UNIVERSITY of MARYLAND BALTIMORE

ADMINISTRATION AND FINANCE

University of Maryland Baltimore
Environmental Health and Safety
Chemical Hygiene Plan

Updated November 2023

Table of Contents

CONTENTS

1.SCOPE AND APPLICABILITY

The Chemical Hygiene Plan (CHP) sets forth the policies, procedures, and guidelines in place to protect laboratory workers from the health and physical hazards associated with hazardous chemical use in the laboratory. The CHP provides guidelines for prudent work practices and procedures for the laboratory use of chemicals. The standard operating procedures (SOPs; including laboratory practices and engineering controls) recommended in this manual identify the safeguards that should be taken when working with hazardous chemicals. The CHP covers employees who work with hazardous chemicals in laboratories. At the University of Maryland Baltimore (UMB), the CHP shall act as the overarching, general plan for all hazardous chemical use on a laboratory scale. All faculty, staff, students, volunteers, visiting scholars, and other personnel using hazardous chemicals in a research or teaching laboratory must adhere to the requirements detailed in this document. All laboratory workers must be made aware of the CHP. New lab members should review the CHP and receive safety training before beginning work with hazardous chemicals or working in areas where hazardous chemicals are handled.

Questions about the CHP or the safe use of chemicals should be directed to the Chemical Hygiene Officer (CHO), the chemical safety team, or the office of Environmental Health and Safety (EHS).

2. RESPONSIBILITIES

2.1 ENVIRONMENTAL HEALTH AND SAFETY

The office of Environmental Health and Safety is responsible for:

- Designing and offering lab safety training programs.
- Offering guidance on development of SOPs.
- Conducting laboratory safety inspections on an annual basis or as needed.
- Updating the Chemical Hygiene Plan.
- Working with the laboratory community, administrators, and others to develop and implement appropriate chemical hygiene policies and practices.
- Providing technical assistance for complying with the Chemical Hygiene Plan and answering chemical safety questions.
- Assisting Principal Investigators (PIs) in the selection of appropriate laboratory safety practices and engineering controls for new and existing projects and procedures.
- Making the final determination for when an exposure assessment is appropriate and conducting or overseeing these assessments.
- Proving guidance on the current legal requirements concerning regulated substances.
- Investigating reported accidents that result in the exposure of personnel or the environment to hazardous chemicals.
- Providing consultation for safe work practices for hazardous chemicals.
- Providing safe working guidelines for laboratory workers through the EHS web page.
- Inspecting fume hoods annually.
- Conducting exposure monitoring, as needed.

2.2 PRINCIPAL INVESTIGATORS

The Principal Investigator (PI) of each lab is responsible for:

- Ensuring that an up-to-date inventory of chemicals is maintained and provided to EHS through ChemTracker (on SciShield).
- Informing researchers working in the laboratory of the potential hazards associated with the use of chemicals in the laboratory and instructing them in the safe laboratory practices, adequate controls, and procedures for dealing with incidents involving hazardous chemicals.
- Supervising the performance of the researchers in the laboratory to ensure the required safety and chemical hygiene rules are adhered to.
- Ensuring appropriate controls (engineering and personal protective equipment) are used and are in good working order.
- Ensuring, in collaboration with EHS, that all new laboratory workers complete training requirements before working unsupervised in the laboratory/facility and that all workers complete this training annually thereafter.
- Ensuring that all laboratory workers receive instruction on safe work practices, lab-specific SOPs for use of highly hazardous chemicals as appropriate, proper use of personal protective equipment (PPE), spill clean-up, and emergency procedures.
- Ensuring that all laboratory workers have read and are familiar with the CHP and know how to access it.
- Providing access to safety information and specific training to laboratory workers for the hazardous chemicals with which they work.
- Developing and establishing SOPs for safe handling and operations applicable to hazardous chemicals as needed.
- Providing all appropriate and required PPE to laboratory workers.
- Correcting deficiencies identified during inspections, as appropriate.
- Reporting all accidents and near misses (which are unplanned events that did not result in injury, illness, or damage but had the potential to do so) that occur in their laboratory/facility and taking corrective measures to prevent recurrence.
- Ensuring proper disposal of all laboratory waste, including hazardous waste, biological waste, and sharps waste from his or her laboratory/facility.
- Informing visitors, vendors, and non-laboratory personnel of hazards before accessing the laboratory/facility.
- Ensuring access to Safety Data sheets (SDS) for hazardous chemicals used in the laboratory/facility and that lab workers know how to access this information.
- Maintaining relevant safety information for the laboratory/facility in SciShield, including but not limited to detailing hazards and maintaining an accurate list of lab members.

2.3 LAB MEMBERS

Members of the UMB community (students, staff, contractors, etc.) who are working in labs have the following responsibilities:

- Developing and maintaining good chemical hygiene habits (chemical safety practices and procedures).
- Reviewing and being familiar with the Chemical Hygiene Plan.
- Following procedures and laboratory practices outlined in the Chemical Hygiene Plan and the EHS Website.
- Adhering to all University and departmental safety policies and procedures and complying with safety directives issued by supervisors and principal investigators.
- Completing all required/assigned lab safety training upon initial hire, new assignment of duties involving hazardous chemicals, and refreshing training annually or as required.
- Reporting all hazardous conditions to their PI and EHS.
- Reviewing the SDS prior to work with hazardous chemicals.
- Consulting with the PI or appropriate designee before conducting any changes in protocol or using any new chemicals.
- Informing the PI of any unapproved changes in protocol or the unapproved use of new chemicals in the laboratory.
- Wearing the appropriate clothing and shoes as well as the appropriate/required PPE in the lab.
- Following all appropriate SOPs necessary for safe laboratory work, and if no such SOP currently exists, working with the PI to develop the necessary SOP.
- Reporting any suspected job-related injuries, exposures, or illnesses to the immediate supervisor and seeking treatment immediately.
- Refraining from operating equipment or instruments that may pose a hazard without the proper instruction, training, and authorization.
- Remaining aware of chemical hazards in the laboratory, by requesting information and training when unsure of how to handle a hazardous chemical or procedure.

3. TRAINING

All employees who work in a laboratory are required to attend initial in-person laboratory safety training. Annual refresher training and job-specific modules are maintained on EHS's online training system. When performing a non-routine task presenting hazards for which the researcher has not already been trained, the supervisor is responsible for discussing the hazards of the task and any special measures (e.g. personal protective equipment or engineering controls) that should be used with all researchers who may have potential exposure. More information about training can be found on the EHS website under the Training tab.

4. GENERAL SAFE WORK PRACTICES

4.1 GENERAL SAFETY GUIDELINES

- Read and become familiar with this CHP and any SOPs developed specifically for the laboratory prior to working in the laboratory.
- Notify supervisors of chemical sensitivities or allergies.
- Always read the SDS and label before using a chemical.

