crack the pipes causing potentially dangerous leaks.
- Vendors and Suppliers will often remove unwanted cryogenic liquids. Contact [EH&S](#) at if you need assistance.

## K. Chemical Inventory

An inventory of all hazardous chemicals (refer [EH&S website](#) for a list of hazardous substances or to individual SDS) **and** non-hazardous chemicals must be prepared for each laboratory. Hard copies of the inventory must be prepared annually. As new chemicals are obtained, the chemical inventory must be updated accordingly. Gas cylinders, cleaning supplies, and common household chemicals must also be inventoried. The inventory must be complete and up to date. The inventory is used to generate the Online SDS Database.

A template of the inventory form can be download from the [EHS website](#) under [Service Request Forms](#). Researchers can, also, upload an excel file of the inventory on the [Chemical Inventory Form](#).

The inventory must contain the following:

- P.I. Name
- Building and Room ID
- Full Chemical Name
- Vender/Manufacturer
- Volume/Quantity

For P.I.'s with multiple labs, each lab must have its own separate chemical inventory, specific for that room. Three copies of the chemical inventory must be maintained:

- A copy of the inventory must be maintained by the P.I./Faculty Member.
- A copy must be maintained and posted on the outside of the laboratory entrance door. It is recommended that an additional copy be used as the first page of the SDS binder.
- A copy must be sent to the EH&S via [safeheal@drexel.edu](mailto:safeheal@drexel.edu) or uploaded using [Chemical Inventory Form](#) on the [EHS Website](#). Copies of these inventories must be sent at least once a year.

In addition, a separate inventory list of carcinogens, mutagens and teratogens must be prepared and sent to EH&S annually.

## L. Safety Data Sheets (SDS)

EH&S maintains an online database of safety data sheets on the [Laboratory Safety](#) page on the [EH&S Website](#). It can be searched using either chemical name or location (i.e. building & room number). The list of SDS on this website is compiled based upon the chemical inventories received by EH&S from the

laboratories. This complies with OSHA regulations. All lab personnel must know how to access and use the database.

It is recommended, but not required, that each lab keep hard copies of the SDS for all of the chemicals within their lab. The hard copies should be kept in a labeled binder, sorted in alphabetical order. The SDS must be kept in a visible location in the laboratory, near the entrance door to the laboratory.

Vendors and manufacturers are required by federal law to provide MSDS upon request, free of charge, within a reasonable time frame. Many vendors post their SDS on their webpages.

The PI/Laboratory Supervisor/Faculty Member is responsible for reviewing the MSDS and recording which materials are carcinogenic, mutagenic or teratogenic. This information must be conveyed to all students and/or employees engaged in research in his/her laboratories, including locations used and stored within the lab. This information must be posted at the entrance to each lab in an effort to inform any individual who may need to enter that space. A copy of this information must be sent to EH&S.

## **M. Chemical Storage**

All hazardous chemicals must be stored in clearly defined designated areas in accordance with this manual and OSHA Regulation 29 CFR 1910.1450 also known as the “Laboratory Standard”. These storage guidelines must be followed when storing hazardous chemicals:

- The chemical inventory must be kept as small as possible. Any old, expired, or unused chemicals should be properly disposed.
- Do not store chemicals on top of high cabinets or shelves. Liquids, in particular corrosives or other hazardous liquids, should not be stored over 5 feet in height. The only exception is that non-hazardous liquids may be stored above 5 feet if there are space limitations. There is no height restriction for solids.
- Keep exits, passageways, areas under tables, and emergency equipment areas free of stored chemicals.
- Provide a definite storage place for each chemical and return the chemical to that location after each use.
- Do not store chemicals on bench tops and in fume hoods, except for those chemicals being used currently.
- Do not store chemicals on the floor.
- Store chemicals in a cool dry place avoiding direct sunlight.
- Ventilated storage cabinets shall be used to store extremely hazardous chemicals. The vents must be directed outside the building.
- Use chemical storage refrigerators and freezers only for chemical storage. Label these refrigerators with the following signage: “**No Food or Drink – Chemical Storage Only**”
- Safety containers must be used when transporting chemicals (i.e. carts, rubber totes, secondary containers etc.), especially outside of the lab area.
- Observe all precautions regarding the storage of incompatible chemicals.
- Dry chemicals (solid materials) shall not be stored with liquid chemicals. If stored in the same cabinet, liquids are always stored under solid chemicals.
- Separate chemicals into the following hazard classes:
  - Flammables
  - Acids

- Organic Acids
    - Inorganic Acids
  - Bases
    - Organic Bases
    - Inorganic Bases
  - Oxidizers
  - Reactives
  - Poisons (Toxic)
  - Non-hazardous or non-regulated chemicals.
- 
- The above hazard classes must be separated from each other. This can be accomplished by 1) placing them in different cabinets, 2) placing them on different shelves, or 3) separating them by placing the different hazard classes into separate secondary containment containers. The trays must be able to contain any spills or leaks and must be made of material compatible with the chemicals they contain.
  - Other means of separating potentially incompatible chemicals are acceptable, such as the Flinn Scientific Guidelines or [Control Banding](#). Contact the EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) to discuss options.
  - Alphabetical storage of chemicals is not allowed. This may result in incompatibles appearing together on a shelf. Chemicals should first be segregated appropriately then stored alphabetically within each hazard class.
  - Chemicals classified as Irritants may be stored separately or with Non-Hazardous Chemicals.
  - Weak acids or bases, in their dry form, often can either be stored as Non-Hazardous or separated out as acids or bases, unless the label specifically classifies it as “Corrosive”. Any chemical specifically labeled as “Corrosive” must be separated out as an acid or a base.
  - Store all flammable liquids in a grounded, flammable storage cabinet with self-closing doors.
  - Do not store flammable liquids in a refrigerator unless it is an approved explosion-proof refrigerator.
  - Organic Acids can be stored in the flammable storage cabinet; however, overspill containers must be used to contain any spills and to act as a means of separation.
  - Acids must be stored separate from bases. Storage in the same cabinet is possible **ONLY IF OVERSPILL CONTAINERS ARE USED TO CONTAIN ANY SPILLS.**
  - Separate inorganic and organic bases. These can be stored in the same cabinet. Shelves or overspill containers can be used as a means of separation.
  - Separate inorganic and organic acids. These can be stored in the same cabinet. Shelves or overspill containers can be used as a means of separation. In particular, nitric acid and acetic acid must not be stored together.
  - Store nitric acid, perchloric acid, and hydrofluoric acid separately from all other chemicals if possible (including from each other). Otherwise store them with other inorganic acids.
  - Oxidizers must be stored in a cabinet separate from all other chemicals. Some oxidizers may cause combustible materials to catch fire on contact. Avoid storing in wood cabinets/shelves and cardboard boxes.
  - Reactive chemicals must be segregated and stored appropriately i.e. flammable cabinet, explosion proof refrigerator, dedicated container etc.
  - Toxic chemicals, including carcinogens, must be properly labeled; small containers should be stored together in unbreakable chemical-resistant secondary containers. These containers must be labeled either “Caution: High Chronic Toxicity,” or “Cancer Suspect Agent.”
  - As stated above, a separate inventory list of carcinogens, mutagens and teratogens is to be forwarded to EH&S in accordance with Federal and State Regulations.
  - Cylinders of compressed gases, empty or full, must be labeled, strapped or chained at all times to a wall or bench top, and must be capped when not in use.

