



Chemical Hygiene Plan

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INTRODUCTION

PURPOSE

The College has developed a Chemical Hygiene Plan to explain the policies and procedures that will promote the safe operation of the college's laboratories. In addition, the Chemical Hygiene Plan satisfies the requirements of the U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1910.1450, *Occupational Exposures to Hazardous Chemicals in Laboratories*. This regulation is known as the "Laboratory Standard"; the objective of the "Laboratory Standard" is to protect employees from health hazards associated with hazardous chemicals in the laboratory.

"The Laboratory Standard" is a regulation developed for the protection of employees. Since students are not employees, they are not officially covered by provisions of the "Laboratory Standard". However, the College extends the provisions of the Chemical Hygiene Plan to our students in addition to our employees.

I. Standard Operating Procedures

A. General

1. The design of the laboratory facility will provide sufficient space for safe work by the number of persons to be in the laboratory. Exit doors of labs and chemical storage rooms will be clearly marked and free of obstructions to permit quick, safe escape in an emergency.
2. Laboratory facilities will be used only by persons with proper qualifications and training. The number of students assigned to the laboratory shall not exceed the number of laboratory stations available. The maximum number of students shall not exceed 24.
3. Staff and students should follow the Chemical Hygiene Plan to minimize their health and safety risks.
4. It is prudent to minimize all chemical exposures because most laboratory chemicals present hazards of one type or another. Employees will follow general precautions for handling all laboratory chemicals. Specific guidelines for some chemicals, such as those found in the appropriate material safety data sheets (MSDSs), will also be followed.
5. Employees should not underestimate the risk, and exposure to hazardous substances should be minimized. The decision to use a particular substance will be based on the best available knowledge of each chemical's particular hazard and the availability of proper handling facilities and equipment. Substitutions, either of chemicals or experiments, will be made where appropriate to reduce hazards without sacrificing instructional objectives. When the risk outweighs the benefit and no substitute is available, then the experiment, procedure, or chemical should be eliminated.
6. Chemicals should not be accepted from a supplier unless it is accompanied by the corresponding MSDS, or an MSDS from that supplier for that chemical is already on file. All MSDSs should be accessible to employees at all times. Employees should be trained to read and use the information found on MSDSs.
7. Generally, textbooks, laboratory manuals, and other instructional materials designate the safety precautions needed for a particular laboratory activity. However, total reliance on such publications to provide complete and accurate information is not advisable. Employees should consult additional references, including MSDSs, before undertaking an unfamiliar activity.

B. Laboratory Procedures

1. Individuals in laboratories:
 - a. Eating, drinking, gum chewing, application of cosmetics, manipulation of contact lenses, or other such activities are not to be done in the laboratory.
 - b. Conduct yourself in a responsible manner at all times in the laboratory. This means that horseplay, throwing items, and pranks are prohibited.
 - c. Employees/students should not work alone in the lab or chemical storage area unless other employees are in the vicinity and are aware that someone is in the laboratory.
 - d. "Wafting" to test chemical odors should only be done with extreme caution and when only specifically directed to do so in the written experimental procedure. Also, chemicals should never be tasted.
 - e. Never pipette by mouth. Always use a bulb or other device for suction.