- Make others aware of special hazards associated with your work.
- Use appropriate ventilation (e.g., fume hood or local exhaust ventilation) when working with hazardous chemicals.
- Be familiar with the location of emergency equipment including:
    - Fire alarm pull stations
    - Fire extinguishers
    - Emergency eyewash, and shower stations
    - Emergency exits
    - Spill cleanup equipment
- Avoid distracting or startling other workers when they are handling hazardous chemicals.
- Use equipment and hazardous chemicals only for their intended purposes.
- Keep chemical containers closed unless actively in use.
- Always be alert for unsafe conditions and actions and call attention to them so that corrective action can be taken as quickly as possible.
- Wear eye and face protection and impervious aprons when appropriate.
- Always inspect equipment for leaks, tears, and other damage before handling a hazardous chemical. This includes fume hoods, gloves, goggles, etc.
- Avoid tasting or smelling hazardous chemicals.
- Ensure all chemical containers are appropriately labeled with full proper name (no abbreviations or nicknames). Labels should be legible and in English to comply with 29 CFR 1910.1200(f)(10).
    - Some nonhazardous buffers can be labeled with an EHS approved abbreviation. Please see the list of approved abbreviations here: https://www.umaryland.edu/media/umb/af/ehs/chemical-safety/EHS-Approved-Chemical-Abbreviations.pdf
- When disposing of or moving unwanted laboratory equipment, it must be decontaminated prior to disposal or removal from the laboratory.
- Do not work alone in the laboratory; use the buddy system by coordinating work with other members, by staying on a Zoom call, checking in via text, or other system. It is extremely important to understand the risks of working alone.
- Follow laboratory signage and postings; refresh signage as needed.
- Segregate and store chemicals properly.
- Never leave exposed sharps, micropipettes, or broken glass on the bench or in washing facilities.

4.2 Personal Hygiene

- Never eat, drink, smoke, chew gum, apply cosmetics, or manipulate contact lenses in the laboratory. Contact lenses may be prohibited in certain chemical laboratories, as indicated in laboratory-specific SOPs.
- Remove PPE (e.g., gloves, aprons, protective footwear, and headwear) before leaving the laboratory space. Do not wear PPE in non-laboratory support areas. Never touch door handles, elevator buttons, etc. with gloved hands.

- Avoid direct contact with any hazardous chemical. Know the types of protective equipment available and use the proper type for each job.
- Confine long hair and loose clothing and always wear footwear that fully covers the feet.
- Do NOT inhale or taste chemicals: use a fume hood or engineering control, cap as soon as done using, never use a mouth pipette, and waft only if absolutely necessary.
- Use appropriate safety equipment whenever exposure to gases, vapors, or aerosols is suspected and ensure exhaust facilities are working properly.
- Wash hands thoroughly with soap and water after handling chemicals, before leaving the laboratory, and before eating or drinking.
- Discard, decontaminate, clean, or sanitize PPE on a regular basis. Replace as appropriate.

Laboratory employees must be familiar with the symptoms of exposure for the chemicals with which they work and the precautions necessary to prevent exposure.

4.3 HOUSEKEEPING

- Food, beverages, cups, and other drinking and eating utensils should not be stored in areas where hazardous chemicals are used or stored.
- Keep lab bench tops, sinks, floors, and other work surfaces clean and uncluttered. Clean up work areas upon completion of an operation or at the end of each workday, including floors.
- Dispose of wastes per UMB waste disposal procedures. For guidelines on the storage and disposal of hazardous wastes from laboratory operations, refer to the Hazardous Chemical Waste Management Guidelines and Instructions (https://www.umaryland.edu/ehs/hazardous-material-management/hazardous-waste-management-guidelines-and-instructions/). Any questions concerning disposal of hazardous waste should be directed to EHS at *(410) 706-7055*.
- Clean spills immediately and thoroughly.
- Do not block exits, emergency equipment, or controls. Avoid using corridors and stairways as storage areas.

5. HAZARD IDENTIFICATION

The Globally Harmonized System of Classification and Labeling of Chemicals *(GHS)* is an internationally standardized approach to hazard communication that provides for a consistent system of classification and labeling of chemicals. Originally conceived by the United Nations *(UN)* in 2003, the Occupational Safety and Health Administration *(OSHA)* adopted the majority of the elements of the GHS through a 2012 revision of the Hazard Communication Standard *(HCS)*.

Any chemical that is manufactured in or distributed from countries that follow the GHS will be provided with standard labeling that includes the name of the chemical, pictograms, signal words, hazard statements, and precautionary statements. Each vendor is also required to provide a Safety Data Sheet *(SDS; formerly known as Material Safety Data Sheet or MSDS)* in the GHS-standardized layout of 16 sections. A SDS is a document containing chemical hazard identification and safe handling information and is prepared in accordance with the OSHA Hazard Communication Standard. This will make it easier for lab workers to identify hazards and seek information on those hazards, and it further establishes a set of pictograms that will allow for faster recognition of chemicals that are characterized as hazardous. The GHS pictograms can be reviewed on the OSHA QuickCard for HCS Pictograms and Hazards (https://www.osha.gov/Publications/HazComm_QuickCard_Pictogram.html).

The Laboratory Standard requires that PIs identify those activities that the PI believes to be of a sufficiently hazardous nature to warrant prior approval before implementation by an employee.

Chemical manufacturers and distributors must provide the purchasers of hazardous chemicals with an appropriate SDS for each hazardous chemical/product purchased. In accordance with the GHS, SDSs will now have a specific 16-section format, including:

Section 1: Identification includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.

Section 2: Hazard(s) identification includes all hazards regarding the chemical; required label elements.

Section 3: Composition/information on ingredients includes information on chemical ingredients; trade secret claims.

Section 4: First-aid measures includes important symptoms/effects, acute, delayed; required treatment.

Section 5: Firefighting measures lists suitable extinguishing techniques, equipment; chemical hazards from fire.

Section 6: Accidental release measures lists emergency procedures; protective equipment; proper methods of containment and cleanup.

Section 7: Handling and storage lists precautions for safe handling and storage, including incompatibilities.

Section 8: Exposure controls/personal protection lists OSHA's Permissible Exposure Limits *(PELs)*; ACGIH Threshold Limit Values (TLVs); and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the SDS where available as well as appropriate engineering controls; personal protective equipment (PPE).

Section 9: Physical and chemical properties lists the chemical's characteristics.

Section 10: Stability and reactivity lists chemical stability and the possibility of hazardous reactions.

Section 11: Toxicological information includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.

Section 12: Ecological information

Section 13: Disposal considerations

Section 14: Transport information

Section 15: Regulatory information

Section 16: Other information, includes the date of preparation or last revision.

The Hazard Communication Standard requires that departments and/or PIs keep SDSs and that the SDSs are readily accessible to laboratory employees. The system a laboratory uses to store SDSs can vary from keeping them in a notebook or file cabinet, to using the EHS information system. The system adopted must provide easy access to SDSs for hazardous chemicals used in the lab.

UMB EHS subscribes to an online SDS repository, accessible by any researcher through single sign on (SSO) using your UMID. If you have trouble accessing an SDS, contact your vendor/supplier, your PI, supervisor, instructor, or EHS at *(410) 706-7055*.

Identifying the specific hazard associated with a chemical greatly reduces chances of misuse by laboratory employees, new users, or visitors to the laboratory. At the very minimum, chemical containers should have labels that identify their contents and the hazards associated with the use of the chemical.

With respect to identifying containers, storage areas, and laboratory entrance ways, the following conditions entail hazard identification:

- Principal investigators *(PIs)*/laboratory supervisors must ensure that labels on incoming containers of hazardous chemicals are not removed or defaced. If any part of the label is obscured or removed, that information must be replaced. Labels contain information on the identity of the chemical(s) in the container and the hazard identification of the chemical(s). It is recommended that incoming containers be labeled with the PI's name and date of receipt.
- When chemicals or mixtures are transferred into a different container, that container also must also be labeled with the name(s) of the chemical(s) and any associated hazards. Secondary containers also should be fully labeled.
- PIs/laboratory supervisors must ensure that employees have access to SDSs. SDSs can be accessed here (https://www.umaryland.edu/ehs/research-safety/chemical-safety/safety-data-sheets/).
- Any chemical mixture shall be assumed to be as toxic as its most toxic component.
- Substances of unknown toxicity shall be assumed to be toxic.

