Chemical Hygiene Plan

Chemistry Department of the College of Science and Technology

Millersville University

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A. CHEMICAL HYGIENE PLAN DESCRIPTION

Purpose

The Chemical Hygiene Plan (CHP) prepared by the Millersville University Chemistry Department Safety Committee aims to provide information to employees (faculty and staff), students and visitors about the necessary work practices, procedures and policies in order to ensure that all are protected from any potentially hazardous chemicals and processes found in a laboratory or work area.

Introduction

The Chemical Hygiene Plan is addressing all laboratory users (faculty, staff, students and visitors) engaged in handling or using hazardous chemicals. This CHP implementation intends to comply with the Occupational Safety & Health Administration (OSHA) Laboratory Safety Standards as indicated in: OSHA LAB STANDARD 29 CFR 1910.1450 (https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106) and the Pennsylvania (PA) Occupational & Industrial Safety Standards as indicated in the: (http://www.dli.pa.gov/Individuals/Labor-Management-Relations/bois/Pages/default.aspx#.V1mlD-TF_pL) which requires that exposures to hazardous chemicals be maintained at or below the permissible exposure limits (PELs). In order for this CHP to be effective, users of laboratory areas must have read and understood this plan as well as engage in the safety practices indicated by the plan.

B. ARGIRES SCIENCE COMPLEX (CAPUTO/RODDY HALLS) RESOURCES AND PROCEDURES

Safety Information

1. Safety Books and Manuals
   Safety books and manuals are available to all chemistry employees (faculty and staff). Those are located in the Chemistry department main office (see directory – Appendix III) and the General Chemistry preparatory area (see directory – Appendix III).

2. Safety Signs/Posters
   All Chemistry laboratories have the following safety features: Exhaust/ventilation (fume hoods) for chemical usage. Chemical storage areas and cabinets (chemical waste area, compressed gas cylinder racks, storage cabinets for flammable liquids, acids and bases), laboratory sinks, emergency eyewashes and showers, fire extinguishers, and access to spill kits. Safety signs and posters are used to alert employees (faculty and staff) as well as students to hazards that exist in their working laboratory area. Employees and students have the right to know of any hazards that exist along with any toxic substances found in their workplace.

The following must be indicated and signs must be posted wherever required:

a. Emergency Equipment and Exit and Evacuation Route Signs
   Employees must be aware of the emergency equipment location (e.g., chemical storage and waste areas, eyewash stations, safety showers, fire extinguishers) and they also must make students aware of their location during class. Signs indicating the exits from a laboratory space, in case of an emergency, as well as evacuation routes must be posted on all exit doors of each laboratory.

b. Emergency Telephone Numbers
   Signs indicating emergency telephone numbers are posted on all exit doors of each laboratory, and next to the nearest phones, as well as next to fire alarm locations and automated external defibrillators (AED). (Appendix I includes the sign with the emergency telephone numbers)
   Telephone numbers of faculty and staff associated with each laboratory, storeroom or stockroom area are shared with the Office of the Dean of the College of Science and Technology, the Environmental Health and Safety (EHS) Director as well as the Millersville University police.

c. No Eating/Drinking/Smoking
   Signs to indicate that there is no eating or drinking in the laboratories should be posted outside the door of each teaching and research laboratory. Smoking is not permitted in any area of Millersville University. It is the policy of Millersville University to comply fully with the Pennsylvania Clean Indoor Air Act, which prohibits smoking in all buildings, indoor areas, and in open or partially open space such as sports or recreational facilities, theaters or performance establishments.

d. Eyewear and Eye Protection
   All laboratories must have signs indicating that proper eye protection (safety glasses or goggles) must be worn before entering and working in any chemistry laboratory.

e. Acid and Flammable Storage Cabinets and Refrigerators
   Signs must be posted outside of storage cabinets indicating acid or flammable storage. A sign should be posted to indicate that no flammable materials should be stored in refrigerators that are not flammable-rated.

3. <u>Labels</u>
   a. Labels on all commercial chemical containers will be maintained and not defaced. Labels must include the following information:

i. The common name of the chemical
ii. Name of the company responsible for the product
iii. A hazard warning indicating the most serious health or safety hazard the chemical poses (e.g., corrosive, carcinogen, water-reactive, flammable)

b. Containers of chemicals synthesized in the laboratory must also be labeled to indicate the contents of the container.

c. Unlabeled containers, if unidentifiable, will be disposed of according to the Environmental Protection Agency regulations and this institution's hazardous waste disposal policy. Waste of unknown or incorrectly described composition presents difficult handling and disposal problems and may require costly analysis before removal and disposal can be accomplished. The cost of this analysis and disposal is the responsibility of the generator.

d. Any laboratory employee finding a container without the minimum required information, an unlabeled container, or a label that is torn or illegible must report it immediately to their supervisor.

4. Accident/Incident Report Form

In case of an accident involving faculty members, staff, or students, an accident report must be filled out for injuries occurring during laboratory or classroom instruction - (the Accident Report Form can be found in Appendix I). If faculty or staff are injured in the workplace, they should fill out a workers' compensation form available in the Human Resources website. All accident reports are collected and filed by the Chair of the College Safety Committee and shared with the College Safety Committee as well as the Department Chair, the Dean, the Health Services Doctor, the Chief of University Police and the Environmental Health & Safety Director. Actions are then taken to prevent recurrence of the accident.

5. Safety Data Sheets (SDS)

a. The Chemistry Department is responsible for maintaining and updating a master inventory of all chemicals used and stored in all chemistry teaching laboratories and preparation areas. Each chemistry faculty is responsible of maintaining and updating the chemical inventory in their own research laboratories. Each research laboratory chemical inventory must also be part of the master inventory of the Chemistry Department. The master chemical inventory must be shared with the Environmental Health & Safety Director. The Environmental Health & Safety Director will maintain a master inventory of all chemicals used and stored at Millersville University (paper or electronic format).

b. Safety Data Sheets (SDS) must be maintained in the Chemistry department to ensure that all chemistry employees (faculty, staff) as well as students have access to them. A copy of each SDS must be forwarded to the Environmental Health & Safety Director.

Emergency Response & Preparedness

1. Emergency Phone Numbers
   Telephone numbers of faculty and staff associated with each laboratory, storeroom or stockroom areas are shared with the Office of the Dean of the College of Science and Technology, the Environmental Health & Safety Director as well as the Millersville University Police.
   Additional Emergency Numbers are indicated in the directory – Appendix III.