- Oxygen and other oxidizing gases must not be stored adjacent to flammable gases (except when in use).
- Do not store flammable gases near sources of heat or ignition.
- If unable to determine the best possible storage options consult the SDS for the chemical. If further assistance is need contact EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu).

## N. Peroxide-forming chemicals

Peroxide-forming chemicals may become unstable and potentially explosive when exposed to air. These unstable peroxides may detonate with extreme violence when the material becomes concentrated by evaporation or distillation, when combined with other compounds that give a detonable mixture, or when disturbed by unusual heat, shock, or friction. As such, all peroxide-forming chemicals must have a receive date and an open date written on their labels. The chemical must be stored in airtight containers in a dark, cool, and dry area. Minimize the quantity of peroxide forming chemicals purchased and stored in the laboratory. Carefully review all cautionary materials supplied by the manufacturer or distributor prior to use. Examples of commonly used peroxide-forming chemicals include:

- Tetrahydrofuran
- Ethyl Ether
- Dioxanes
- Isopropyl Ether,
- Styrene
- Vinyl Pyridine
- 2-Propanol

Most peroxide-forming chemicals must be disposed of after 12 months, although some uninhibited peroxide-formers may only be used up to 24 hours after opening. Refer to the university's [Chemical Hygiene Plan](#) or the [EH&S website](#) for additional information.

**Typical Peroxide Form Chemicals and Storage Time**

| Chemical Name   | Unopened Container Storage Time | Opened Container Storage Time |
|-----------------|---------------------------------|-------------------------------|
| Isopropyl Ether | 18 months                       | 3 months                      |
| Cyclohexanol    | 18 months                       | 12 months                     |
| Dioxanes        | 18 months                       | 12 months                     |
| Diethyl Ether   | 18 months                       | 12 months                     |
| Tetrahydrofuran | 18 months                       | 12 months                     |
| 2-Propanol      | 18 months                       | 12 months                     |

Perchloric Acid is another potentially explosive chemical which should be disposed after 12 months. While not as potentially hazardous as other peroxide-formers, older containers of 2-Propanol should be



handled with care. To track how old the chemicals are, all labs are required to write the receive date and open date on the containers of peroxide-formers, unless there is an expiration date already present.

DO NOT handle any peroxide forming chemical if there are signs of crystal growth or precipitation. Immediately contact EH&S at 215-895-5919 or at safeheal@drexel.edu if this occurs and leave the area.

## O. Labeling

### 1. Hazard Warning Labels

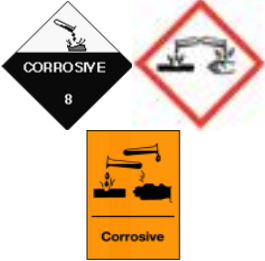



Hazard warning signs are required by several regulatory agencies and advise individuals who work in or may need to enter an unfamiliar laboratory as to the types of hazards that are present. These signs are also required by emergency response personnel such as Drexel's Public Safety, EH&S, and the Philadelphia Fire Department. The exterior surface of laboratory doors must be reserved for hazard communication labels. All laboratories containing hazardous materials must have the appropriate hazard warning posted on the entrance door. All chemical storage areas within the laboratory must be labeled with the appropriate hazard warning such as a symbol or NFPA diamond. Work areas designated for the use of highly hazardous chemicals (such as cadmium or pyrophoric chemicals) must also be appropriately labeled. Storage and work areas for biological and radiological hazards must also be properly labeled. If someone needs to enter a location posted with a hazard sign, consult with either the laboratory personnel or EH&S before entering and make sure the room is secured when you leave.



### 2. Hazard Symbols

Hazard symbols are easily recognizable symbols design to warn about hazardous materials, locations, or objects. The following are typical hazard warning symbols utilized throughout Drexel University and Drexel University College of Medicine.



|   |   |  |   |
|---|---|--|---|
|  |  |  |  |
| Corrosive   | Radioactive   | Poison   | Irritant  |

### 3. Chemical Container Labels

OSHA requirements for labeling under the Chemical Hygiene Plan will be the same as those defined in the hazard communication standard 1910.1200 and 1900.1450. Therefore, all containers in the workplace (including secondary containers (beakers, Erlenmeyer flasks, cap bottles, etc.) must contain the following information:

- Identity of the substance.
  - Full chemical name.
  - Abbreviations and/or symbols are not acceptable.
- Signal word – Danger or Warning.
- Hazard Statement – flammable, oxidizer, irritant, toxic, etc.
- Responsible party.

All labels must be prominently displayed and legibly written (printed) in English and other language as appropriate for employees. It is the responsibility of the principal investigator to inspect all incoming shipments of containers of hazardous chemicals to ensure that they bear labels with the appropriate information.

The names of buffers (PBS, TBS, HEPES, Tris, etc.) may be abbreviated, as long as a Key or Legend stating the full name is placed in a clearly visible location in the laboratory, preferably by the lab entrance. Abbreviations, formulae, or symbols of commonly used chemicals may also be written on secondary containers, provided they are included on a key or legend visibly posted in the lab.