6. Standard Laboratory Facility Requirements

6.1 Laboratory Labels and Signs

Labels and warning signs need to alert employees to potentially hazardous materials and allow those unfamiliar with the laboratory surroundings to identify hazardous chemical use and storage areas, safety facilities, emergency equipment, and exits, and to assist emergency response personnel. Some signs and labels are available from EHS; others may be purchased from scientific vendors or user-generated.

Laboratories that use hazardous materials must have signs visibly posted with emergency contact numbers (two names, preferably the PI, laboratory supervisor or head technician) on the external doorway to the lab. These names and numbers must be updated when personnel change. In case of an emergency, responders need this information to contact knowledgeable personnel about specific laboratory hazards. The sign also must include information on the hazards in the laboratory and the proper precautions to take when entering the laboratory. Laboratory door signs can be obtained by going to MyEHS (https://afcf.umaryland.edu/ehs/sec/myehs/) and requesting a door sign.

6.2 Restricted Access and Designated Areas

Facilities containing certain hazards must have warning signs posted at the designated area of the laboratory where the hazard exists and at the entranceway to the laboratory. Any areas placarded as such are must restrict access to trained personnel. Such hazards may include:

- Known carcinogens
- Lasers
- Strong magnetic fields
- HIV and HBV research laboratories and production facilities*
- Biological agents that require Biosafety Level 2 or higher protective measures*
- Radioactive materials or sealed radioactive sources*
- Other chemical hazards will be dealt with on a case-by-case basis, with consultation from EHS.

**Please contact EHS for requirements on these items.*

6.3 CHEMICAL STORAGE

- Chemicals should be stored according to compatibility. In this chart, incompatible materials are marked with an "X" and should not be stored together:

	Flammable Liquids	Oxidizers	Organic Acids	Inorganic Acids	Bases	Reactives	Toxics
Flammable Liquids		X		X		X	
Oxidizers	X		X			X	
Organic Acids		X		X	X	X	
Inorganic Acids	X		X		X	X	
Bases			X	X		X	
Reactives	X	X	X	X	X		X
Toxics						X	

- Click here (https://www.umaryland.edu/ehs/research-safety/chemical-safety/chemical-substance-incompatibilities/) for a compatibility guide for some specific chemicals.
- Particularly hazardous chemicals should be stored and handled with extreme care.
- When ordering chemicals that are unfamiliar, review the SDS before purchase so that use and storage guidelines are understood.
- Storage areas for biohazardous agents and radioisotopes should be appropriately labeled. Contact EHS for more information.
- All peroxide-forming chemicals must be labeled with the date the container was received and the date it was opened. After the recommended disposal date, the chemicals should be tested for peroxides or disposed of properly. A list of peroxide forming chemicals can be found here (https://www.umaryland.edu/ehs/research-safety/lab-auditing/additional-information-on-audit-findings/peroxide-forming-chemicals/).
- Information on proper handling, storage, and disposal of hazardous chemicals and access to related SDSs must be made available to all laboratory employees before the use of the chemical.
- Always purchase the minimum amount necessary to maintain operations.
- Chemical containers with missing or defaced labels or that violate appropriate packaging regulations should not be accepted.
- Chemicals should not be stored on high shelves and large bottles should be stored no more than 2 feet from floor level.
- Chemical storage areas must be labeled as to their contents.
- Storage of chemicals on the laboratory bench or in other work areas shall be kept to a minimum.

- Chemicals shall not be stored in the corridor.
- An up-to-date and accurate inventory of all hazardous chemicals must be maintained.

6.4 Personal Protective Equipment

University policy on the use and selection of Personal Protective Equipment (PPE) must be followed. However, the following is some basic information on PPE commonly found in laboratories.

PPE must be provided to employees under the appropriate circumstances. Employees must be trained on the proper use of any PPE issued to them and employees have the responsibility of properly using such equipment.

The SDS may be consulted for information on proper PPE selection and safety procedures recommended for a given chemical, though the SDS may not provide sufficient information concerning the specific type of safety equipment required (for example, it may say "use gloves" but not list the best glove to use). EHS should be contacted if more information is needed. The EHS web page also contains additional information on the use and selection of personal protective equipment.

OSHA has adopted the American National Standards Institute (ANSI) consensus standards for eye protection and emergency shower and eyewash facilities.

6.4.1 Gloves

Gloves protect against chemicals that are easily absorbed through the skin. They also work to prevent eye contact and ingestion of chemicals, as the gloves keep hands free from contaminants and people are less likely to touch their faces with gloves on their hand. Nitrile and latex examination gloves are the most commonly used by laboratories, though other glove types may be more protective in certain situations. The SDS may have more information on which type of glove to wear for a specific material. Some general rules that apply to all gloves, no matter the type:

- Inspect gloves for weather wear (i.e. brittleness, discoloration, adherence of gloves to one another), holes, cracks, or contamination before use. Discard any gloves found to be inadequate or questionable.
- Replace gloves periodically (every 1-2 hours) during use; all glove materials are eventually permeated by chemicals. Manufacturers generally provide information on breakthrough times and chemical compatibility.
- Discard disposable gloves immediately after each use or whenever they become contaminated, whichever occurs first.
- Rinse reusable gloves with soap and water, carefully remove them, and allow them to dry completely for storage after each use.
- Always remove gloves prior to leaving the laboratory.
- Wash your hands thoroughly with soap and water after your gloves have been removed, and prior to leaving the laboratory.
- Remove disposable gloves by grabbing the cuff of the left glove from the outside with the gloved right hand and removing the left glove, taking care not to touch skin with the right glove. While holding the removed left glove in the palm of the gloved right hand, insert a finger under the cuff of the right glove from the inside and gently invert the right glove over the removed left glove.
- Do not wear contaminated gloves when performing common tasks such as working on the computer, answering the phone, grabbing a door handle, using an elevator, etc.

- Wear two pairs of gloves when working with particularly hazardous chemicals or hazardous chemicals that are easily absorbed through the skin. You may need to change gloves more frequently.

6.4.2 Eye Protection

Eye protection must be made available to all employees or visitors to laboratories where chemicals are used and stored. Protective eye and face equipment must be used where there is a reasonable probability of injury from hazardous chemicals that can be prevented from such equipment. The minimum acceptable requirements are for hardened glass or plastic safety spectacles. The PI or laboratory supervisor should establish the level of eye protection needed per laboratory activity. Specialized types of eye protection, such as ultraviolet light restricting safety glasses, are available. All eye protective devices must be stamped with "Z87" by the manufacturer if they meet ANSI standards. If eye protection is not marked, it may not be the most effective protection available. The following types of eye protection are recommended for use in the laboratory by ANSI:

- Safety glasses with side shields offer minimal protection against flying fragments, chips, particles, sand, and dirt. When a splash hazard exists, other protective eye equipment must be worn.
- Safety goggles (impact goggles) offer protection against flying particles and must be worn when working with glassware under reduced or elevated pressure or with drill presses or other similar conditions.
- Chemical splash goggles (acid goggles) have indirect venting for splash-proof sides, which provide adequate protection against splashes. Chemical splash goggles offer the best eye protection from chemical splashes. Impact goggles should not be worn when danger of a splash exists.
- Face shields protect the face and neck from flying particles and splashes. Always wear additional eye protection under face shields. Ultraviolet-light face shields should be worn when working around UV light sources.