2. Fire Drills/Evacuation/Fire Safety Training
   Practice fire drills are conducted semi-annually for each Millersville University academic and administrative building. Practice fire drills are performed to ensure fire safety systems are functioning properly, and to educate students, faculty and staff how to safely evacuate a building in case of a fire or emergency. The Environmental Health & Safety Office offers fire safety training programs such as fire safety awareness and fire extinguisher training.

3. Emergency Exit Routes and Assembly Points
   Emergency exit route signs are posted in all laboratories, offices, and hallways. In case of a fire or emergency, faculty, staff and students are to safely evacuate the building using the route leading to the closest exit. Once outside the building, individuals are to keep 100 feet away from the building (assembly points are located at the north, south, west and east of the science complex) and remain there until an official (Fire Chief, police officer, EHS Director) indicates that is safe to return to the building.

4. Proficiency of Lab Personnel in Use of Emergency Equipment
   Laboratory personnel should be proficient on how to use and operate emergency equipment such as eyewash stations, safety showers, spill kits and fire extinguishers. Laboratory personnel should also be aware of the location of first aid kits and closest evacuation route in case of an emergency.

Emergency Response & Preparedness Equipment

1. Fire Extinguishers
   All laboratories are equipped with at least one fire extinguisher, which is fastened to the wall closest to the laboratory exit. Fire extinguisher type “ABC” is the most common type of fire

extinguisher one can find in the chemistry laboratories. This is a combination fire extinguisher, which will put out fires involving combustible materials like paper, flammable liquids like gasoline, and electrical fires. The fire extinguishers are inspected annually by the office of EHS.

2. Smoke Detectors/Sprinklers/Fire Alarms
   All laboratories and offices as well as classrooms are equipped with smoke detectors and a sprinkler system. The office of EHS inspects those annually. Fire alarms are located throughout the Argires Science Complex and are visual as well as audible when activated. The office of EHS inspects those annually.

3. Eyewash and Safety Showers
   All laboratories are equipped with eyewash stations and safety showers. The eyewash stations and safety showers should be free of any obstructions. Eyewash stations and safety showers are inspected annually.

4. First Aid Kits
   All laboratories have access to first aid kits for simple injuries. When injuries require medical assistance, people are directed to the Millersville Health Services or the nearest hospital (see directory – Appendix III).

5. Spill Clean-up Kits
   All laboratories have access to laboratory appropriate spill clean-up kits.

6. Spill Clean-up Cart - Contents and Location
   A spill clean-up cart is available (see directory – Appendix III). The cart contains a biohazard kit as well as spill kits for large spill containment (mercury, acid, base) and personal protective equipment (different types of gloves, goggles, face shield, respirators and rubber boots).

Personal Protective Equipment

Personal Protective Equipment (PPE) includes, but is not limited to protective eyewear (safety glasses, goggles) and protective apparel [clothing (lab coat, chemically-resistive apron) closed-toed shoes, gloves].

1. Protective Eyewear
   a. To minimize the risk of eye injury, the Chemistry Department requires that all faculty, staff, students and visitors, wear eye protection at all times while in laboratories.

b. Eye protection is required when an operation or activity has the potential of an eye injury from liquids, impact, glare, or any other foreign object entering the eye. Eye protection is required whether or not one is actually performing a "chemical operation".

c. Contact lenses offer no protection against eye injury and cannot be substituted for safety glasses and goggles. Wearers of contact lenses must also wear appropriate eye protection in a hazardous environment.

d. Prescription glasses do not provide adequate protection against injury, and their use should be limited to providing minimal protection when one is present in the laboratory but not carrying out a chemical operation.

e. Safety glasses with side shields and goggles provide the minimal level of acceptable protection when working in a chemical laboratory. Those should be worn when carrying out operations in which there is reasonable danger from splashing chemicals, flying particles, *etc*. Eye protection should be designed and used so that it provides both adequate ventilation and protects the wearer from splash entry.

f. In some instances "safety shields" should be set up around experiments for additional protection. Since goggles offer little protection to the face and neck, full-face shields should be worn when conducting particularly hazardous laboratory operations. In addition, the use of laser or ultraviolet light sources requires special glasses or goggles.

2. <u>Protective Apparel (clothing, shoes, gloves)</u>
   The specific hazardous substances being used in an experiment determine the choice of protective apparel. However, certain general guidelines should be observed at all times in the laboratory.

   a. Skin contact with any potentially hazardous chemical should always be avoided. If skin comes in contact with the chemical, immediate flushing of the affected area with water for 10-15 min is required. If further medical attention is required, one should be directed to the MU Health Services or the nearest hospital (see directory – Appendix III).

   b. Certain chemicals and classes of chemicals require that protective apparel be worn, such as a lab coat or a chemical-resistant apron.

   c. Bare feet, sandals, or open-toed shoes should be avoided. Closed-toed shoes should always be worn in the laboratory. Long hair and loose clothing should be confined when present in the laboratory.

d. Suitable gloves must always be worn when working with hazardous substances. Gloves made of material known to be resistant to permeation by the substance in use must be chosen. In some cases, two gloves should be worn on each hand to ensure that no exposure will occur in the event of damage to the outer glove. More information about the appropriate gloves to be used (e.g. latex, nitrile, neoprene, *etc.*) when handling a chemical substance is included in the individual chemical's SDS.

Always inspect gloves for small holes or tears before use. In order to prevent the unintentional spread of hazardous substances, always remove gloves before handling objects such as doorknobs, telephones, pens, *etc*.

References

Occupational Safety & Health Administration (OSHA) Laboratory Safety Standards: OSHA LAB STANDARD 29 CFR 1910.1450 https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106

Pennsylvania (PA) Occupational & Industrial Safety Standards: http://www.dli.pa.gov/Individuals/Labor-Management-Relations/bois/Pages/default.aspx#.V1mlD-TF_pL

Lock Haven University Chemical Hygiene Plan: http://www.ehs.wisc.edu/chemicalhygieneplan.htm

University of South Carolina Chemical Hygiene Plan: http://www.chem.sc.edu/faculty/morgan/safety/

Mechanical/Physical Safety

1. Lighting
   a. Lighting should be adequate to perform tasks. Expired lamps in lab spaces should be replaced immediately or as soon as possible.

   b. Workers should observe caution with the heat created by lights. Lights should be allowed to cool before they are touched or moved.

   c. Light stands must be stable. Loose cables should be bundled or attached to the floor.

   d. Electrical power overload should be avoided.

   e. All lights should have adequate ventilation. Incandescent lamps should not be covered.