Sample vials too small to write the full chemical name and hazard information on may be coded. Codes may be printed up on a key or legend and placed in a visible location at the work area for this purpose. Otherwise all code keys must be written clearly and legibly in the laboratory notebook. Signage is required at all work stations denoting both that the code key is located in the notebook and the location of the notebook itself. The laboratory notebook must be kept in a visible area and returned there at the end of the experiment or the end of the day.

It is recommended that the date be placed on all chemical containers when they are received and opened. This is required for any peroxide-forming chemicals. For any solutions prepared by the laboratory personnel (i.e. buffers, media, and dilutions), it is also recommended to add the date it was made to the container's label.

If a container received from the chemical distributor is improperly labeled, laboratory personnel must contact the EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu), who will notify the vendor for correction, and the receiving department for informational purposes.

Portable or secondary containers used for purposes of transferring hazardous material from a labeled container for immediate and complete use by an investigator or his /her technicians or research staff or student do not require labeling. However, if the transferred hazardous material is to be used by other research personnel/student, or is not immediately used, it is the responsibility of the investigator/lab supervisor/faculty member/student/lab technician for whom the chemical material was first intended, to properly label the portable container.

#### 4. Chemical Storage Labeling

All cabinets, shelves and refrigerators containing chemicals (including the cleaning supplies) must be labeled with the appropriate warning label (Flammable, Acids, Bases, Oxidizers, Reactives, Poisons (Toxic), Non-Hazardous, and/or NFPA Diamond).

Refrigerators and freezers used for chemical storage must be labeled with appropriate hazard warnings and with the signage: “NO Food or Drink – Chemicals Storage Only.” Any refrigerator used of food or drink storage must be label as such and remain outside the laboratory. Laboratory microwaves and ovens must also have “No Food or Drink” signs.

Biohazard labels must be applied to all appropriate areas, such as Biological Safety Cabinets and refrigerators. Radiation hazard tape or labels must be applied to all applicable work and storage areas. UV Light warning labels must be placed on any device that can generate ultra-violet light, such as Biological Safety Cabinets.

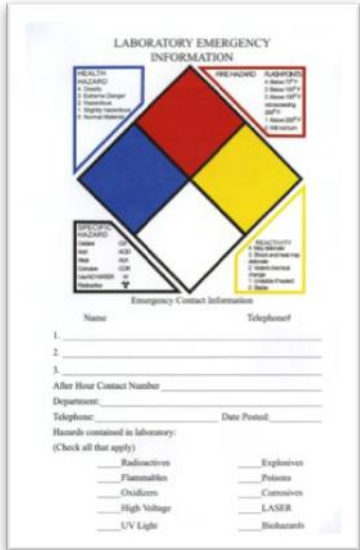
Old and obsolete labels in the lab must be removed or defaced.

#### 5. Laboratory Door Labels

All laboratory entrance doors must be labeled as follows:

- NFPA diamond. Laboratory personnel shall fill in the diamond with the highest hazard number pertaining to their laboratory.
- Biohazard label and appropriate Biosafety Level (if applicable).
- UV Light label (if applicable).
- Radiation Hazard Label (if applicable).
- Emergency contact information. The information must include a name and number to contact in the event of an emergency. It must be clearly visible and placed on each outer laboratory door

Additional warning labels as applicable, i.e. “carcinogen in use”, “water reactive materials”, “inhalation hazard, respiratory protection required in this area”, “high noise, hearing protection required in this area”, etc.



The form is titled "LABORATORY EMERGENCY INFORMATION" and features a central diamond-shaped graphic divided into four colored quadrants: red (top), blue (left), yellow (right), and white (bottom). Each quadrant is associated with a specific hazard category:
 

- Red (Top):** Flammable
- Blue (Left):** Corrosive
- Yellow (Right):** Oxidizer
- White (Bottom):** Reactives

 The form includes several sections for data entry:
 

- Emergency Contact Information:** A table with columns for Name and Telephone, with three rows for contact details.
- After Hour Contact Number:** A field for providing contact information outside regular hours.
- Department:** A field for the laboratory's department name.
- Telephone:** A field for the laboratory's phone number.
- Date Posted:** A field for the date the label was last updated.
- Hazards contained in laboratory:** A checklist section with the instruction "(Check all that apply)". It includes checkboxes for:
  - Radiation
  - Explosives
  - Flammables
  - Poisons
  - Oxidizers
  - Corrosives
  - High Voltage
  - LASER
  - UV Light
  - Biohazards

## 6. Receiving Chemicals

Laboratory personnel must inspect all chemical packages delivered to the laboratory. Packages that are damaged or leaking must not be accepted from the delivery person. Do not open any damaged or leaking packages. Contact EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) if you have damaged or leaking package.

All chemicals delivered to the laboratory must have an SDS present in the package. Manufacturers are required by OSHA to provide the SDS with every chemical product. The PI must review the SDS with all the laboratory members prior to using the chemical. Contact EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) if the package did not contain the SDS.

All newly delivered chemicals must be immediately added to the laboratory's inventory. The PI must send an email ([safeheal@drexel.edu](mailto:safeheal@drexel.edu)) to EH&S indicating the arrival of the new chemical. The information is used to update the online SDS system.

## P. Syringes and Needles

The hypodermic needle is a dangerous instrument. To lessen the chance of accidental injection, aerosol generation, or spills, the use of syringes should be avoided when alternate methods are available.

- When working with hazardous material, use the syringe and needle in a, chemical fume hood or glove box and avoid quick and unnecessary movements of the hand holding the syringe.
- **Re-capping** the needle is strictly prohibited. Dispose all contaminated needles in an approved sharps container.
- Place the needle-syringe in a tray or other protective container for transportation or storage between injections.
- Needles **must not** be bent, sheared broken, recapped, removed from disposable syringes or otherwise manipulated before use.
- Examine glass syringes for chips and cracks, and needles for barbs and plugs. This should be done prior to sterilization before use.
- Use needle-locking syringes only, and be sure that the needle is locked securely into the barrel. Replace glass syringes with plastic disposable syringes whenever possible.
- Whenever possible use safer needle systems.
- Wear personal protection equipment for all manipulations with needles and syringes.
- Discard syringes into a sharps container. DO NOT bend, shear, recap or otherwise manipulate the needle.