6.4.3 Protection of Skin and Body

Skin and body protection involves the use of protective clothing to protect individuals from chemical exposure. Determine clothing needed for the chemical being used, as protective garments are not equally effective for every hazardous chemical. Some chemicals will permeate a garment in a very short time, whereas others will not. The basic and most effective forms of protection are gloves and lab coats.

- Protect exposed skin surfaces when there is a reasonable anticipation of a splash. Open-toed shoes, sandals, shorts, etc., are not permitted when working in University laboratories.
- Even when there is minimal danger of skin contact with an extremely hazardous substance, lab coats, coveralls, aprons, or protective suits should be utilized. These garments should not leave the work site.
- Exposures to strong acids, acid gases, organic chemicals, strong oxidizing agents, carcinogens, and mutagens require the use of specialized protective equipment that prevents skin contamination. Impervious protective equipment must be utilized. Examples include: appropriate gloves, aprons, boots, and protective suits.
- Flame resistant (FR) lab coats may also be required.

6.4.4 Respirators

The use of respirators in laboratories is strongly discouraged. The use of respirators is only allowed where engineering controls are not feasible or where they are being installed. Any individual that uses a

respirator as part of their work at the University must be enrolled in the respirator program. Before using a respirator for the first time or for a new activity, employees must complete a medical questionnaire and be approved by a physician, attend an EHS respiratory training session, and be fit-tested. Fit-testing must be repeated at least annually. Please contact EHS at (410) 706-7055 for a copy of the University Respiratory Protection Program. It also can be found here (https://www.umaryland.edu/ehs/occupational-safety-and-health/occupational-safety/policy-on-the-use-of-respirators/).

6.4.5 Laundry Contaminated with Potentially Infectious Material

All laundry that is contaminated with potentially infectious material shall be bagged at the location where it was used and shall not be sorted or rinsed in the location where it was originally used. Contaminated laundry shall be placed and transported in bags or containers labeled with the universal biohazard symbol. Whenever contaminated laundry is wet and presents a reasonable likelihood of soak-through or leakage from the bag or container, the laundry shall be placed and transported in bags or containers that prevent soak-through and/or leakage of fluids to the exterior. In addition, when a department ships contaminated laundry off-site for laundering, it must ensure that the laundry is in bags or containers labeled with the universal biohazard symbol. The cost of off-site laundering is the responsibility of the employee's department.

6.5 Emergency Equipment

6.5.1 Safety Showers

Safety showers provide an immediate water drench of an affected person. It is important to know the location of the closest safety shower. Safety showers are inspected annually by Facilities Operations and Maintenance. EHS recommends the following ANSI standards for location, design, and maintenance of safety showers:

- Showers shall be located within 25 feet of areas where chemicals with a pH of < 2.0 and > 12.5 are used.
- Showers shall be located within 100 feet of areas where chemicals with a pH of > 2 and < 4 or > 9 and < 12.5 are used.
- The location of the shower should be clearly marked, well-lit, and free from obstacles, closed doorways, or turns.

6.5.2 Eyewash Facilities

Eyewash facilities should be within 25 feet or 10 seconds of travel for laboratories where injurious or corrosive chemicals are used or stored. Eyewash facilities must be activated/flushed for at least 10 to 15 seconds once per week to ensure clean water flow. It is the responsibility of the PI to ensure that the eyewashes are flushed weekly and that there is record of this testing.

- Optimally, those affected must have both hands free to hold open the eye to ensure an effective wash behind the lids. This means providing eyewash facilities that are operated by a quick release system and simultaneously drench both eyes.
- Eyewash facilities must provide the minimum of a 15-minute water supply at no less than 0.4 gallons per minute.
- Eyewash facilities must not exceed 25 pounds per square inch *(PSI)* pressure.

Contact EHS regarding specific designs for eye wash facilities.

6.5.3 Fire Extinguishers

Class ABC fire extinguishers are located in the hallway of each academic lab building. These extinguishers are checked annually by the Office of the Fire Marshall. Fire extinguishers should only

be used by those who have taken fire extinguisher training. Labs working with metallic compounds (sodium, potassium, etc.) are required to have Class D fire extinguishers on hand and have a least one member with fire extinguisher training.

All non-University owned fire extinguishers must be maintained in accordance with their manufacturer's requirements/recommendations. A physical check of fire extinguishers should be performed monthly by a member of the laboratory or building staff, with records of such.

6.5.4 VENTILATION CONTROLS

Ventilation controls are controls intended to minimize employee exposure to hazardous chemicals by removing air contaminants from the work site.

There are two main types of ventilation controls:

- *General (dilution) exhaust:* A room or building-wide system that brings in air from outside and ventilates within. Laboratory air must be continually replaced, preventing the increase of air concentration of toxic substances during the workday. General exhaust systems are not recommended for the use of most hazardous chemicals.
- *Local exhaust:* A ventilated, enclosed workspace intended to capture, contain, and exhaust harmful or dangerous fumes, vapors, and particulate matter generated by procedures conducted with hazardous chemicals *(i.e., fume hood)*.

To determine ventilation requirements, assess the SDS. Some SDS terminology, as listed below, may indicate a need for special ventilation considerations beyond general exhaust ventilation:

- Use with adequate ventilation.
- Avoid vapor inhalation.
- Use in a fume hood.
- Provide local exhaust ventilation.

<u>Proper Use of Local Ventilation Systems</u>

Once a local ventilation system is installed in a work area, it must be used properly to be effective. For use of hazardous chemicals warranting local ventilation controls, the following guidelines should be observed:

- Conduct all operations that may generate air contaminants at or above the appropriate PEL or TLV inside a fume hood.
- Keep all apparatus at least 6 inches back from the face of the hood and keep the slots in the hood baffle free of obstruction by apparatus or containers. Large equipment should be elevated at least 2 inches off the base of the fume hood, to allow for the passage of air underneath the apparatus.
- Do not use the hood as a waste disposal mechanism.
- Minimize storage of chemicals or apparatus in the hood.
- Keep the hood sash closed at all times except when the hood is in use.
- Minimize foot traffic and other forms of potential air disturbances past the face of the hood.
- Do not have sources of ignition inside the hood when flammable liquids or gases are present.
- Use the sash as a safety shield when boiling liquids or conducting an experiment with reactive chemicals.

- Periodically check the air flow in the hood using a continuous monitoring device or another source of visible airflow indicator. If airflow has changed, contact EHS for an inspection or Work Control at *(410) 706-7570* for repair.
- Never work with hazardous chemicals if the required ventilation system is not working.

EHS performs hood inspections annually; after an inspection, hoods are passed or failed for use based on the following criteria:

- The face velocity of air being drawn into the hood with sash open is measured quantitatively in feet per minute (fpm). One measurement is taken per square foot of face space and averaged. Hoods must have an average face velocity of 80-120 fpm, depending on their design, with 100 fpm being the ideal average face velocity with the sash fully open.
- If the exhaust system does not pass the face velocity test, the PI will be informed by the inspector. EHS will contact Work Control to have repairs initiated.
- If the exhaust system does pass, the inspector will post the date of inspection and will mark the hood to indicate proper sash position for optimum hood performance. The hood sash should be set at this point for procedures that could generate toxic aerosols, gases, or vapors. In general, the sash height should be set at a level where the operator is shielded to some degree from any explosions or violent reactions that could occur and where optimum airflow dynamics are achieved. If a fume hood has no markings regarding sash height or inspection dates, please contact EHS at 410-706-7055 to arrange for an inspection.