2. Indoor Air Quality
    a. General laboratory ventilation must comply with Pennsylvania state building codes and OSHA standards.

    b. General laboratory ventilation must operate continuously during working hours to provide a source of air for input to local ventilation devices.

    c. Doors to laboratories should be kept closed, as containment of hazardous materials is partially dependent on proper balance of airflow. Disruption of the positive pressure in the corridor by a laboratory door opened for an extended period of time may result in transmission or airborne materials from the laboratory to the corridor. Laboratory fume hoods will also function more efficiently when the door is kept closed.

    d. General laboratory ventilation should not be relied on for protection from toxic substances. The ventilation system shall direct airflow into the laboratory from non-laboratory areas and out to the exterior of the building.

3. Vacuum systems
    a. Local vacuum pumps, when used, should have exhaust ventilation, such as a spot exhaust.

    b. Vacuum pump oil should be changed regularly. Any worker changing pump oil should wear protective clothing such as gloves and eye protection. Used pump oil should be treated as hazardous waste.

    c. Local exhaust ventilation systems must be used after every effort has been made to control the contaminant by isolation, a change in the process, or by substitution of a less harmful material.

    d. The following activities must be conducted in a laboratory fume hood or under vacuum:
        i. Chemical reactions
        ii. Heating or evaporating solvents
        iii. Work involving explosive or reactive chemicals
        iv. Working with 100 milliliters or more of a substance, which is known to be a fire hazard

4. Fume hoods
    a. Fume hoods should be used when chemicals or process reaction byproducts are considered to be carcinogens, reproductive toxins, allergens, or highly toxic and the breathing zone air concentration (if no hood is present) exceeds the substance's permissible exposure limit (PEL), threshold limit value (TLV), or other safe limit.

    b. The ventilation flow rate must be commensurate with federal and state regulations. Fume hoods should be maintained in working order.

5. Faucets/Drains

   Faucets and drains should be inspected annually by the method of turning on water at maximum capacity and allowing it to drain into the basin for five minutes.

6. Floors

   Floors must be kept clean and uncluttered in order to allow egress and to prevent accidental tripping over equipment. Spills of hazardous materials should be cleaned immediately. (see sections 5 and 6 of Emergency Response & Preparedness Equipment)

7. Electricity

   a. Electrical hazards should be minimized. Equipment or lab apparatus should be inspected for damage before use. Damaged equipment or equipment with frayed electrical wiring, should never be used.

   b. Rubber-soled shoes should be worn when working with high voltage or high current.

Chemical Safety

This section defines criteria and procedures for safe handling of chemicals.

1. Chemical Storage

   a. An organizational scheme must be adopted in each laboratory to ensure that incompatible chemicals are not stored in close proximity. For example, strong acids and bases must not be stored close to one another and strong oxidizers must be kept away from flammable materials.

   b. Proper labeling of stored chemicals must be maintained. Labels that are falling off of bottles or are becoming difficult to read must be replaced with new labels that fully document the contents.

   c. Working containers of chemicals should not be kept on benches for extended periods of time. Working containers must be labeled to indicate their contents.

   d. Storage of chemicals in fume hoods should be minimized to prevent interference with airflow and reduce the risk of accidents while working in the hoods.

   e. Proper attention must be paid to acceptable storage conditions for chemicals as noted in the SDS, e.g. temperature, light exposure, *etc.*

   f. Secondary containment trays should be used to minimize the effects of spilled or broken containers.

   g. For any chemicals that have the potential to undergo hazardous reactions (e.g. peroxide formation) over time, the date of opening must be noted on the container.

Such chemicals must be tested for hazardous condition or disposed of no later than the expiration date specified by the manufacturer. If no expiration date is provided, the recommendations provided in [1] should be followed.

h. A stockroom or storeroom in which large quantities of chemicals are stored must have access restricted to authorized persons and must be locked when such persons are nor present.

i. Shelving for chemical storage must be secured to the building structure to prevent tipping. Shelving should be composed of corrosion resistant materials and include "lips" to prevent items from sliding off.

j. Chemical storage areas must meet all applicable fire codes.

k. Flammable materials must be stored in cabinets designed for that purpose that meet applicable OSHA and NFPA specifications. Container size and composition for these materials must likewise meet OSHA and NFPA requirements.

l. Gas cylinders must be clearly labeled in regard to contents. Cylinders must be restrained by suitable brackets or chains secured to the building structure. Cylinder caps should be installed on all cylinders not in active use. When moving gas cylinders, a hand truck designed for that purpose must always be used.

m. Laboratory refrigerators and freezers suitable for storage of flammable materials should be clearly marked as such. Refrigerators and freezers that are not specifically designed for flammable materials must bear signage indicating that storage of class I flammable materials is forbidden. Under no circumstances may food intended for consumption be stored in laboratory refrigerators or freezers.

2. Chemical Hazards

Investigators (faculty, staff, students and visitors) must understand the hazards associated with all chemicals with which they work. The primary resource in this endeavor is the chemical's Safety Data Sheet (SDS), which should be obtained from the vendor for any purchased chemical. The SDS describes the hazards associated with a chemical, suitable storage conditions, and incompatibilities with other materials. This information must be understood before any work with a chemical begins.

Other resources for gathering information about hazardous chemicals are the regulations promulgated by the US Department of Transportation (DOT) and the US Environmental Protection Agency (EPA).

These regulations can be accessed online through the Government Publishing Office portal at: https://www.gpo.gov/fdsys/search/home.action

The US Department of Transportation defines nine hazard classes for materials:

a. Explosives. This class is defined at 49 CFR 173.50

b. Gases (flammable, non-flammable, toxic). This class is defined at 49 CFR 173.115

c. Flammable and Combustible Liquids. This class is defined at 49 CFR 173.120

d. Flammable Solids. This class is defined at 49 CFR 173.124

e. Oxidizers and Organic Peroxides. This class is defined at 49 CFR 173.127 and 173.128

f. Poisonous or Infectious Substances. This class is defined at 49 CFR 173.132 and 173.133

g. Radioactive Materials. This class is defined at 49 CFR 173.134

h. Corrosive Materials. This class is defined at 49 CFR 173.136

i. Miscellaneous Hazardous Materials. This class is defined at 49 CFR 173.140
- Ethidium Bromide (see Appendix IV for Usage Policies)

At 49 CFR 172.101, The Department of Transportation publishes the Hazardous Materials Table, which identifies the hazard classes for many substances. Although this is primarily intended for use in meeting shipping regulations, it is a useful resource for those who wish to use a listed material.