- f. Do not force glass tubing into rubber stoppers. Lubricate the glass and hold the tubing with a cloth towel as the tubing is inserted into the stopper.
 - g. Proper Bunsen burner procedures shall be followed. Never leave a flame unattended.
 - h. Dress appropriately for laboratory work. Avoid loose or baggy clothing and dangling jewelry. Confine or tie back long hair. Sandals or any open toed shoes are not permitted in the laboratory.
 - i. Should a fire drill or any other evacuation occur during a lab activity, turn off all Bunsen burners and electrical equipment. Leave the room as directed.
 - j. Remember hot glass looks like cold glass, and glass remains hot for a long time. Determine if an object is hot by bringing your hand close to the object but do not touch the object.
 - k. Careful storage and handling procedures should be used to avoid glassware breakage. In the event of breakage, protection for the hands should be worn when picking up the broken pieces. Small pieces should be swept up with a brush and pan. Broken glass should be separated from other waste by placing it in a special container marked Broken Glass. Broken glass contaminated with chemicals must be treated as hazardous waste.
 - l. The quantities of flammable liquids used in the laboratory shall not exceed five gallons.
 - m. Containers of chemical substances shall be closed when not in use.
 - n. Evaporation is not an acceptable means to dispose of chemical materials.
2. Students in the laboratory:
- a. Must read lab directions ahead of time and follow all verbal and written instructions.
 - b. Shall only perform authorized experiments.
 - c. Shall report all accidents or injuries to the instructor at once, no matter how trivial it may seem. The student must go to Health Services for the treatment of cuts, burns, accidental ingestion of chemicals, or inhalation of fumes. The faculty member must complete an Incident Report (found online at www.etown.edu/safety) and forward it to Human Resources.
 - d. Shall only work in a laboratory or chemical storage area under the direct supervision of a faculty member.

C. Housekeeping Practices

1. Individuals in the laboratory:
 - a. All laboratory areas must be kept clean and contain only those items needed for the task at hand.
 - b. Place all wastes in appropriate, segregated receptacles that are properly labeled.
 - c. Sinks are to be used only for disposal of water and those solutions designated by the instructor. Other solutions must be placed in the appropriate labeled waste container.
 - d. Tabletops are to be swept clean and washed at the end of the lab activity.
 - e. Clean up all chemical spills as soon as they occur. Chemicals and cleanup materials should be disposed of correctly.
 - f. Never block access to emergency equipment, showers, eyewashes, or exits.
 - g. Store chemicals and equipment properly. Chemicals should not be stored in aisles, on the floor, in stairwells, on desks, or laboratory tables.
 - h. Before leaving the laboratory, turn off services (gas, electricity, water).
 - i. Keep all cabinets and drawers closed when not in use to avoid catching and bumping hazards.
 - j. Aisles should be kept clear; no chemicals may be stored on the floors.
2. Students in the laboratory:
 - a. Bring only your lab instructions, calculators, writing instruments, and any required personal protective equipment (e.g. safety goggles) to the laboratory area.
 - b. Leave backpacks and other books in the classroom area.

D. Chemical Procurement

1. The purchasing of chemicals should be guided by the philosophy that less is better. The lower the chemical inventory, the fewer the problems associated with storage, and the less likely that the College will face excessive costs to dispose of outdated or surplus chemicals.



2. Chemicals should be ordered in quantities that are likely to be consumed in one year and should be purchased only in the quantity sufficient for the declared use.
3. All chemicals should be in tightly closed, sturdy, and appropriate containers.
4. A chemical should not be accepted without the MSDS and an adequate identifying label.
5. When a chemical is received, proper handling, storage, and disposal should be known.
6. The container should be marked with the date(s) it is received.
7. The chemical inventory list should be updated each time a chemical is received.
8. Donated chemicals should be accepted only after approval is obtained from the Chemical Hygiene Officer. It should be established that the donated chemical is in excellent condition, that an appropriate MSDS is available, and that there is a specific use for the donated material.