Certain types of local exhaust systems are not designed for the use of hazardous chemicals. If a local exhaust system's capabilities are not fully understood, check the manufacturers' specifications or call EHS before using hazardous chemicals in the system.

6.6 Chemicals Developed in the Laboratory

The following requirements apply to chemical substances developed in the laboratory:

- If the composition of the chemical substance that is produced exclusively for the laboratory's use is known, the PI must determine if it is a hazardous chemical. This can be done by a literature search for similar substances. If the chemical is determined to be hazardous, the PI must provide appropriate training to protect employees.
- If the chemical produced is a product or a byproduct whose composition is not known, the PI must assume that the substance is hazardous and must comply with the requirements of the CHP.
- If the chemical is produced for sale or use outside of the laboratory, the PI must prepare an appropriate SDS in accordance with the OSHA Hazard Communication Standard (29CFR 1910.1200).

6.7 Transporting Chemicals

- Carry containers in leak-resistant, unbreakable secondary containment
- When transporting chemicals on a cart, use a cart that is suitable for the load and one that has high edges to contain leaks or spills.
- When possible, transport chemicals in freight elevators to avoid the possibility of exposing people on passenger elevators.

6.8 Unattended Operations

At times, it may be necessary to leave a laboratory operation unattended. Follow these basic guidelines in the design of an experiment to be left unattended:

- Always check with your laboratory supervisor to determine if it is necessary to leave a laboratory operation unattended. If necessary, develop a protocol with your laboratory supervisor for the unattended operation of potentially dangerous equipment or methods.
- Develop a protocol for potential interruptions in electric, water, inert gas, and other services and provide containment for toxic substances as part of the protocol.
- A warning notice must be posted in the vicinity of the experiment if hazardous conditions are present.

7. STANDARD OPERATING PROCEDURES FOR DIFFERENT HAZARD

7.1 PROVISIONS FOR PARTICULARLY HAZARDOUS SUBSTANCES (TOXIC MATERIALS)

Permissible Exposure Limits *(PEL)* - The Laboratory Standard requires that employers assure that employees' exposures do not exceed the PELs. The PELs represent Time Weighted Averages *(TWAs)* in parts per million *(ppm)* or milligrams of substance per cubic meter of air *(mg/m3)*. The TWA represents the ratio between exposure and work shift.

The American Conference of Governmental Industrial Hygienists *(ACGIH)* has established Threshold Limit Values *(TLVs)*, which are TWA values similar to PELs. The TLVs are in some cases lower than the PELs. To keep employee exposures as low as reasonably achievable, employers will be expected to uphold the lowest exposure limit, be it a PEL or a TLV.

Exposure limits can be found on the chemical's SDS or by contacting EHS.

Employee Exposure Determination - Employers must contact EHS to perform employee exposure monitoring under the following circumstances:

1. Initial monitoring must be performed if there is a reason to believe employee exposure levels routinely exceed ½ the PEL.
2. Periodic monitoring must be performed when initial monitoring reveals an exposure over ½ the PEL.

Monitoring can be terminated in accordance with the relevant standard. EHS will notify each employee of the monitoring results within 15 working days after receipt of monitoring results. The results must be individually distributed in writing or posted in a location accessible to all affected employees.

Special Considerations. The OSHA Laboratory Standard requires that special precautions for additional employee protection be followed for the laboratory use of select carcinogens, reproductive toxicants, and chemicals with a high degree of acute toxicity.

Protection from these hazards is provided by assuring exposure to such hazards is minimized, i.e., kept under the PEL, TLV, or Short Term Exposure Limit (STEL), or eliminated. To minimize exposure, it is necessary to determine the route by which exposure may occur, whether by inhalation, absorption, injection, ingestion, or a combination of exposure routes. To ensure employees do not receive exposures in excess of the PEL or TLV, hygienic standards have been established for many toxic materials. The following general hygiene standards should be observed when using select carcinogens, reproductive toxicants, and chemicals with a high degree of acute toxicity.

<u>Establish a designated area</u>

- Use and store materials only in designated areas: a restricted access hood, glove box, or portion of a lab, designated for use of highly toxic substances. Assure that all personnel with access are aware of necessary safety precautions.
- Label all containers, storage, and use areas appropriately.

Use proper containment devices for the protocol and chemical(s) being used

- Use a hood or other containment device for procedures that may result in the generation of aerosols or vapors; trap released vapors to prevent their discharge with fume hood exhaust.
- It is recommended that breakable containers be stored in chemical-resistant trays. Work and mount apparatus above such trays or cover work and storage surfaces with removable, absorbent, plastic-backed paper.

Removal of Contaminated Waste

- Follow the guidelines established in the Hazardous Chemical Waste Management Guidelines and Instructions (https://www.umaryland.edu/ehs/hazardous-material-management/hazardous-waste-management-guidelines-and-instructions/) policies.

Follow decontamination procedures before leaving the designated area

- Upon leaving the designated area, remove protective apparel *(place it in an appropriate, labeled container)* and thoroughly wash hands, forearms, face, and neck.
- Thoroughly decontaminate or dispose of contaminated clothing or shoes. If possible, chemically decontaminate by chemical conversion to a less-toxic product.
- Decontaminate vacuum pumps or other contaminated equipment, including glassware, before removing them from the designated area. Decontaminate the designated area before normal work is resumed.
- Use a wet mop or a vacuum cleaner equipped with a HEPA filter to decontaminate surfaces. **DO NOT DRY SWEEP SPILLED POWDERS**.
- Protect vacuum pumps against contamination with traps and/or appropriate filters and vent effluent into the hood.

Always take extra precautions when working with particularly hazardous chemicals

- Consult the SDS for toxic properties and follow the specific precautions and procedures.
- Guard against spills and splashes. Appropriate safety apparel, especially gloves, should be worn. All hoods, glove boxes, or other essential engineering controls should be operating properly before work is started.
- Notify the PI of all incidents of exposure or spills.

7.2 FLAMMABLE/COMBUSTIBLE MATERIAL

	Flash Point	Boiling Point
Flammable		
Class IA	< 73 deg F (22.8 deg C)	< 100 deg F (37.8 deg C)
Class IB	< 73 deg F (22.8 deg C)	>100 deg F (37.8 deg C)
Class IC	>73 deg F (22.8 deg C) and < 100 deg F (37.8 deg C)	
Combustible		
Class II	>100 deg F (37.8 deg C)&< 140 deg F (60 deg C)	
Class IIA	>140 deg F (60 deg C)&< 200 deg F (93 deg C)	
Class IIIB	>200 deg F (93 deg C)	

Flammable liquids have a flashpoint below 100F. The flash point is defined as the minimum temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air near the surface of the liquid. Flammable solids are materials that are easily ignited by external heat sources

General Hazard Control

- Eliminate ignition sources such as open flames, hot surfaces, sparks from welding or cutting, operation of electrical equipment, and static electricity.
- Ensure there is proper bonding and grounding when it is required, such as when transferring or dispensing a flammable liquid from a large container or drum. Assure bonding and grounding is checked periodically.
- Assure appropriate fire extinguishers and/or sprinkler systems are in the area.
- Keep the containers of flammable chemicals tightly closed at all times when not in use to prevent accumulation of flammable vapors.