## Q. Laboratory Glass

Uncontaminated, non-sharp and unbroken "Laboratory Glass" is considered Sharps waste and must be disposed in an approved Sharps container. Laboratory glassware and plastic ware is any item that could puncture regular trash bags and potentially cause injury to someone. Use tongs, dustpan and broom or heavy gloves when handling and disposing broken glassware.

Following procedures are to be followed for disposing nonhazardous or non-infectious glassware.

- Place broken and unbroken glassware in an approved Sharps container.
- Place broken and unbroken rigid plastic ware in an approved Sharps container.

- Chemical bottles must triple rinsed. The labels defaced prior to placing in the approved Sharps container.
- DO NOT place glassware in regular waste containers.
- Do not contaminate the container with hazardous or radioactive waste.
- Once the container is 3/4<sup>th</sup> full, close the lid of the sharps container.
- Leave Sharps container in the laboratory for removal by the University's vendor.

Contact the Department of Environmental Health and Safety to request sharp containers. EH&S will provide a 17-gallon reusable container for disposal of sharps.

## R. Thermometers

Use of mercury thermometers is not harmful when properly used but do pose a threat to the environment when they are broken or disposed as trash. Broken mercury thermometers cause mercury to spill out into the environment leading to potential exposures to laboratory personnel. Mercury thermometers when they break in ovens or incubators may lead to high mercury concentrations in the air since mercury evaporates readily at high temperatures. Alternatives to the use of mercury thermometers must be considered since they are as effective and affordable. Available alternatives include spirit filled, alcohol filled or microprocessor-digital readout thermometers.

EHS has over the past several years implemented a mercury thermometer exchange program. This program has drastically reduced the number of mercury thermometers utilized in research. Contact EHS at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) to exchange mercury thermometers.

Broken mercury thermometers and mercury spills are considered **major spill events** because mercury breaks into very small droplets and can spread over a large area. In the event of a broken mercury thermometer in the laboratory, the major spill response procedures as outlined below must be implemented:

1. Immediately isolate the area.
2. Do not touch or move the thermometer or sweep of the broken pieces.
3. Notify all personnel in the immediate area that a spill has occurred.
4. If clothes become contaminated remove contaminated clothing and leave in the area of the spill. If skin, eye or body contamination has occurred immediately decontaminate using the eyewash or safety shower. Refer to the [personal decontamination procedures](#) in this manual.
5. Evacuate room and close door.
6. Contact the Public Safety 24 Hour Call Center at 215-89-2222.
7. In order to assess the situation be prepared to provide the following information:
  - a. Name and call back number.
  - b. The location of the spill (building and room number).
  - c. The amount of material spilled.
8. Remain on or near the telephone until you have received instructions from Public Safety or EHS.

## S. Rotary Evaporators

Glass components of the rotary evaporator should be made of Pyrex or similar glass. Glass vessels should be completely enclosed in a shield to guard against flying glass should the components implode. Increase

in rotation speed and application of vacuum to the flask whose solvent is to be evaporated must be gradual.

Safe operation of rotary evaporator operation involves the mitigation of the hazards associated with implosions, explosions, and solvents.

### **1. Implosion Hazard**

- Use only glassware that is free from cracks and imperfections.
- Use heavy-walled vacuum flasks.
- Use shatter-proof collection bulb.
- Use safety netting around the condenser.

### **2. Explosion Hazard**

- Compounds such as azides and peroxides are thermally unstable and must not be isolated via a rotary evaporation unit.
- Laboratory personnel must investigate the properties of the compounds prior to isolation.
- Ethereal solvents can form peroxides when exposed to air and light over time. Evaporation of these types of solvents will concentrate the peroxides which may can a very violent explosion.

### **3. Solvent Hazard**

- Large amounts of organic solvent vapor can be generated during the evaporation. The collection bulb and condenser must be cooled to minimize solvent loss into the vacuum system.
- The cooling trap prevents hazardous solvent vapors from entering the vacuum system. It protects the pump and the piping from the potentially damaging effects of the material. It protects the maintenance personnel who may have to work on the system.

## **T. Laboratory Doors**

Laboratory doors must be closed at all times as required by the Philadelphia Fire Code. Closed laboratory doors maintain the required fire resistance rating as well as the negative pressurization of the laboratory. This rating and pressurization is necessary to prevent chemical vapors, fire, and smoke from spreading into other portion of the building. Propping the door open for extend periods of time eliminates the fire-resistant rating and disrupts the negative containment within the laboratory allowing chemical vapors, fire and smoke to spread in the event of an emergency. The loss of the negative pressurization and its effect on the air flow of the laboratory by leaving the doors open also reduces the efficiency of the chemical fume hoods and biological safety cabinets in the laboratory.

Since doors obviously serve as an exit from the lab space, it is important not to place obstructions near them so personnel can quickly exit in an emergency. Do not block lab door window panes with paper, lab coats, or other items. It helps the emergency and security personnel identify, notify and assist individuals in emergencies.

## U. Ethylene Oxide Sterilizers

The Drexel University Ethylene Oxide Exposure Through the Use of Sterilizers Protection Program is designed to protect employees whose duties require them to work in areas where the potential for ethylene oxide (EtO) exposure exists. The purpose of this program is to reduce and limit exposure to EtO through the use of engineering and work practice controls. Due to the determination that EtO presents a carcinogenic, mutagenic, genotoxic, reproductive, neurologic, and sensitization hazard to exposed workers, the OSHA created the Ethylene Oxide Standard, 29 CFR 1910.1047. The *Drexel University Ethylene Oxide Exposure Through the Use of Sterilizers Protection Program* complies with this standard. Please contact EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) for further details regarding this program.

## V. Vacuum Systems

Vacuum pumps are used in the lab to remove air and other vapors from a vessel or manifold. The most common usages are on rotary evaporators, drying manifolds, centrifugal concentrators (“speedvac”), acrylamide gel dryers, freeze dryers, vacuum ovens, tissue culture filter flasks and aspirators, desiccators, filtration apparatus and filter/degassing apparatus. Selection of a vacuum pump depends upon the type of application to be used, nature of the sample (air, chemical or moisture) and size of the sample.