E. Storage and Distribution

1. All chemicals should be in tightly closed, sturdy, properly-labeled containers that are compatible with the chemical.
2. Chemicals shall not be stored where they have access to the sanitary or storm sewers.
3. All cup sinks in hoods will be protected with a permanent barrier to keep chemicals out of the sanitary sewer. Quantities of chemicals in the hood will not exceed the capacity of the barrier.
4. If the chemical has been transferred to a secondary container, the new container should be appropriately labeled, including the hazard information.
5. Chemicals should be stored based on the compatibility group of the chemical.
6. Large containers and containers with reactive chemicals, such as acids and bases, should be on low shelves.
7. The classification system used for the storage of chemicals should be displayed in the principal storage area.
8. Flammable chemicals shall be stored in approved storage containers and in approved flammable chemical storage cabinets.
9. Combustible packaging material should not be stored near flammable chemical storage cabinets.
10. All storage areas should be securely locked when not in use. Storage and preparation areas should be accessible only to those persons authorized to use the chemicals.
11. Glass bottles containing highly flammable liquids (Class 1A) shall not exceed 500 mL. For larger volumes, metal or approved plastic may not exceed 1 gallon, and safety cans shall not exceed 2 gallons. (NFPA 45)
12. Chemicals should not be transferred to another location without the simultaneous transfer of a copy of the appropriate MSDS, nor should they be transferred without the person receiving the chemicals having had an appropriate training in their use, storage, and disposal.
13. Refrigerators used to store flammable chemicals shall be labeled and shall be of explosion proof or of lab safe design. (NFPA 45)
14. OSHA standards and NFPA Guidelines or local fire regulations should be consulted on the proper use of flammable chemicals in the laboratory.
15. Compressed Gases
 - a. A compressed gas is defined as any material or mixture having in the container either an absolute pressure greater than 276 kPa (40 lb/in²) at 21 °C, or an absolute pressure greater than 717 kPa (104 lb/in²) at 54 °C or both, or any liquid flammable material having a Reid vapor pressure greater than 276 kPa (40 lb/in²) at 38 °C.
 - b. Gas cylinders should only be moved from one location to another with the protective cap securely in place.
 - c. Both full and empty cylinders should only be stored where they may be securely restrained by straps, chains, or a suitable stand.
 - d. A cylinder should be considered empty when there is still a slight positive pressure.
 - e. An empty cylinder should be returned to the supplier as soon as possible after having been emptied or when it is no longer needed.



- f. Cylinders should not be exposed to temperatures above 50 °C.
 - g. Store flammable gases separately from oxidizer gases.
 - h. Storage: Full cylinders are currently stored in the Chemistry stockroom by the outside door. Each cylinder is secured by a single, heavy chain. All cylinders should have a protective cap securely screwed on to the tank.
 - i. When a cylinder is empty, it is to be secured to one of the cylinder mounts found on the tables located near the outside entrance. Protective cap should be fully screwed on and a sign placed on the empty cylinder indicating it is empty.
 - j. Transport: When transporting gas cylinders, proper protective eyewear is required. The cylinder must be securely fastened to an approved cart. In case of cylinder malfunction, resulting in leakage, it is not recommended that the user accompany the cylinder in the elevator. Rather, the cylinder (properly attached to transport cart) is placed in the elevator and the appropriate button pushed. User should use the stairs and meet the cylinder at its destination. There have been documented cases of asphyxiation when the cylinder has leaked while in an elevator that itself has malfunctioned leaving the person stranded in the elevator with the defective tank.
 - k. Use: Students should be instructed as to the proper use of gas cylinders. They should be reminded that proper eyewear is to be worn while working with pressurized gases.
16. Used oil will be stored in a closed and properly labeled container and disposed of at the College's used oil storage site.
17. Each lab should have a separate inventory of the chemicals stored in that lab
18. Minimal amounts of solvents and other chemicals should be kept in the teaching and research laboratories. Primary storage should be the chemical storage area of the Biology and Chemistry stockrooms.