Engineering Controls

Flammable and combustible chemicals should be used in a chemical fume hood (or other similarly ventilated area) whenever possible. This is especially true for highly flammable chemicals, large quantities (> 500mL) of flammable chemicals, or when using flammable chemicals at increased temperature or pressure.

Handling and Storage Guideline

- Store in NFPA-approved flammable liquid containers or storage cabinets, in an area isolated from ignition sources or in a special storage room designed for flammable materials.
- Segregate flammable chemicals from incompatible materials, such as oxidizers, corrosives, combustibles
- Flammable chemicals should not be stored in regular, domestic refrigerators/freezers. If a flammable chemical must be kept below room temperature, the refrigerator/freezer used for storage must be an approved explosion-proof.

7.3 CORROSIVES

Materials that can react with the skin, causing burns similar to thermal burns, and/or which can react with metal, causing a deterioration of the metal's surface. Corrosives can be liquids, solids or gases, and can therefore affect the skin, eyes and respiratory tract.

General Hazard Control

- Containers and equipment used for storage and processing of corrosive materials must be corrosion-resistant.
- Eye protection and appropriate gloves must be used when handling corrosive materials. A face shield, rubber apron, and/or rubber boots also may be appropriate.
- Never add water to acid. When mixing concentrated acids with water, add the acid slowly to water.
- An eyewash and safety shower must be readily accessible to areas where corrosives are used and stored. In the event of skin or eye contact with corrosives, immediately flush the area of contact with cool water for 15 minutes. Remove all affected clothing. Obtain medical help. See the "Personal Protective and Safety Equipment" section of this document for eyewash and safety shower specifications.

Engineering Controls

Corrosive chemicals should be used in a chemical fume hood when used in high concentrations, or when the chemical, or reactions with the chemical, may produce an airborne hazard such as a gas, mist or fume.

Handling and Storage Requirements

- Acids and bases may react violently with one another. Keep acids and bases stored separately.
- Liquid acids and bases must be stored in corrosion-resistant secondary containment that can hold the full amount of chemicals being stored
- Corrosive materials (acids and bases) must be stored below eye level, and should not be stored in flammable storage cabinets
- Corrosives should be stored in separate areas from organic chemicals and flammable/combustible materials

7.4 OXIDIZERS

Materials that react with other substances by giving off electrons and undergoing reduction. This reaction may result in fire or explosion. The intensity of the reaction depends on the oxidizing-reducing potential of the materials involved. The following steps must be followed.

General Hazard Controls

- Know the reactivity of the materials involved in the experiment or process. Ensure there are no extraneous materials in the area that could become involved in a reaction.
- If the reaction is anticipated to be violent or explosive, use shields or other methods for isolating the materials or the process.
- Minimize the quantities of oxidizers used and stored in the laboratory.
- Keep oxidizing materials away from heat, flammables and potential fuels such as clothing and other combustible materials.

Engineering Controls

- Oxidizing chemicals should be stored and used in a well-ventilated area.
- Safety shielding is required any time there is a risk of an explosion, splash hazard or highly exothermic reaction.

Handling and Storage Requirements

- Oxidizers should be stored away from any flammable/combustible material.

7.5 REACTIVE MATERIALS

Highly Reactive Chemicals hazard class includes a wide variety of hazards. Though basic control measures may be implemented for the class as a whole, the SDS of highly reactive chemicals should be consulted for specific information on hazard controls and safety measures. The following are different types of reactive materials:

- **Water-Reactive Materials**
    - Materials that react with water to produce a flammable or toxic gas or other hazardous condition. Often a fire or explosion results. Safe handling of water-reactive materials will depend on the specific material and the conditions of use and storage. Examples of water-reactive chemicals include alkali metals such as lithium, sodium, and potassium; acid anhydrides; and acid chlorides.
    - Store water-reactive chemicals in closed container in a dry place away from water, sources of water (e.g. sinks and safety showers) and water-containing chemicals (e.g. aqueous buffers, diluted acids). Containers of water-reactive chemicals should be tightly sealed and water-tight
- **Pyrophoric Materials**
    - Materials that ignite spontaneously upon contact with air. Often the flame is invisible. Examples of pyrophoric materials are silane, silicon tetrachloride, and white or yellow phosphorous. Pyrophoric chemicals must be used and stored in inert environments.
    - Store self-reactive, pyrophoric and self-heating chemicals at low temperatures away from direct sunlight, heat, sparks, open flames and hot surfaces. Because pyrophoric chemicals can ignite spontaneously when in contact with air, they must be handled under an inert atmosphere and in a way that prevents exposure to air. Extra care must always be taken when using these chemicals
    - Pyrophoric chemicals should be stored under an inert atmosphere or solvent to prevent exposure to air. Storage locations may include inert gas-filled desiccators or glove boxes. If a pyrophoric chemical must be stored below room temperature, the refrigerator/freezer must be an explosion-proof or modified domestic piece of equipment. Only those laboratory workers who have been trained on how to handle

highly reactive chemicals should have access to storage areas containing pyrophoric materials.

- **Peroxidizable Chemicals *(Organic Peroxides)***
    - Materials that undergo auto-oxidation *(a reaction with oxygen in the air)* to form peroxides *(an O2 group)* that can explode with impact, heat, or friction. Since these chemicals may be packaged in an air atmosphere, peroxides can form even though the container has not been opened, necessitating careful handling.
    - Store organic peroxides at low temperatures, but not at temperatures below the temperature at which they freeze. The sensitivity of most peroxides can be decreased by diluting them with an inert solvent (e.g. hexane). Do not allow contact of peroxides with metal lab ware, tools or equipment
    - Peroxide-forming chemicals should be kept away from heat and sunlight and their containers should be tightly sealed after each use. Refrigeration does not prevent peroxide formation. Containers of peroxide-forming chemicals should be labeled with the date received and the date opened. Because of the high potential for fires and explosions, these chemicals must be disposed of one year after the opening of the container, or by the expiration date (whichever is sooner). Laboratory personnel can test for the presence of peroxides to extend the shelf-life by one year.
    - The following steps must be taken:
        - Date all peroxide-forming chemicals upon receipt and upon opening. After the recommended disposal date, test the chemical for peroxides or dispose of them properly.
        - Do not open any container that has obvious solid formation around the lid.
        - Addition of an appropriate inhibitor to quench the formation of peroxides is recommended.
        - It is recommended to chemically test for peroxides periodically.
        - Follow the same basic handling procedures as for flammable materials.
        - EHS must be contacted to remove any peroxide-forming chemicals that are un-dated or have not been used for extended periods of time.
- **Light-Sensitive Materials**
    - Materials that degrade in the presence of light, forming new compounds that can be hazardous or resulting in conditions such as pressure buildup inside a container, which may be hazardous. Examples of light-sensitive materials include chloroform, tetrahydrofuran, ketones, and anhydrides.Store light-sensitive materials in a cool, dark place in amber-colored bottles or other containers that reduce or eliminate penetration of light.
- **Unstable Materials**
    - Compounds that can spontaneously release large amounts of energy under normal conditions or when struck, vibrated, or otherwise agitated. Some chemicals become increasingly shock-sensitive with age. Of great concern in the laboratory is the inadvertent formation of explosive or shock-sensitive materials such as peroxides, perchlorates *(from perchloric acid)*, picric acid, and azides.