When using a vacuum pump on a rotary evaporator, the collection bulb and condenser must be cooled to minimize solvent loss into the vacuum system. The cooling or cold trap prevents hazardous solvent vapors from entering the vacuum system. It protects the pump and the piping from the potentially damaging effects of the material. It protects the maintenance personnel who may have to work on the system.

Vacuum pumps can pump vapors from air, water to toxic and corrosive materials like TFA and methylene chloride. Oil seal pumps are susceptible to excessive amounts of solvent, corrosive acids and bases and excessive water vapors. Pump oil can be contaminated quite rapidly by solvent vapors and mists. Condensed solvents will thin the oil and diminish its lubricating properties, possibly seizing the pump motor. Corrosives can create sludge by breaking down the oil and cause overheating. Excess water can coagulate the oil and promotes corrosion within the pump. Proper trapping (cold trap, acid trap) and routine oil changes greatly extend the life of an oil seal vacuum. Pump oil should be changed when it begins to turn a dark brown color.

Diaphragm pumps are virtually impervious to attack from laboratory chemical vapors. They are susceptible to physical wearing of the membrane if excessive chemical vapors are allowed to condense and crystallize in the pumping chambers. A five-minute air purge either as part of the procedure or at day’s end will drive off condensed water vapors further prolong pump life.

The exhaust from stand-alone vacuum pumps must be exhausted into the hazardous exhaust system to prevent exposures to hazardous chemical vapors. The pumps can be exhausted into the chemical fume hood or into a local exhaust snorkel. The pumps must not be placed into the chemical fume hood.

All processes utilizing the house vacuum system must be scrubbed prior to entering the main piping system. The overall purpose is to protect the system and personnel working on the system.

- Use a filter for particulate contaminants.
- Use a filter flask at room temperature of most aqueous and non-volatile liquids.

- Use a cold trap of sufficient size and cold enough to condense vapors generated followed by a filter flask capable of collecting fluid that could be aspirated out of the trap.

The use of cold and acid traps is essential but introduce other hazards associated with the trap contents (i.e. skin, inhalation and explosion hazards). Personnel must review and understand the risks associated with these types of traps.

## **W. Use of Earbuds and Headphones in the Laboratory**

EH&S prohibits the use of earbuds and headphones in the laboratory. Earbuds and headphones can become contaminated with chemical, biological, or radioactive material. This cross contamination may provide a route of entry and put the laboratory member's health at risk. In addition, the use blocks the ambient noise and emergency notifications which puts the laboratory member at risk of an accident.

## **X. Pregnancy Protection**

The pregnant woman and her fetus are uniquely susceptible to the effects of ionizing radiation, toxic chemicals and infectious organisms, which may be present within the laboratory. Reproductive toxins are chemicals that can affect the reproductive system, including mutagens (chromosomal damage) and embryotoxins (harm the fertilized egg or fetus). Some chemicals may cross the placenta, exposing the fetus. A developing fetus may be more sensitive to some chemicals than its pregnant mother, particularly during the first twelve weeks of pregnancy, when the mother may not know she is pregnant. Proper handling of chemicals and use of protective equipment is especially important to reduce fetal exposure to chemicals. The period of greatest susceptibility is the first 8 - 12 weeks of pregnancy, which includes a period when a woman may not know she is pregnant.

Exposure to reproductive pathogens or other infectious materials cause immediate health risk to pregnant women. The EH&S and the investigator may review work procedures to ensure that potential exposure is minimized. Consideration maybe given for reassignment to other asks that does not involve exposure to reproductive hazards.

Laboratory workers who are contemplating pregnancy or are pregnant should review the toxicity of the chemicals in their laboratory and may consult EH&S to determine whether any of the materials used in the laboratory pose additional risk during pregnancy. EH&S provides confidential counseling to help determine what actions are recommended.

The following precautions should be taken:

- Pregnant women have the right to declare their pregnancy. If the pregnant woman who works with radioactive material chooses to declare her pregnancy, the Drexel University's Radiation safety office should be notified as soon as possible. Radiation exposure limits for women whom declared their pregnancy are 1/10th those allowed for the average laboratory worker. See the Drexel University's radiation safety guide for specific procedures.
- Women of childbearing age who are considering becoming pregnant or who may
- be pregnant should, if at all possible, avoid exposure to known teratogens (embryo toxins), mutagens, carcinogens and infectious agents. Commonly used laboratory teratogens include formamide, organo-mercurials, lead compounds and anesthetic agents (additional reproductive hazards are listed in the chemical safety portion of this manual). Exposure reduction/elimination can be achieved through



reassignment, engineering controls, administrative requirements and as a last resort, the use of additional personal protective equipment.

- If you are pregnant or planning a pregnancy, you should discuss your work with your physician to determine any additional precautions that should be observed. If your duties require you to work with infectious agents, you must consider all possible consequences to yourself and your child. Special note: NIH Publication 73-439 recommends that pregnant women are not to be employed in a laboratory, which conducts studies on infectious viruses.
- Pregnant women may consider the following protocol in an effort to reduce the potential risks:
  - Declare your pregnancy through the Department of EH&S and the Radiation Safety Office;
  - Request a meeting with a university's safety representative, your PI and Radiation Safety Officer to discuss all possible options;
  - Review all options with you doctor and
  - Notify your PI, EH&S, and radiation safety of your decision as soon as possible so that proper procedures are implemented in an expeditious manner.

## **XI. Hazardous Waste Management**

The [Hazardous Waste Management plan](#) is updated annually and can be download on the [EH&S website](#).

### **A. Hazardous Waste**

Hazardous waste includes substances that are solids, liquids and gases. The EPA definition of hazardous waste includes substances that possess a hazardous characteristic (e.g. toxic, ignitable, corrosive or reactive with other substances), or substances that are listed as hazardous waste by the EPA on the basis of their usage or chemical constituents.

### **B. Hazardous Waste Identification**

EH&S will perform identification of hazardous wastes. Since the majority of chemicals used in our facility are reagent grade the identification will be performed using Safety Data Sheets, bottle labels, and 40 CFR Part 261 Subpart B, C, and D. A third-party contractor will test for the ignitability, cross-reactivity, reactivity, and toxicity of unknown hazardous wastes.