EPA regulations have the primary goal of preventing hazardous waste from causing environmental damage and, as such, are mainly of concern to personnel who manage the waste stream. It is nonetheless incumbent upon investigators (faculty, staff, students and visitors) to have some familiarity with these regulations, as there is considerable overlap between laboratory safety and environmental risk. The most relevant EPA regulations for purposes of laboratory work can be found at 40 CFR 260 and 261 where general definitions and criteria are given.
Of particular concern are “acutely hazardous” chemicals on the “P-list” at 40 CFR 261.33(e). Aside from their highly hazardous nature, the presence of these materials in the waste stream in significant quantity can affect the University's waste generator classification. The Chemistry Department Safety Committee should approve use or generation of these materials.

3. Chemical Transportation
In general, the transportation of chemicals by university personnel is discouraged due to safety and legal considerations. Exceptions may be made for purposes of chemical demonstrations for off-campus outreach activities. In such cases, the department chair and the safety committee must approve the transport. Requirements described in ACS publication “Safe Transportation Recommendations for Chemicals Used in Demonstrations or Educational Activities” [https://www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/safetypractices/transporting-chemicals.pdf] must be followed.

References

"Review of Safety Guidelines for Peroxidizable Organic Chemicals" J. Chem. Health Saf., September/October 1996, 3(5), pp. 28–36.

Radiation/Magnetic Safety

1. Radioactive Materials

   The use of radioactive materials entails a unique set of requirements. Before any radioactive materials are procured, a detailed plan must be drawn up indicating that state and federal licensing requirements have been met, how the materials will be stored and secured, used, and disposed of when no longer needed. The Department Chair, the Chemistry Department Safety Committee and the University Director of Environmental Health & Safety must approve this plan.

2. Lasers

   Lasers are an essential component of several laboratory instruments. In such systems, to prevent inadvertent exposure to the beam, the instrument manufacturer will generally provide interlocks. Should a situation arise in which the proper operation of such an interlock is in question, the instrument must be taken out of service until repairs can be made.
   Use of standalone lasers in laboratories requires engineering controls and signage pursuant to ANSI Z136.1 [https://www.lia.org/PDF/Z136_1_s.pdf].

3. Radio frequency (RF)

   Radio frequency fields may be present in the vicinity of some instruments (e.g. NMR spectrometers). Warning signs must be conspicuously posted at the entrance to laboratories in which such fields may be present.

4. Magnetic Fields

   Strong static or low frequency magnetic fields may be present in the vicinity of some instruments. These fields may present a risk to persons with medical implants as well as a projectile hazard involving magnetizable objects. Warning signs must be conspicuously posted at the entrance to laboratories in which such fields may be present.

Biosafety

As needed, the Department of Chemistry at Millersville University of Pennsylvania will work with all appropriate departments and administrative offices to help ensure that all of the following are in place throughout the instructional and research laboratories where potential biohazards are located:

- appropriate biosafety training
- standard operating procedures
- waste handling
- emergency protocols

This biosafety plan will include the use of:

- proper laboratory practices and procedures
- personal protective equipment (PPE)
- safety equipment
- containment systems
- a facility design that enables the appropriate level of containment relative to the biological hazard in use

References

Biological Safety at Penn: http://www.ehrs.upenn.edu/programs/bio/

Biological Safety Manual: http://www.ehrs.upenn.edu/programs/bio/bsm/

Hazardous Waste

1. General Principles

   With very few exceptions (e.g. dilute non-toxic salt solutions), all waste materials produced during laboratory work must be placed in designated hazardous waste receptacles. Such containers must be clearly labeled as to the general class of waste (e.g. "inorganic", "non-halogenated organic", *etc.*) as well as a list of the specific contents.

   The College Safety/Lab Technician is responsible for collecting waste containers from laboratories as necessary, generating manifests detailing the contents and characteristics of the waste, and transporting the containers to the university's central waste accumulation site for storage. At regular intervals, a licensed waste disposal contractor will collect the waste from the central storage site for disposal in accordance with EPA regulations.

2. Work Practices

   a. The generation of hazardous waste should be minimized. Investigators (faculty, staff, students and visitors) are encouraged to develop and use validated experimental procedures that replace hazardous materials with non-hazardous materials, minimize generation of hazardous wastes, or result in effective treatment of wastes to reduce or eliminate hazardous characteristics.

   b. When adding waste to a receptacle, it is essential that the name of the waste material be added to the list of receptacle contents in a clear and legible manner. Use of abbreviations should be avoided unless such abbreviations are universally understood.

   c. Chemical waste receptacles must not be overfilled. A minimum of 10 – 15% headspace should be left in liquid waste containers to allow for thermal expansion.

   d. Designated broken glass containers are present in laboratories. If a piece of glassware is broken, any hazardous residue should be rinsed into an appropriate waste receptacle and the broken pieces should then be disposed of in the broken glass container. Other

waste that presents a puncture hazard (e.g. hypodermic needles) must be placed in a properly labeled puncture resistant container for disposal. Disposal of such items in general wastebaskets is forbidden.

e. Chemical waste should be segregated by characteristic as indicated on the container label. For example, flammable organic waste such as acetone should be disposed of in a container labeled "organic" waste as long as there are no halogenated components present. Halogenated organic waste must be placed in an appropriately labeled container.

f. The use of mercury and mercury compounds in laboratory work is strongly discouraged and should be avoided if any suitable substitute exists. If mercury compounds are used, quantities must be minimized and waste must be scrupulously confined to a waste receptacle specifically labeled for mercury bearing waste.

g. Biologically hazardous waste must be collected in special bags designed and labeled for that purpose. These bags will be collected and disposed of by a licensed contractor periodically.

Lab Safety Training

1. General Safety Training Guidelines & Safety Culture

   In adherence with the 2015 ACS Guidelines & Evaluation Procedures for Bachelor's Degree Programs all of the following groups will be responsible for reading, understanding, and adhering to all sections of this Chemical Hygiene Plan.