- Contact EHS when it is suspected that the inadvertent formation of shock-sensitive materials in ductwork, piping, or chemicals being stored has occurred.
- Date all containers of explosive or shock-sensitive materials upon receipt and when opened.
- If there is a chance of explosion, use barriers or other methods for isolating the materials or the process.

General Hazard Control

- Whenever possible, use a less hazardous alternative chemical to complete the experiment.
- Minimize the quantity and/or concentration of highly reactive chemicals used or synthesized to the smallest amount immediately needed for an experiment.
- Plan experiments involving highly reactive chemicals carefully, including consulting the SDS(s). Do not handle highly reactive chemicals until all safety precautions have been read and understood.
- Ensure an appropriate fire extinguisher is nearby before using highly reactive chemicals.
- All containers of highly reactive chemicals should be dated as soon as they are received, and never opened after their expiration date.
- Combine highly reactive chemicals to other chemicals slowly, watching for increased heat or release of gases

7.6 CRYOGENS

Cryogenic liquids such as oxygen, nitrogen, argon, helium, and hydrogen are substances that are normally in the gaseous state but are cooled to extremely low temperatures so that they are liquids. Some of the hazards associated with cryogens are fire, pressure, weakening of materials, and skin or eye burns upon contact with the liquid.

General Hazard Control

- Equipment must be kept clean, especially when working with liquid or gaseous oxygen.
- Mixtures of gases or fluids must be strictly controlled to prevent the formation of flammable or explosive mixtures.
- Always wear safety glasses with side shields or goggles when handling cryogens. If there is a chance of a splash or spray, a full-face protection shield, an impervious apron or coat, cuffless trousers, and high-topped shoes should be worn. Watches, rings, and other jewelry must not be worn. Gloves should be impervious and sufficiently large to be readily thrown off should a cryogen spill occur. Pot holders also could be used.
- Cryogenic containers and systems should have pressure-relief mechanisms.
- Cryogenic containers should be made from materials such as austenitic stainless steels, copper, and certain aluminum alloys that are capable of withstanding extremely low temperatures.
- Since glass ampoules can explode when removed from cryogenic storage if not sealed properly, storage of radioactive, toxic, or infectious agents should be placed in plastic cryogenic storage ampoules.

7.7 COMPRESSED GASES

Special systems are needed for handling materials under pressure. Cylinders pose mechanical, physical, and/or health hazards, depending on the compressed gas in the cylinder.

- Cylinders with regulators must be individually secured. Only cylinders with valve-protection caps securely in place may be safely gang-chained *(chained in groups)*.
- When storing or moving a cylinder, have the valve-protection cap securely in place to protect the valve.
- Cylinders must be secured in an upright position at all times. Use suitable racks, straps, chains, or stands to support cylinders against an immovable object, such as a bench or a wall, during use and storage. Do not allow cylinders to fall or lean against one another.
- Use an appropriate cart to move cylinders. Cylinders should be secured to prevent rolling or falling off during transport.
- Never bleed a cylinder completely empty. Leave a slight pressure to keep contaminants out.
- Oil or grease on the high-pressure side of an oxygen cylinder can cause an explosion. Do not lubricate an oxygen regulator or use a fuel gas regulator on an oxygen cylinder. Use an oxygen-approved regulator. All wrenches used on oxygen cylinders should be made of non-ferrous material.
- Always wear goggles or safety glasses with side shields when handling compressed gases.
- Always use appropriate gauges, fittings, and materials compatible with the particular gas being handled.
- When work with a toxic, corrosive, or reactive gas is planned, EHS should be contacted for information concerning specific handling requirements. Generally, these gases must be used and stored with local exhaust ventilation such as a lab hood or a gas cabinet designed for that purpose.

7.8 FORMALDEHYDE

Any laboratory using formaldehyde (https://www.epa.gov/formaldehyde) in quantities that may exceed the Occupational Safety and Health Administration's *(OSHA)* **Short-Term Exposure Limit *(STEL)*** of 2.0 ppm or **Action Level** of 0.5 ppm has the potential of being covered under OSHA's **Formaldehyde Standard**. The Formaldehyde Standard has the following requirements: development of a sampling strategy for determining employee exposure to formaldehyde; periodic personal monitoring; providing and ensuring the use of appropriate personal protective equipment; medical surveillance; development of a written hazard communication program for formaldehyde; and providing information and training to employees on the hazards of working with formaldehyde.

- If a laboratory is using formaldehyde and would like an exposure assessment to determine if they are covered under OSHA's Formaldehyde Standard, it should contact EHS at *(410) 706-7055*.
- The following are some results from operations that have been sampled for formaldehyde; Sampling Data (https://www.umaryland.edu/ehs/occupational-safety-and-health/occupational-safety/sampling-data/).

7.9 RADIOACTIVE MATERIALS

Use of radioactive materials at the University is strictly controlled. Contact the Radiation Safety office at *(410) 706-7055* if you plan to use radioactive materials. See the Radiation Safety (https://www.umaryland.edu/ehs/research-safety/radiation-safety/) website for more information on the use of radioactive material at the University.

7.10 BIOLOGICAL MATERIALS

Please refer to the University's policies on the use of biological materials in the laboratories. Contact the Biosafety Office at *(410) 706-7055* if you plan to use unfixed human tissue, blood, or other bodily fluids,

or cells; recombinant or synthetic nucleic acid molecules, or infectious materials. See Biosafety (https://www.umaryland.edu/ehs/research-safety/biosafety/) for more information.

8. Emergency/Medical Procedures

8.1 Basic Steps for Emergency and Spill Response

Releases of hazardous substances that pose a significant threat to health and safety or that, by their very nature, require an emergency response regardless of the circumstances surrounding the release or the mitigating factors are emergency situations. The following definitions designate emergency situations:

- The situation is unclear to the person causing or discovering the spill.
- The release requires evacuation of persons.
- The release involves or poses a threat of fire, suspected fire, explosion or other imminent danger; conditions that are Immediately Dangerous to Life and Health (IDLH); high levels of exposure to toxic substances.
- The person(s) in the work area is uncertain they can handle the severity of the hazard with the personal protective equipment (PPE) and response equipment that has been provided and/or the exposure limit could easily be exceeded.

Conversely, releases that do not pose a significant safety or health hazards to person(s) in the immediate vicinity or to the person(s) cleaning up the material and do not have the potential to become emergencies within a short time frame are not emergency situations. The following situations are non-emergency situations:

- The person causing or discovering the release understands the properties and can make an informed decision as to the exposure level.
- The release can be appropriately cleaned by lab personnel.
- The materials are limited in quantity, exposure potential, or toxicity and present minor safety or health hazards to persons in the immediate work area or those assigned to clean up the activity.
- Incidental releases of hazardous substances that are routinely cleaned up by EHS need not be considered an emergency.

Instructions

First stop all work immediately and alert others in the area. Staff involved in the decontamination and disposal area of the affected spill will wear the appropriate level of personal protective equipment (PPE).

If there are questions about proper spill response techniques, call EHS at 410-706-7055. After hours, dial 911.

Emergency Situation — Fire: The following steps are basic protocol for handling a fire or fire-related emergency situation in the laboratory:

1. Pull the fire alarm
2. Call 911.
3. Evacuate using the nearest emergency exit.
4. Inform building emergency wardens or the building evacuation coordinator of the nature and location of the fire.