### **C. Mixed Chemical Waste**

EH&S shall require that only compatible chemical waste be combined into one waste container. Refer to the SDS for chemical compatibility or contact EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) for assistance.

### **D. Multi-Hazardous Waste**

Multi-Hazardous waste is waste that contains any combination of chemical, radioactive, or biological hazards. Any waste stream that presents more than one type of hazard will require special management consideration because the selected treatment technology appropriate for one type of waste may not be appropriate for the other types. Multi-hazardous waste will be evaluated on an individual basis and the constituent that poses the greatest hazard will be given priority. Please contact EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) for further instructions.

## E. Drain Disposal

EH&S will permit drain disposal of elementary neutralized (pH adjustment of waste that are hazardous only because they exhibit the cross-reactivity characteristic) acidic aqueous solutions. The elementary neutralized aqueous solution must have a final pH value between 6 and 8. **The limit of material that may be neutralized is 1 liter.** EH&S will also permit drain disposal of common salts, sugars and agars in both liquid and solid forms. For solids, the material must be dissolved in tap water. The limit of material that may be disposed is 1kg of solid or 1 liter of liquid per day. EH&S prohibits the drain disposal of the following:

- Flammable or explosive pollutants
- Pollutants that will cause corrosive structural damage to the Publicly Owned Treatment Works (POTW), but in no case discharges with pH lower than 5.0.
- Solid or viscous pollutants that may cause an obstruction of flow in the POTW
- Pollutants capable of releasing fumes or vapors
- Pollutants, including oxygen-demanding pollutants (high biological oxygen demand), which may cause interference with the POTW
- Waste water with sufficient heat to inhibit biological activity in the POTW (must not exceed 104 F at the POTW)
- Petroleum, oil, non-biodegradable cutting oil or products of mineral oil origin in
- amounts that will cause interference or pass through Organic chemicals
- Heavy metal solutions
- Nitric, hydrofluoric, perchloric, and chromic acid
- Toxic/Poisonous solids and liquids
- Pharmaceutical waste.

## F. Satellite Accumulation Areas

A satellite accumulation area is an area at or near a process that generates chemical wastes. The area must be under the control of the operator of that process. EH&S designates each laboratory as a satellite accumulation area. The laboratory Principal Investigator, LSL, Chemical Hygiene Officer, is responsible for following the policies of EH&S regarding satellite accumulation areas.

### 1. Allowable Amount Accumulated

Laboratories may accumulate as much as 5 gallons of hazardous waste or one quart of acutely hazardous waste (immediately hazardous to life and health) in compatible containers at or near any point of generation.

### 2. Labeling

- All containers must be labeled with the complete chemical name of each primary component. Formulas, acronyms and abbreviations are not acceptable.
- If possible, the label should include the approximate percentage of each chemical.
- Do not place the date or the words “Hazardous Waste” on the container. EH&S will re-label the container during pick-up as either a recyclable/re-distributable material or as hazardous waste at which time the container will be dated and moved to the temporary storage vault.

### 3. Container Types

There is a wide selection of biohazard containers. All containers must be kept closed except when it is necessary to add. Consult a Safety Data Sheet (SDS) to find specific information about chemical properties and compatibility. EH&S provides some containers made of plastic. Contact EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) for additional information on the selection, use and obtaining containers.

### 4. Accumulation Time

There will be no limit on accumulation time; however, once a container is full or more than 5 gallons of hazardous waste or 1 quart of acutely hazardous waste is accumulated, the full container or excess waste must be moved to the accumulation area within 72 hours.



### G. Chemical Pick-up Request

EH&S has an online [chemical pick-up request form](#). This form should be immediately filled out when:

- Unwanted and old chemical reagents need to be removed;
- The satellite accumulation waste container is full and
- There is more than 5 gallons of hazardous waste or one quart of acutely hazardous waste accumulated.

Laboratory personnel can submit [chemical pick-up requests](#) electronically to EH&S. The request must be completely filled out with the requested information. Once the request is submitted a return email is sent to confirm the request. Personnel from EH&S will respond to chemical pick-up request within 72 hours of receipt of request. Unknown chemicals will not be removed from the laboratory.

## XII. Hazardous Material Emergency Response

The Hazardous Materials Emergency Response plan is designed to minimize hazards to human health and the resulting environment from any unplanned release of hazardous materials. This plan outlines the emergency procedures that shall be followed by personnel if hazardous materials are released. EH&S has designed the Hazardous Materials Emergency Response plan in compliance with all local, state, and federal regulations.

### A. Training

EH&S will provide training to all university employees who handle hazardous materials in laboratories. Each employee shall receive training on proper handling of chemicals and emergency response procedures.

Initial training must be completed during the first month of employment and annually thereafter. Emergency procedure training will be conducted as part of the annual laboratory safety training. Additional training sessions can be arranged by email EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu).

The Department of Environmental Health and Safety shall document all emergency response training. Training records will be kept for at least three years from the date the employee last worked at the university.

## **B. Hazardous Material Spill Identification**

EH&S separates hazardous material spills in to two categories: Major or Minor.

### **1. Major Spills**

EH&S characterizes major spills as any one of the following:

- Chemical spills greater than 500 milliliters or grams.
- Chemical spills involving any amount of acutely hazardous materials.
- Blood spills greater than 500 milliliters.
- Any amount of Select Agents.
- Any amount of hazardous gases.
- Any amount of mercury and mercury compounds
- Radioactive materials released where the nature of the potential hazard cannot be ascertained, someone is contaminated, the release is in unrestricted areas, there is airborne radioactive materials generated, there are injuries that might involve the material, uptake potential is high, and evacuation of the room or building is necessary.

### **2. Minor Spills**

EH&S characterizes a minor spill as a small spill that is less than 500 milliliters or grams of non-acutely hazardous materials.

An incident involving radioactive material can be considered minor if the following conditions are met:

- The nature and potential hazards are known
- There is no contamination of personnel
- One or two people can clean up the incident in about an hour
- There is no release of radioactive material into unrestricted areas
- There is no airborne radioactive material
- There are no injuries (e.g., lacerations from broken glass) except where radioactive material is not involved and medical attention is not required
- There is no potential uptake of radioactive material

All minor spills must be reported to EH&S the day of the incident. The incident can be reported to EH&S by email at [safeheal@drexel.edu](mailto:safeheal@drexel.edu).