   - research advisors
   - laboratory instructors
   - chemistry department staff members

   In adherence of OSHA, the state of Pennsylvania occupational and industrial safety standards, and the 2015 ACS Guidelines & Evaluation Procedures for Bachelor's Degree Programs, research advisors and/or laboratory instructors will ensure that all individuals working with chemicals (laboratory workers: including undergraduate students, coworkers, and guests) have all of the necessary information and training to ensure that they are informed of the chemical hazards present in their work area (undergraduate research laboratories and/or teaching laboratories).

   In adherence with the 2015 ACS Guidelines & Evaluation Procedures for Bachelor's Degree Programs our program in the department of chemistry at Millersville University of Pennsylvania:

- seeks to continually ensure that that all of the students are instructed in all aspects of current chemical safety and general laboratory safety appropriate to their educational, scientific, and professional needs and aspirations.
- maintains a strong culture of safety in which students are initially trained, periodically practice, demonstrate, and consistently apply their understanding of laboratory and chemical safety practices germane to their current laboratory setting and experimental work.

- organizes curriculum so that all students' safety training begins during their very first chemistry laboratory experience at Millersville University in their initial Chemistry 111 (Introductory Chemistry/General Chemistry) Laboratory Course.

- structures curriculum so that each student's safety training continues, as appropriate, through every single laboratory course that they participate in during their education in the department.

- arranges safety curriculum so that important themes and concepts are intermittently reviewed and mindfully spiraled throughout our curriculum to encourage prudent long-term habits and practices of chemical and laboratory safety.

2. Student Safety Training

Prior to beginning undergraduate research within the department, students have already completed general laboratory safety training throughout their pre-requisite coursework (general chemistry I and II and organic chemistry I and II/CHEM 111, 112, 231, and 232).

Undergraduate research students also receive project specific and laboratory specific training appropriate to their individual research projects and the safety needs of their research advisor's research group.

Students' safety understanding and skills are developed throughout our entire curriculum and assessed throughout our curriculum.

- The entire laboratory curriculum includes ample and engaging discussion of the need for safe practices, risk assessment, and experiment specific safety considerations and concerns.

- Students develop the skills necessary to safely and responsibly segregate and dispose of all waste (chemicals, chemically contaminated, and biologically contaminated).

- Students are trained to seek out, comply with, and adhere to any and all safety regulations for any laboratory that they are working in presently and in the future.

- Students are trained on the prudent selection of and the responsible use of personal protective equipment to minimize exposure to hazards.

- Students are trained in how to seek out and understand the categories of hazards associated with chemicals (health, physical, and environmental).

- Students are trained in the use of Safety Data Sheets (SDS) and other online reference materials and databases.

- Students are trained to recognize chemical and physical laboratories. They are trained to assess the risks from these hazards.

- And they are trained in discerning how best to minimize the risks and prepare for emergencies.

3. Additional Safety Training Responsibilities & Resources

As mandated by OSHA and encouraged by the Pennsylvania occupational and industrial safety standards, all laboratory workers (students, coworkers, and guests) will be educated on how to safely and responsibly work with and properly dispose of all chemicals that they are working with.

The laboratory instructor and/or research advisor shall ensure that all new laboratory workers receive the necessary safety and waste disposal instruction, training, and education prior to working with any chemicals.

Laboratory workers shall take an active role in their training in conjunction with other parts of this Chemical Hygiene Plan.

Additional training resources can be found on the following sites:

- ACS Committee on Chemical Safety: https://www.acs.org/content/acs/en/about/governance/committees/chemicalsafety.html

- ACS Chemical Safety Practices & Recommendations: https://www.acs.org/content/acs/en/about/governance/committees/chemicalsafety/safetypractices.html

- Creating Safety Cultures in Academic Institutions: https://www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/academic-safety-culture-report-final-v2.pdf

- Laboratory Waste Management: A Guidebook: https://global.oup.com/academic/product/laboratory-waste-management-9780841227866;jsessionid=0E1033A98CEB2C083BFA2E2465FFED0E?cc=us&lang=en&

- Safe Transportation Recommendations for Chemicals Used in Demonstrations and Educational Activities: https://www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/safetypractices/transporting-chemicals.pdf

As appropriate, the following topics are covered during course laboratory specific training and undergraduate research specific training throughout the curriculum in the Department of Chemistry at Millersville University and will be available in the chemistry department office (see directory – Appendix III):

- The contents of the OSHA standard 29 CFR 1910.1450 and its appendices that shall be available to all chemistry department employees.

- Millersville University Department of Chemistry's Chemical Hygiene Plan shall be available to all chemistry department employees.

- The location (physical and/or online) and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the department and in each specific laboratory. This may include Safety Data Sheets (SDS) and other reference sources including SciFinder.

- The existence of Standard Operating Procedures (SOP) and their applicability to each specific laboratory.

- The emergency procedures provided by Millersville University of Pennsylvania's office of EH&S.

Additional training provided by the undergraduate research advisors should be as specific to the activities conducted in the research laboratory as possible. When applicable, it should include:

- The permissible exposure limits for OSHA regulated substances (or published exposure limits for hazardous chemicals where there is no applicable OSHA standard) for chemicals used in their lab.

- Signs and symptoms associated with exposures to hazardous chemicals used in their laboratory.

- Health risks (both chemical and physical) posed by the experimental procedures conducted in their lab.

- The existence and location of all designated safety areas (showers, eyewash stations, chemical waste, *etc.*) in the laboratory.

- The selection and use of personal protective equipment appropriate for laboratory tasks. See the table of contents to locate the section of this CHP containing additional information on personal protective equipment.

References

ACS Guidelines & Evaluation Procedures for Bachelor's Degree Programs: https://www.acs.org/content/dam/acsorg/about/governance/committees/training/2015-acs-guidelines-for-bachelors-degree-programs.pdf

OSHA 1910.1450: Occupational Exposure to hazardous chemical in laboratories: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106

PA occupational and industrial safety standards: http://www.dli.pa.gov/Individuals/Labor-Management-Relations/bois/Pages/default.aspx#.V12wWI6wXf7

UPenn Chemical Hygiene Plan (Section II): http://www.ehrs.upenn.edu/programs/labsafety/chp/prepare.html

Lab Inspection Programs

1. Inspections
   Departmental Safety Committee members will hold inspections periodically. Infractions of policy will be reported to the department chair and to the owner of the lab in which the hazards were detected.