F. Waste Disposal

- 1. The College and the Chemical Hygiene Officer shall ensure that the disposal of laboratory chemicals is in compliance with Environmental Protection Agency/Department of Environmental Protection Regulations.
 - a. A waste characterization will be performed when generator knowledge is not sufficient to determine whether a waste is hazardous or not.
- 2. The College to be considered a Small Quantity Generator (SQG) of hazardous waste, by the Pennsylvania Department of Environmental Protection, must generate, in each and every calendar month, less than:
 - a. 100 kg of hazardous waste
 - b. 1 kg of acutely hazardous waste
- 3. Guidelines for waste minimization:
 - a. Employees shall minimize generation of hazardous wastes (microscale labs, selecting less hazardous materials, etc.).
 - b. Chemicals should be ordered in quantities that are likely to be consumed in one year or less.
 - c. Avoid the inadvertent accumulation of hazardous waste. Potential waste materials are surplus, old, and/or unnecessary chemicals. Every attempt must be made to avoid accumulating such chemicals.
 - d. Prior to ordering new chemicals, using existing chemicals, or creating products from reactions, employees shall determine if the material will need to be treated as hazardous waste.
- 4. Guidelines for hazardous waste disposal:
 - a. Flammable, combustible, water-immiscible materials, or water soluble solutions of toxic substances shall not be poured down the drain.
 - b. Separate waste containers should be provided for heavy metal compounds, chlorinated hydrocarbons, nonchlorinated hydrocarbons, and any other categories recommended by the College's hazardous waste transporter company.
 - c. Waste chemicals should be stored in appropriately labeled containers that include "hazardous waste", chemical name, start accumulation date, fill date, and date moved to central storage area. These



- containers must be stored inside SAA(s) secondary containment and must remain closed at all times when waste is not being added to the container.
- d. Hazardous wastes should never be placed in the common solid trash container.
 - e. Upon completion of the laboratory activity, the waste containers shall be placed in the Satellite Accumulation Area (SAA) and the appropriate label (see Appendix A) must be completed and attached.
 - f. When the waste containers become full, the containers shall be transferred to the hazardous waste central storage area (CSA) within three (3) days. In addition, waste in SAAs should be moved to the CSA at the end of every semester. Hazardous waste will be removed from the CSA once a semester.
5. Biological Waste
- a. The following protocols should be adhered to regarding the use and disposal of live biological materials. Biological material that falls under this category includes live cells, viruses, tissue samples, and organs
 - i. Any glass or (non-disposable) plastic containers used for containment or delivery of biological material (e.g., cell lines, blood) should be soaked in straight bleach followed by autoclaving.
 - ii. Aqueous solutions of live biological waste should be poured into a bleach-containing container. The solution can then be poured down the drain.
 - iii. Disposable pipets should be placed in a bucket containing bleach. After several hours, the plastic-ware can be transferred to a biohazard bag for eventual autoclaving.
 - iv. Empty non-reusable plastic ware (with the exception of disposable pipets) and non-reusable glass ware (e.g., microscope slides) should be placed directly into biohazard bags for autoclaving.
 - v. Surfaces that were exposed to live biohazard material should be wiped down with a 70% ethanol solution or other appropriate biocidal cleanser.
 - vi. Containers of biological waste will be kept closed when not in use.
 - vii. All biohazard bags should be labeled with a start date and initials, and all bags should be autoclaved within 30 days of the start date
 - viii. All biological waste must be stored in suitable containers with closed lids.
6. Chemical Waste
- a. In chemical laboratories (both teaching and research), organic solvent waste containers should be clearly labeled as to whether they are halogenated or nonhalogenated; whenever possible, halogenated solvents should not be mixed with nonhalogenated solvents.
 - b. A list should be maintained with each container so the exact contents and the approximate amounts are known. When the container is 80% full, the list should be secured onto the container and the container transported to the chemical storage area in the stockroom.
 - c. Acid or base waste solutions should be neutralized (verified by pH paper or a pH meter) and poured down the drain in consultation with a faculty member.
 - d. For containers bearing reagent that has lost its potency or have been contaminated, the container should be labeled as such and the container properly transported to the chemical waste area of the chemical storage area in the stockroom.
- G. Spills
1. If the chemical involved in the spill is judged to present an immediate hazard, evacuation is to be absolute, and the area should be isolated until a HAZMAT team arrives. The faculty member in charge should contact Security and Risk Management to notify them of the spill.
 2. If hazardous vapors are present, the area should be isolated. Only persons trained in the use of respirators may enter the area. This will frequently mean waiting outside the building for the arrival of a HAZMAT team.
 3. If a volatile, flammable material is spilled, immediately extinguish flames (only those persons trained in using fire extinguishers should use them), turn off all electrical apparatus, and evacuate the area.