Emergency Situation – Spill: If the spill is of high toxicity or flammability or you are unsure of how to proceed or the spill is more than 1 liter, execute the following:

1. Evacuate personnel from the spill area and alert occupants to the spill.
2. Shut down equipment if possible.
3. Isolate the spill area and close doors to the room where the spill occurred.
4. For non-emergent/non-life-threatening spills, notify University Police at 410-706-6882 (or 6-6882 for a campus phone) and inform them to contact EHS. Evacuation of the building may be necessary if chemicals or contaminants could enter the air-handling system of a building.

   For emergent/life-threatening spills, activate the nearest fire alarm pull station and call 911.
5. Provide information about the nature and location of spill to emergency response personnel.

Attend to victims for a body or eye splash:

1. Remove victim(s) from spill area to fresh air only if an attempt to rescue victim(s) does not present a danger to the rescuers.
2. If contact with body:
   a. Remove contaminated clothing while under an emergency shower.
   b. Flood affected area with water for at least 15 minutes or longer if pain persists.
   c. Wash skin with mild soap and water — do not use neutralizing chemicals, unguents, creams, lotions, or salves.
3. If contact with eyes:
   a. Lead the victim(s) immediately to an emergency eye wash facility.
   b. Hold eye lids open.
   c. Flush eyes for at least 15 minutes or longer if pain persists.
4. The victim should follow standard injury reporting (https://www.umaryland.edu/policies-and-procedures/library/research/procedures/ehs/report-a-work-related-incident-or-illness.php) procedures, including submission of a first report of injury and seeking medical treatment. If the victim is unable to seek care on their own due to the seriousness of their condition, call 911. Have the SDS(s) for the chemical(s) involved available if possible.

Mercury Spills

1. Evacuate personnel from the spill area and alert occupants to the spill.
2. Isolate the spill area and close doors to the room where the spill occurred.
3. Contact EHS at 410-706-7055 to have a mercury spill cleaned up.

Non-Emergency Situation: If the spill is less than 1 liter and the chemical involved is of low toxicity and a low flammable hazard, handle it in the following manner:

1. Choose the proper protective equipment.
   a. Always wear gloves and protective eyewear. Use additional protective equipment such as an apron, coveralls, or boots if necessary.
2. Utilize absorbent materials (i.e., paper towels).
3. Confine or contain the spill.
4. Properly dispose of any contaminated equipment or waste.

5. Staff may still wish to contact EHS for further review.

Non-reactive spills:

1. Cover liquid spills with absorbent and scoop into a plastic disposal bag.
2. Sweep solid materials into a dustpan and place in a sealed container.
3. Follow the University Hazardous Waste Disposal Procedures for disposal.

Reactive or potentially reactive spills:

1. Cover liquid spills with absorbent and scoop into an appropriate disposal container.
2. Wet-mop dry substances to avoid spreading hazardous dust, provided it is not water-reactive.
3. If spilled chemical is a volatile solvent, transfer disposal bag to a hood for containment.
4. Follow the University Hazardous Waste Disposal Procedures (https://www.umaryland.edu/ehs/hazardous-material-management/) for disposal.

8.2 Injury and Illness

The Employee's First Report of Injury form (https://www.umaryland.edu/about-umb/offices/risk-management-and-workers-compensation/workers-compensation/) must be completed on all work-related employee injuries. The completed form must accompany the injured worker to University of Maryland Campus Health (UMCH). If the injury is not treated by UMCH, a copy of the completed form must be faxed to the Office of Risk Management at 410-706-0954 or scan and email a copy to UMBRiskManagement@umaryland.edu.

The Supervisor's Report of Injury and the Accident Witness Statement (https://www.umaryland.edu/about-umb/offices/risk-management-and-workers-compensation/workers-compensation/) should be completed and faxed immediately to the Office of Risk Management at 410-706-0954 whenever possible.

All serious injuries should be reported immediately to EHS at 410-706-7055.

Failure to follow the above procedure may result in the delay of payment for medical expenses and/or jeopardize the proper leave status for your work injury.

8.3 Medical Consultations and Examinations

Health assessments prior to work assignment for new employees may be required under certain circumstances.

The University must provide employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations that the examining physician determines to be necessary, under the following circumstances:

- When an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee must be provided an opportunity to receive an appropriate examination.
- Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the Permissible Exposure Limit) for an OSHA-regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected employee as prescribed by the particular standard.
- Whenever 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, the affected employee shall be

provided an opportunity for a medical consultation. Such consultations shall be for the purpose of determining the need for a medical examination.

- All medical consultations and examinations must be performed by or under the direct supervision of a licensed physician and must be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

The department or PI shall provide the following information to the physician:

- The identity of the hazardous chemical(s) to which the employee may have been exposed.
- A description of the conditions surrounding the exposure, including available quantitative exposure data.
- A description of the signs and symptoms of exposure that the employee is experiencing if any.
- A copy of the SDS(s).

The department shall obtain a written opinion from the examining physician that shall include the following:

- Any recommendations for further medical follow-up.
- The results of the medical examination and any associated tests.
- Any medical condition that may be revealed in the course of the examination that may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace.
- A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.
- The written opinion of the physician shall not reveal the specific finding of diagnoses unrelated to occupational exposure.

9. Standard Repair /Close-out/ Decommissioning Procedures

9.1 Decontamination of Equipment

Before repairing or moving equipment, any chemical, biological, or radioactive contaminants must be properly decontaminated. Follow the decontamination procedures outlined in the following section.

9.2 Preparing a Lab for Renovation Work

To protect construction workers and University personnel from hazards associated with laboratory work, the following procedures must be followed when work is to be performed in an area that has contained hazardous chemicals, biological hazards, and/or radioactive materials.

- Chemical Hazard: Any surface that a hazardous chemical has come in contact with must be wiped down with a solution of warm soap and water. This applies only to areas that construction workers, movers, or other maintenance staff would be exposed to in the normal course of their work. For example, fume hoods *(inside and out)*, laboratory bench tops, floors, refrigerators, and sinks must be cleaned. Chemical containers must be moved and stored away from where renovation work is to be performed in the laboratory.
- Biological Hazard: Any surface that a biological hazard has come in contact with must be decontaminated. A solution of 1:10 household bleach *(originally 5.25 percent sodium hypochlorite, diluted to 0.525 percent sodium hypochlorite)* can be used to inactivate most infectious agents. The PI is responsible for verifying that this has been performed and that sodium

hypochlorite was the appropriate material to use to inactivate the agent. This applies only to areas that construction workers, movers, or other maintenance staff would be exposed to in the normal course of their work. For example, laboratory bench tops, floors, biological safety cabinets, and clean benches, centrifuges, and refrigerators/freezers must be decontaminated. Biological safety cabinets are required to be decontaminated before being moved or serviced. The cabinet then must be recertified when it is installed in its new location. Please contact EHS to determine how the cabinet must be decontaminated well in advance of the planned move.

- Radiological Hazards: A *"certification for unrestricted use"* must be on file or obtained from the Radiation Safety Office. Contact Radiation Safety at *(410) 706-7055* for additional information and instructions.

All cleanup procedures must be performed using appropriate personal protective equipment *(PPE)*. After appropriate cleanup and decontamination has been completed, fill out, sign, and post a Renovation/Vacancy Clearance Form (https://www.umaryland.edu/ehs/research-safety/lab-start-up-or-clearance/) on the lab door or specific equipment.

9.3 CLOSEOUT PROCEDURES

To closeout a lab, either due to leaving the University or moving to a new space on campus, please follow the closeout SOP. If a large amount of chemicals/biological samples need to be disposed of, the Environmental Programs Manager must be contacted AT LEAST one month before the final day of lab operations.