2. Lab Self-Inspection Checklist
   The committee will periodically develop a Lab Self-Inspection Checklist. This list is to be distributed to all teaching and research faculty members who will perform the lab self-inspection at least once every academic year.

Safety Responsibility of Science and Technology Faculty and Staff

1. Safe Practices of Lab Workers
   Lab workers (ex. students, staff, faculty, visiting faculty) should exercise caution when working in laboratories.

2. Safety Training of Students
   a. All lab courses shall include safety training and chemical hygiene protocols as part of the course coverage.
   b. The instructor of record is responsible for disseminating information regarding hazards to all students.
   c. Research lab owners (principal investigators) are responsible for disseminating information regarding hazards to students involved in research.

APPENDIX I

Millersville University

Emergency Calls

Medical and Life Threatening Emergencies

In an emergency **call 911**

If the building needs to be evacuated, leave the building and **call 911** from a safe location

Non-Emergency Calls

Non Life Threatening Medical or General Assistance*

In a non life threatening medical situation or for general assistance

call the University Police: 871- 4357

*General assistance examples:

1) Requesting the opening of a campus building, 2) Reporting problems with a motor vehicle

3) Reporting an incident or unsafe condition, 4) Reporting a malfunctioning elevator

MILLERSVILLE UNIVERSITY
College of Science and Technology

ACCIDENT REPORT FORM

Date of Report: _____

Report Filed by: _____ **Department:** _____

Person(s) Involved: _____ **Department:** _____

MU# of Person(s) Involved: _____

Accident Date: _____ **Time:** _____ **Room Number:** _____

Cause and Description of Accident: _____

_____

_____

_____

_____

Action Taken: _____

_____

_____

_____

If the injured person is escorted to the Infirmary for medical aid, the **signature of the instructor** or the **University Police Officer** who accompanies the individual is to be given below.

Signature of Escort: _____

Date: _____ **Time:** _____

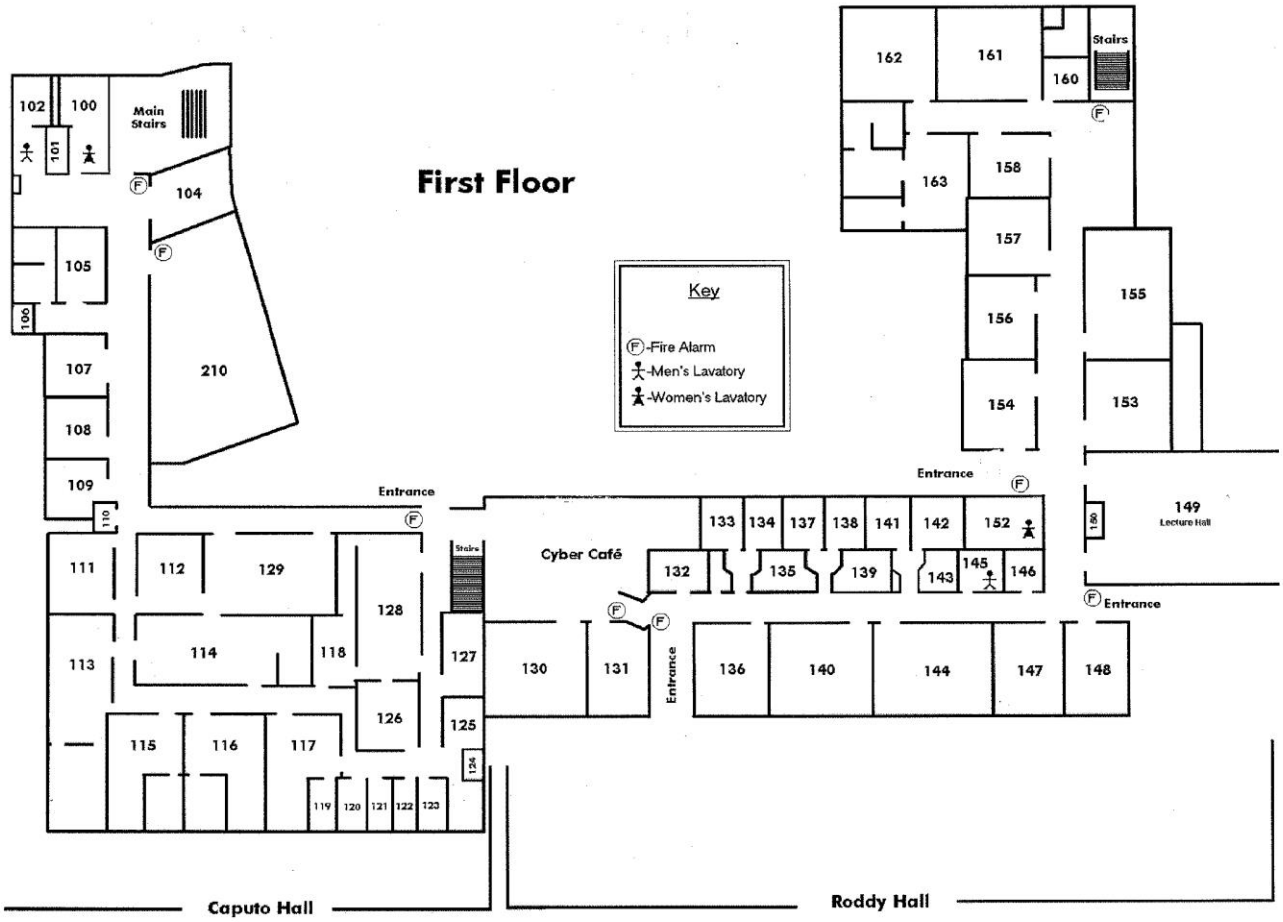
RETURN COMPLETED FORM TO: **Dr. Maria Schiza**
Chair of the Safety Committee and Safety Officer for the College of Science & Technology

cc Ms. Joanne Ocasio, BSN, RN, Nurse Supervisor, Health Services
Dr. M. Jackson, Dean, College of Science and Technology
Mr. P. Weidinger, Employee Health and Safety Officer
Chief Pete Anders, University Police
Department Chairperson

06/17

APPENDIX II

Argires Science Complex (Caputo/Roddy Halls) – Floor maps: 1st through 4th floors