Consult the MSDS for appropriate cleanup procedures. If the quantity exceeds the employee's ability or training to handle the spill, seal the area until appropriately trained personnel arrive.

4. If there is no immediate danger (flammability, toxicity, reactivity, corrosivity) to personnel, containment should be accomplished by use of spill pillows, towels, rolls, or other devices that will keep the spill from spreading.
5. If there is no immediate danger, cleanup procedures listed on the MSDS should be followed. Appropriate personal protective equipment shall be used.
6. Mercury spills should be contained using a suction bulb/pipet and the contents stored in a separate labeled container. For any mercury that remains, it should be treated with sulfur (to convert to the sulfide) and added to the container bearing the spilt mercury
7. A spill kit should be accessible for each laboratory.
8. If the spill material was a hazardous chemical, all of the materials involved in the cleanup must be disposed of as hazardous waste.
9. If a major spill occurs (cannot be cleaned up safely by yourself), cleanup shall only be undertaken by individuals who are trained in HAZMAT procedures.

H. Accidents

In the event of an accident where a student is injured, the following should be followed:

1. Instructor should assess the severity of the accident and determine what level of treatment is needed:
 - a. If student needs medical attention, instructor should arrange for another student to accompany the injured student to University Physicians Group; or if necessary, Campus Security should be contacted for student transport. Even in minor circumstances, the student should be encouraged to have a medical professional look at the affected area, given the fact that the instructors are not licensed health care professionals.
 - b. If accident is so severe that immediate treatment at the emergency room is required, call ext. 1111.
 - c. If accident involves blood, instructor should be cognizant of bloodborne pathogens (e.g., AIDS) and take appropriate measures when handling the injured student. For this reason, each laboratory should have boxes of disposable gloves on hand for such instances.
 - d. If accident involves exposure of the eyes to chemicals (vapor, liquid or solid exposure) student should be assisted in flushing his/her eyes for 15 minutes in the eye wash. Student should then be treated by a medical professional.
 - e. For chemical exposure incidents not involving the eyes (discussed above), instructor should make the appropriate decision as to how to treat the student. Certain accidents may require flushing of exposed area using cool water from the faucet. If the student has experienced substantial exposure to their clothing, item(s) should be removed and then the exposed skin flushed with water. In extreme cases, the student may need to be placed under the safety showers. If necessary, clothing may need to be removed. In rare cases like this, modesty should not displace the need for immediate proper care.
 - f. Accidents involving burns should be evaluated by a medical professional.
2. After the instructor has assessed and implemented proper action for the injured student, the next detail he/she needs to address is identifying the causative agent of the accident and take immediate steps to terminate the danger.
 - a. If accident involved a spill, the instructor should take appropriate measures to clean up the spill including, but not limited to, the use of disposable gloves, face shield, dust mask, and/or respirator.
 - b. If deemed necessary for the protection of the students, the lab should be temporarily evacuated while the cleanup is underway.
3. Regardless of the severity of the accident, all accidents should be properly reported; an Accident Investigation Report must be completed and forwarded to Human Resources (can be found online at www.etown.edu/safety). The chair of the department should be made aware of the accident as soon as possible.