## **C. Hazardous Material Spill Procedures for Minor Spills**

Laboratory personnel are responsible for the containment and clean-up of all **minor** spills.

## 1. Minor Chemical Spill

- Notify persons in the immediate area that a minor spill has occurred.
- Immediately implement personal decontamination procedures if injured or contaminated with a hazardous substance prior to reporting spill. Utilize the eyewash or safety shower to remove contamination.
- Notify your supervisor a spill has occurred.
- Prior to initiating the clean-up review the safety data sheet for the spilled material to determine the required personal protection equipment and best clean-up method.
- Proper personal protection equipment must be worn during the clean-up of all **minor** spills. Contact EH&S for assistance if appropriate PPE is not available.
- Use the spill kits to clean-up the spill. The kits contain splash goggles, heavy duty gloves, chemical apron, neutralizing agents, waste bags, and absorbent pads.
- All non-disposable personal protective equipment shall be decontaminated and stored.
- All disposable personal protective equipment and clean up materials shall be disposed of as hazardous waste.

## 2. Minor Radioactive Spill

- **Notify** all other persons in the room or area that a spill has occurred.
- **Prevent spread of contamination** by covering the spill with absorbent paper.
- **Decontaminate** the area. Using paper towels or absorbent pads, clean towards the center of the spill. Place all waste into plastic bag and dispose as radioactive waste. Disposable gloves, lab coat, and if appropriate, shoe covers should be worn. Cleansing agents may be used after initial decontamination attempt.
- **Survey** the area and all contaminated and potentially contaminated individuals with a G-M survey meter. Survey for removable contamination using wipe samples.
- **Report** the incident to the Radiation Safety Office at 215-762-4050 or via email at [radiationsafety@drexel.edu](mailto:radiationsafety@drexel.edu).

## D. Hazardous Material Spill Procedures for Major Spills

All major spills will be cleaned up by EH&S or a qualified contractor. An incident involving radioactive materials is considered major when the following conditions are met:

- The nature or potential hazard cannot be ascertained.
- Personal contamination (skin or clothing; contamination of personal protective equipment, e.g., lab coats is not personal contamination).
- The cleanup will take more than two people or more than an hour to perform.
- There is a release of radioactive material into unrestricted areas.
- Airborne radioactive material is generated.
- Injuries which might involve radioactive material (e.g., laceration from contaminated glass)
- Injuries which require medical attention.
- There exists the potential for an uptake of radioactive material.
- Fire or explosion.
- Evacuation of the room or building is necessary.

For more information on the university radiation safety program, consult the university's [Radiation Safety Manual](#).

## 1. Major Chemical or Blood Spill

- Notify persons in the immediate area that a spill has occurred.
- Avoid breathing vapors, mists, or dust of the spilled material.
- If possible turn off all ignition sources, turn on chemical fume hood exhaust and open sash if spill is not in hood.
- Immediately implement personal decontamination procedures if contaminated with a hazardous substance prior to reporting spill.
- Evacuate room and close the door.
- Contact the Public Safety 24-hour Call Center at 215-895-2222.
- Provide the following information to the Dispatcher:
  - Name and call back number.
  - The location of the spill (building and room number).
  - Type of material spilled.
  - The amount of material spilled.
- Remain on or near the telephone until you have received instructions from the Public Safety or EHS.

## 2. Major Radioactive Material Spill

- **Clear the area:** notify all persons not involved with or near the spill to vacate the room.
- **Prevent spread of contamination:** cover the spill with absorbent paper. Do NOT attempt to clean it up. Assemble all potentially contaminated personnel near the room entrance.
- **Close the room:** prevent entry into the room.
- **Call for help:** Immediately contact Radiation Safety.
- **Decontaminate personnel:** Survey personnel for contamination. Contaminated clothing should be removed and stored for evaluation by Radiation Safety. Contaminated skin should be flushed thoroughly with lukewarm water and then washed with mild soap and lukewarm water.

# XIII. Emergency Response

## A. Life Threatening Injury or Illness

In the case of a life-threatening injury or illness call 911 immediately and then contact Drexel Public Safety 24 Hour Call Center at 215-895-2222. The operator will notify security and the emergency response team who will perform rescue procedures and/or transfer the victim to the nearest emergency room. When speaking to the emergency operator state your name, location and the nature of the incident.

## B. Non-life Threatening Injury or Illness

For all non-life threatening injury or illness, immediately contact your principal investigator or laboratory supervisor. Contact Drexel Public Safety 24 Hour Call Center at 215-895-2222 to report the injury. Provide the dispatcher your name, description of the incident, and the exact location of the incident.

Employees must seek medical treatment if necessary at WorkNet or Parkway Health and Wellness during normal hours of 8 am to 5 pm Monday through Friday. The locations are:

| <b>Service Provider</b>     | <b>Address</b>  |
|-----------------------------|---|
| Worknet Occupational Health | Bobst Building, Room 113<br>245 North 15 <sup>th</sup> Street<br>Philadelphia, PA 19102 |
| Worknet Occupational Health | One Reed Street<br>Philadelphia, PA 19147   |
| Parkway Health and Wellness | 1601 Cherry Street, 2 <sup>nd</sup> Floor<br>Philadelphia, PA 19102                     |

Public Safety can arrange transportation to the WorkNet Facilities or Parkway Health and Wellness for employees. After normal hours or during holidays employees should report to the nearest emergency room.

All employees must complete an injury report. This report can be obtained from WorkNet, Parkway Health and Wellness, or by contacting EH&S at 215-895-5919.

Students should seek medical treatment with his or her family physician, student health or closest emergency room with the exception of needle sticks. Students who suffered a needle stick can report to the University's Occupational Health Office (WorkNet or Parkway Health and Wellness), student health or the closest emergency room for needle stick injuries.

### **C. Exposures**

Always seek medical attention when exposed to hazardous materials.

- Eyes – Immediately flush eye(s) for a minimum of 15 to 20 minutes using the eyewash station.
- Face, Eye(s), and/or Body – immediately flush for a minimum of 15 to 20 minutes using the safety shower. Remove contaminated clothing while flushing.
- Hand(s) – immediately flush for a minimum of 15 to 20 minutes using the sink. If injected with an infectious needle utilize soap and water.
- Ingestion and inhalation – seek medical attention immediately.