Second Floor
Entrance
Dean's Office
Armstrong Auditorium
Elevator
Stairs to First Floor Courtyard
Greenhouse
Courtyard
Computer Lab
Lecture Hall
Raised Outdoor Walkway
Communications
Conference Room
Caputo Hall
Roddy Hall


Observation Deck
401
Meteorology Lab & Weather Center
400
STB Storeroom
301
302
303
402
403
404
405
409
410
411
Elevator
305
310
312
311
313
Roof
Fourth Floor
Caputo Hall
Breezeway Lounge
316
315
317
319
318
320
324
321
322
323
326
325
327
329
331
328
330
332
Stairs
Third Floor
Caputo Hall

APPENIX III - DIRECTORY

Room Number Directory

	Room	Telephone
Chemistry Department Main Office	Caputo 234	(717) 871-4297
General Chemistry Preparation Area	Caputo 330	
Chemical Spill Clean-up Cart Location	Preparatory room behind Caputo 210	

Life Threatening Emergency and Incident Report - Phone Number Directory

	Telephone	Address	Website
Fire, Police, Ambulance, Medical Emergency	911		
Millersville University Environmental Health & Safety Office	(717) 871-4950	P.O. Box 1002 Millersville, PA 17551-0302	https://www.millersville.edu/hr/ehs/index.php
Lancaster General Hospital	(717) 544-5511	555 N Duke St, Lancaster, PA 17602	http://lancastergeneralhealth.org/LGH/
Lancaster Regional Medical Center	(717) 291-8211	250 College Ave, Lancaster, PA 17603	http://www.lancastermedicalcenters.com/

American Association of Poison Control Centers	(800) 222-1222		www.aapcc.org
PA Department of Environmental Protection (DEP)	(866) 825-0208		http://www.dep.pa.gov/About/ReportanIncident/Pages/default.aspx#.V2FTMS5v_RY

Other Assistance for Millersville University (MU) – Phone Number Directory

	Telephone
Non-Emergency Medical Care (MU Health Services)	(717) 871-5250
Non-Emergency Police	(717) 871-4357
Facilities and Maintenance Operations	(717) 871-7874 or (717) 871-7875
Environmental Health & Safety Office	(717) 871-4950
Help Desk	(717) 871-7777
Information	(717) 871-4636 (INFO)
Student Memorial Center (SMC) Information Desk (open 24 hours/7 days a week)	(717) 871-4636
Threat Assessment Team (TAT)	(717) 871-7070
Telephone Repairs	(717) 871-7777

Argires Science Complex (Caputo/Roddy Halls) - Telephone Directory - Important Offices & Telephone Extensions (All phone number extensions start with (717) 871-)

BIOLOGY		
Hoover, John (Dept. Chair)	7427	Caputo 312
Roberts, Beth *(Dept. Secretary)*	4321	Roddy 288A
CHEMISTRY		
Drennen, Emily L. *(Dept. Secretary)*	4297	Caputo 234
Peurifoy, Stephen *(Safety/Laboratory Technician)*	7413	Caputo 330B

Rajaseelan, Edward (Dept. Chair)	7395	Caputo 213
Schiza, Maria *(Safety Committee Chair)*	7437	Caputo 219
COMPUTER SCIENCE		
Liffick, Blaise (Dept. Chair)	4315	Roddy 132-A
Pyles, Tonya *(Dept. Secretary)*	4305/4306	Roddy 132
DEAN'S OFFICE		
Frantz, Marianne *(Admin. Assistant)*	4292	Caputo 206
Jackson, Michael (Dean)	4292	Caputo 206C
Martin, Kevin *(Storeroom Manager)*	4302	Caputo 303
EARTH SCIENCES		
Clark, Richard (Dept. Chair)	7434	Caputo 409
Devlin, Marty *(Dept. Secretary)*	4359	Nichols 101
NURSING		
Kuhns, Kelly (Dept. Chair)	5276	Caputo 123
Williams, Melissa *(Dept. Secretary)*	4274	Caputo 127
PHYSICS		
Hendrick, Sean (Dept. Chair)	7446	Caputo 239
Drennen, Emily L. *(Dept. Secretary)*	4297	Caputo 234

Appendix IV - Ethidium Bromide Usage Policies

Millersville University – College of Science and Technology

Ethidium Bromide Usage Policy – Approved – June 8, 2018

(Adapted from *Guidelines for Ethidium Bromide Disposal* of the Lincoln University Police Department, Environmental Health and Safety)

Handling Ethidium Bromide Solutions and Gels

Ethidium bromide (EtBr) is a nucleic acid binding agent that is commonly used to visualize DNA and RNA bands generated during gel electrophoresis. At high concentrations, it has the potential to be mutagenic and toxic. Precautions should be taken when handling liquids and gels containing EtBr or equipment that has been used with EtBr.

Each laboratory that uses EtBr will have specific glassware and gel units reserved for its use to avoid general contamination. These items will be labeled clearly with "Ethidium bromide (warning potential mutagen)".

Solutions of EtBr and gels containing EtBr should be handled by individuals wearing laboratory coats and gloves (nitrile or latex). Concentrated EtBr solutions ($\geq$10 mg/mL) should be kept in a labeled container (4 °C) and opened/handled under a chemical fume hood. Pipet tips contaminated with concentrated EtBr should be placed in a labeled container with top for short term storage/transport and then disposed of in the EtBr hazardous waste container (under desk with digital imaging station in Caputo 302) as outlined below.

Powdered EtBr should be avoided whenever possible and it should only be used under the supervision of a trained faculty member.

Preparing EtBr Gels < 10 µg EtBr per mL (< 10 ppm)

Only the glassware that has been reserved for EtBr should be used to prepare the gel solution. Work carefully to avoid any spills but if one occurs, refer to the section "Management of Ethidium Bromide Spills and Contaminated Instruments" to handle the situation. To prepare an agarose gel with EtBr, microwave the required grams of agarose in buffer (1X TAE or 0.5X TBE) until the agarose is fully dissolved. Let the solution cool until the flask is touchable but still fairly warm. Working under the fume hood, promptly (before agarose starts to solidify), add 1µl of EtBr stock (10 mg/mL) per each 10 mL of gel solution. The final concentration will be ~1 µg/mL (<< 10 µg EtBr per mL, << 10 ppm)).