II. Control Measures



A. Personal Protective Equipment

1. It is the responsibility of the College to require appropriate safety and emergency equipment for employees and students.
2. Protective apparel shall be compatible with the required degree of protection for the substances being handled.
3. Laboratory aprons or coats, eye protection, and non-permeable gloves are considered standard equipment for school laboratory programs and should be readily available to employees and students.
4. All eye protection devices should conform to ANSI Standard Z87.1-1989. Eyeglasses, even with side shields, are not acceptable protection against chemical splashes.
5. Chemical splash safety goggles should be used as the standard protective eyewear. Such goggles should fit the face surrounding the eyes snugly to protect the eyes from a variety of hazards.
6. Any experiment that involves heating or the use of chemicals, or glassware shall require the use of chemical splash safety goggles. The goggles also serve to reduce dust and fumes from reaching the eye.
7. Contact lenses are not necessarily prohibited in the laboratory. If contact lenses are permitted, chemical splash goggles must be worn at all times.
8. Full face shields protect the face and throat. They must be worn for protection when there is a greater risk of injury from flying particles and harmful chemical splashes. A full face shield should also be worn when an operation involves a pressurized system that may explode or an evacuated system that may implode. For full protection, safety goggles must be worn with the face shield.
9. Standing shields should be used when there is a potential for explosions, implosions, or splashes, or when corrosive liquids are used. Goggles should be worn whenever using a standing shield.
10. A standing shield should be used for group protection from chemical splash and impact. The standing safety shield should be used with safety goggles and, if appropriate, with a face shield.
11. Lab coats or aprons worn in the laboratory should offer protection from splashes and spills, and should be easy to remove in case of an accident, and should be fire resistant.
12. When gloves are required, it should be remembered that no one kind of glove is suitable for all situations. The MSDS should be consulted for information regarding the proper type of gloves to be used.

B. Administrative Controls

1. Inventory Control
 - a. A chemical inventory should be updated each time a chemical is received or consumed. The list should be audited for accuracy on at least an annual basis.
 - b. The chemical inventory list should contain the following information about each chemical found in storage: the chemical name, location, the date purchased, the amount present, the CAS number, and the examination date for possible disposal.
 - c. Every area in which chemicals are used or stored should have an up-to-date inventory.
 - d. A printed copy of the most recent inventory should be kept by the department chair and by the chemical hygiene officer.
2. Hazard Identification and Labels
 - a. Labels on incoming containers of hazardous chemicals are not to be removed or defaced.
 - b. Laboratory chemicals should be properly labeled to identify any hazards associated with them for the employee's information and protection.
 - c. If a chemical is stored in its original bottle, it should have the manufacturer's original label identifying potential hazards, and the date of purchase, the date opened, and the initials of the person who opened the container.
 - d. If a chemical has been transferred to a secondary container, the new container should be appropriately labeled with the chemical name, formula, concentration (if in solution), solvent (if in solution), hazard warnings, and name or initials of the person responsible for the transfer.
 - e. Unlabeled bottles should not be opened, and such materials should be disposed of promptly, as outlined in the section on disposal procedures.