### **D. Personal Decontamination Procedures**

Please be advised that these procedures are general decontamination procedures. These procedures might not be appropriate for certain types of hazardous materials. In effort to ensure proper decontamination consult the Safety Data Sheet prior to conducting any experiments. Implement **immediately if contaminated with a hazardous substance** prior to cleaning up or reporting spill:

**For spills contacting the of skin, follow these procedures:**

- Immediately flush with flowing water for no less than 15 minutes (i.e. sink or safety shower).
- If there is no visible burn, wash with warm water and soap, removing any jewelry to facilitate clearing of any residual material.

- Check the material safety data sheet to see if any delayed effects should be expected. If the MSDS is not available contact the EHS immediately at 215-895-5919 or 215-778-4278.
- Seek medical attention for even minor chemical burns.
- Do not use creams, lotions, or salves.

**For spills on clothing, follow these procedures:**

- Do not attempt to wipe the clothes.
- Quickly activate the safety shower and remove all contaminated clothing, shoes, and jewelry.
- Seconds count, so do not waste time because of modesty
- Take care not to spread the chemical on the skin or, especially, in the eyes.
- Use caution when removing pullover shirts or sweaters to prevent contamination of the eyes; it may be better to cut the garments off.
- Immediately flood the affected body area with warm water for no less than 15 minutes. Resume if pain returns.
- Get medical attention as soon as possible.
- Discard contaminated clothes as hazardous waste or have them laundered separately from other clothing.

**For splashes into the eye, take these steps:**

- Using the eyewash immediately flush for at least 15 minutes.
- Hold the eyelids away from the eyeball, and move the eye up and down and sideways to wash thoroughly behind the eyelids.
- Get medical attention immediately. Follow first aid by prompt treatment by a member of a medical staff or an ophthalmologist who is acquainted with chemical injuries.

## **XIV. Medical Surveillance**

A laboratory worker shall be required to obtain medical consultation and examination under the following circumstances:

- Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory.
- Where exposure monitoring reveals an exposure level above the OSHA Action Level (AL), Permissible Exposure Limit (PEL) or Short-term Exposure Limit (STEL).
- When an event takes place in the work area such as a spill, leak, explosion, or other occurrence resulting in the likelihood of a hazardous exposure.
- When working with certain biological, chemical, and physical agents including employees who work with patients, laboratory animals, bloodborne pathogens, other infectious agents, formaldehyde, xylene, class 3b or 4 lasers, and/or those whose work requires the use of a respirator.
- Whenever an individual's immune status may have changed, such as in the event of a change in personal health status, or pregnancy.

Medical consultations are provided through the university occupational health care provider. Personal health status may impact an individual's susceptibility to infection, ability to receive immunizations or prophylactic interventions. An attending physician will decide if the employee needs to be referred for



further treatment. If there is a medical emergency, personnel should go immediately to the Emergency Room (ER), and call the Drexel’s Public Safety Office at (215) 895-2222, if assistance is needed.

In the event of an incident, PIs, Lab Safety Liaisons and/or Supervisors shall collect as much information as possible about the person, the substances involved, MSDS, symptoms, and any other relevant data, to provide to the attending physician. The physician in charge will inform the employee about the medical examination results, related conditions, tests required, and whether any follow-up is required.

The occupational health provider shall keep written records of all such medical examinations and must maintain these records for the duration of employment plus 30 years. Such records shall contain, but are not limited to, physicians’ opinions, recommendations, results of any tests performed, and any follow-up actions. Upon written request by the employee or an authorized representative, the employer shall make such records available for review.

### **A. Occupational Health Services**

Drexel University offers occupational health services to all employees. Employees are provided at orientation the Guideline for Occupational Health Services form. This form determines whether or not occupational health services are required. The purpose of the services is to create a baseline analysis of the employee’s health prior to working with specific agents or chemicals. Services will include appropriate vaccinations, baseline medical monitoring and physicals as required under federal and state regulations for those individuals who have a potential for exposure. Additional medical services and consultations may be recommended by EH&S prior to the approval of protocols involving the use of extremely hazardous or pathogenic agents.

The service is provided at several locations:

| <b>Service Provider</b>     | <b>Address</b>  |
|-----------------------------|---|
| Worknet Occupational Health | Bobst Building, Room 113<br>245 North 15 <sup>th</sup> Street<br>Philadelphia, PA 19102 |
| Worknet Occupational Health | One Reed Street<br>Philadelphia, PA 19147   |
| Parkway Health and Wellness | 1601 Cherry Street, 2 <sup>nd</sup> Floor<br>Philadelphia, PA 19102                     |

In addition to the initial and annual services, the healthcare services provide support for employee injuries. Employees with life threatening injuries must call 911 for immediate medical care. Employees with non-life threatening injuries must seek medical attention at one of the service provider locations.

All injury-related examinations and consultations are performed by or under the direct supervision of one of panel of licensed physicians without cost to the employee, without loss of pay, and at a reasonable time and place.

Contact EH&S at [safeheal@drexel.edu](mailto:safeheal@drexel.edu) for additional information about occupational health services.

## B. Personal Exposure Monitoring

Upon request of the laboratory personnel, the University CHO will review laboratory work practices and normal operations in an effort to determine if university employees are at risk of exposure to regulated substances in accordance with the [OSHA permissible exposure limits](#) and action levels as outlined in [29 CFR 1910](#).

Initial and annual surveillance monitoring (environmental and personal) will be conducted whenever exposures to hazardous agents are anticipated to exceed the action level, the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLV) or [OSHA'S PEL](#). Additionally, monitoring will be conducted when:

- Past monitoring has indicated elevated exposures.
- When requested by an employee or student.
- When an employee or student experiences signs or symptoms of overexposure.
- When laboratory operations change such that an area previously identified as not expected to have significant exposure would now be expected to have elevated concentrations of hazardous agents.

All personal exposure monitoring activities (including sampling, analysis and record keeping) will be performed in accordance with OSHA requirements and/or NIOSH recommended practices. In addition, the results of the sampling will be uploaded to the specific laboratory in BioRAFT.