Disposal of EtBr Gels (see above section on handling gels)

Gels containing concentrations < 10 µg EtBr per mL (< 10 ppm) may be disposed of by wrapping the gel in plastic wrap, placing it in a new garbage bag (along with EtBr-contaminated gloves and other disposable items), tying the bag securely, and then placing this package in the regular trash.

Gels containing concentrations ≥ 10 µg EtBr per mL (≥ 10 ppm) are not recommended. If they are used they must be clearly labeled, run under a chemical fume hood, and then disposed of in the EtBr disposal container (solid waste disposal bucket from storeroom) that is located under the desk with the digital imaging station in Caputo 302 for removal by the Hazardous Waste Vendor (see Stephen Peurifoy, Chemistry Department). Please remember to record the amount of EtBr added to the container in the 'EtBr Log' (in top left drawer of desk with digital imaging station) as described below.

Disposal of EtBr Solutions and Concentrated Waste

All EtBr-contaminated items (solids) exceeding permissible concentrations (> 10 µg EtBr per mL (> 10 ppm)) must be placed in the EtBr disposal container (wide-mouth solid waste disposal bucket from storeroom). The container must be clearly labeled as "HAZARDOUS, Ethidium Bromide Solid Waste" and should remain tightly closed unless adding items. This waste container is located in Caputo 302 under the desk with the digital imaging system. When an item is added to the container, an entry should be made into the log indicating the total amount of EtBr added. This log is kept in the top drawer of the desk to the left of the container (labeled 'EtBr Log'). Gloves, paper towels, and other minimally contaminated items should NOT be placed in this container. They should be rinsed with tap water thoroughly to decontaminate them and then disposed of in the regular trash.

Aqueous solutions containing < 10 µg EtBr per mL (< 10 ppm) may be disposed of down the drain. Containers and sink surfaces should then be rinsed thoroughly with tap water.

Aqueous solutions exceeding ≥ 10 µg EtBr per mL (≥ 10 ppm) must be treated by pouring over a charcoal collection filter (available from VWR and stored in Caputo 302 in the desk drawer on the bottom left of the desk with the gel imaging station). The charcoal will capture the EtBr and reduce its concentration in the solution. The treated eluate may be disposed of down the drain. Each charcoal filter can be used multiple times and the amount of EtBr collected each time should be recorded in the log with the funnels. When its total capacity is met, the funnel must be placed in the EtBr disposal container (under desk with digital imaging station) for removal by the Hazardous Waste Vendor. Stephen Peurifoy, College Safety Lab Technician, can assist with this process. Please remember to record the amount of EtBr added to the container in the EtBr Log as described above.

EtBr-Contaminated Glassware and Equipment

EtBr-contaminated items should be triple rinsed with water and, as long as the concentration of EtBr in the rinsate is < 10 µg EtBr per mL (< 10 ppm), the rinsate may be released down the drain. Rinsates at concentrations ≥ 10 µg EtBr per mL (≥ 10 ppm) must be treated by pouring through a charcoal filter as described above.

Management of Ethidium Bromide Spills and Contaminated Instruments

EtBr spills can be managed with a freshly prepared (day of use) decontamination solution. Working in a fume hood and wearing safety glasses, gloves and a lab coat, make the decontamination solution by adding 20 mL of hypophosphorus acid (50%) to a solution of 4.2 g of sodium nitrate in 300 mL water. This procedure has been validated for EtBr contaminated stainless steel, Formica, glass, vinyl floor tile surfaces, and filters of transilluminators.

Wear protective rubber gloves, lab coat, and safety glasses. Turn off electrical equipment before decontamination. Soak paper towel in decontamination solution, place on contaminated surface, and scrub. Scrub five more times with paper towels soaked in water, using a fresh towel each time. Place all towels in a container and soak in fresh decontamination solution for one hour. Test squeezings from final towel scrub and mixture for fluorescence; repeat procedure with fresh decontamination solution if fluorescence is present. When no fluorescence is observed, decontamination is complete. Everything should then be neutralized with sodium bicarbonate and discarded as nonhazardous waste.

General First Aid Measures for Ethidium Bromide (from https://fscimage.fishersci.com/msds/45442.htm)

Eyes: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid.
Skin: In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid. Wash clothing before reuse.
Ingestion: If swallowed, do not induce vomiting unless directed to do so by medical personnel. Get medical aid.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

GLOSSARY/ABBREVIATIONS

AED	Automated External Defibrillators
CHP	Chemical Hygiene Plan
DOT	Department of Transportation
EHS	Environmental Health & Safety
EPA	Environmental Protection Agency
NFPA	National Fire Protection Association
OSHA	Occupational Safety & Health Administration
PEL	Permissible Exposure Limit
PPE	Personal Protective Equipment
SDS	Safety Data Sheet
SOP	Standard Operating Procedure
TLV	Threshold Limit Value

REFERENCES

- Occupational Safety & Health Administration (OSHA) Laboratory Safety Standards: OSHA LAB STANDARD 29 CFR 1910.1450 https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106

- Pennsylvania (PA) Occupational & Industrial Safety Standards: http://www.dli.pa.gov/Individuals/Labor-Management-Relations/bois/Pages/default.aspx#.V1mlD-TF_pL

- Lock Haven University Chemical Hygiene Plan: http://www.ehs.wisc.edu/chemicalhygieneplan.htm

- University of South Carolina Chemical Hygiene Plan: http://www.chem.sc.edu/faculty/morgan/safety/

- "Review of Safety Guidelines for Peroxidizable Organic Chemicals" J. Chem. Health Saf., September/October 1996, 3(5), pp. 28–36.

- Biological Safety at Penn: http://www.ehrs.upenn.edu/programs/bio/

- Biological Safety Manual: http://www.ehrs.upenn.edu/programs/bio/bsm/

- ACS Guidelines & Evaluation Procedures for Bachelor's Degree Programs: https://www.acs.org/content/dam/acsorg/about/governance/committees/training/2015-acs-guidelines-for-bachelors-degree-programs.pdf

- OSHA 1910.1450: Occupational Exposure to hazardous chemical in laboratories: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106

- PA occupational and industrial safety standards: http://www.dli.pa.gov/Individuals/Labor-Management-Relations/bois/Pages/default.aspx#.V12wWI6wXf7

- UPenn Chemical Hygiene Plan (Section II): http://www.ehrs.upenn.edu/programs/labsafety/chp/prepare.html