3. Signs and Posters
 - a. Emergency telephone numbers (i.e. Campus Security) shall be posted in all laboratory areas.
 - b. Signs shall be used to indicate the location of exits, evacuation routes, safety showers, eyewash stations, fire extinguishers, fire blankets, first aid kits, fume hoods, and other safety equipment.
 - c. Warnings shall be posted at areas or equipment where special or unusual hazards exist.
 - d. Posters to reinforce laboratory safety procedures should be displayed in the laboratory and the classroom.
4. Material Safety Data Sheets:
 - a. Each MSDS received with incoming shipments of chemicals should be maintained and made readily available to laboratory employees and to students.
 - b. The MSDSs for each chemical in the laboratory usually give recommended limits or OSHA - mandated limits, or both, as guidelines to exposure limits. Typical limits are expressed as threshold limit values (TLVs), permissible exposure limits (PELs), or action levels. When such limits are stated, that limit, along with any other information about the hazardous characteristics of the chemical, should be used to set laboratory guidelines. These laboratory guidelines may be used in determining the safety precautions, control measures, and personal protective equipment that apply when working with the toxic chemical.
 - c. All chemicals must have a MSDS. These forms must be stored in the department in which they are used; they must be easily accessible. The College also subscribes to an MSDS on-demand service through 3E Company. Individuals can call 1-800-451-8346 to have an MSDS faxed for specific chemicals. This permits quick access should an emergency situation arise regarding that chemical.
5. Records
 - a. Chemical Inventory Records
 - i. An inventory of all chemicals shall be conducted annually and chemical usage determined.
 - ii. The chemical hygiene officer shall retain a copy of the chemical inventory.
 - b. Inspection Record
 - i. Inspections of the hazardous waste central storage areas (CSA) must occur monthly and be recorded on the checklist in the CSA.
 - ii. Safety equipment should be tagged to indicate the date and the results of the last inspection. Eyewash stations must be inspected monthly; hoods must be inspected annually.
 - iii. Records indicating the dates of repairs and regular maintenance of safety equipment should be maintained.
 - c. Training Records: the college should maintain records of employee training for at least 30 years, and they should be made available to employees.
 - d. Incident Report: incident reports must be completed for any incident. Copies are to be retained by the Human Resource Department.
 - e. Medical and Exposure Records: Records of air concentration monitoring, exposure assessments, medical consultations, and medical examinations must be kept for at least 30 years after the employee ceases employment with the college.
 - f. Waste Disposal Records: The college shall retain records of disposal of hazardous waste. The records shall conform to the requirements of the Department of Environmental Protection and Environmental Protection Agency Hazardous Waste Rules.
 - g. MSDSs: The college should maintain a file of MSDSs and should make them accessible to employees. If an MSDS is not available when a new chemical is received, that chemical should not be used until an MSDS is obtained.
6. Exposure Monitoring
 - a. If there is reason to believe that exposure levels for a regulated substance have exceeded the action level or permissible exposure limit, the chemical hygiene officer should ensure that the employee or student exposure to that substance is measured.



- b. Factors which may raise the possibility of overexposure and therefore warrant an initial measurement of employee or student exposure include:
 - i. The manner in which the chemical procedures or operations involving the particular substances are conducted.
 - ii. The existence of historical monitoring data that shows elevated exposures to the particular substance for similar operations.
 - iii. The use of a procedure that involves significant quantities or is performed over an extended period of time.
 - iv. There is reason to believe that an exposure limit may be exceeded.
 - v. Signs or symptoms of exposure (e.g., skin or eye irritation, shortness of breath, nausea, or headache), which are experienced by employees or students.
- c. If the substance in question does not have exposure monitoring or a medical surveillance requirement, exposure monitoring and medical surveillance shall be continued until exposure levels are determined to be below the action level or 50% of the PEL. In the absence of PELs, the ACGIH TLVs should be referenced.
- d. If a substance has an exposure monitoring requirement and if there is reason to believe that exposure levels for that substance routinely exceed the action level or in the absence of the action level, the PEL, the College shall measure the employee or student exposure to the substance.
- e. If the initial monitoring (described in d. above) discloses employee or student exposure over the action level or in the absence of an action level, the PEL, the employer shall immediately comply with the monitoring provisions of the relevant standard.
- f. The College shall, within 15 working days after the receipt of any monitoring results, notify the employee or student of these results in writing either individually or by posting the results in an appropriate location that is accessible to employees and students.
- g. The following substances are regulated by OSHA standards and require monitoring: lead, benzene, 1,2-dibromo-3-chloropropane, acrylonitrile, ethylene oxide, formaldehyde, asbestos, vinyl chloride, and inorganic arsenic.

C. Special Hazards

1. Broken Glass
 - a. All broken glass should be placed in the cardboard containers designated for broken glass. Under no circumstances should it be placed in the regular waste cans as this poses a safety hazard for Environmental Services.
2. Freezers and Refrigerators
 - a. All items kept in freezers and refrigerators should be properly labeled.
 - b. Each unit should be labeled as to what may (or may not) be placed in the unit.
 - c. The faculty member responsible for each unit should ensure that it is properly maintained, including defrosting whenever necessary.
 - d. Key storage freezers and refrigerators should be clearly identified and powered by a back-up generator in case of electrical power failure.
3. Transporting Chemicals
 - a. Persons should have protective eyewear when transporting chemicals.
 - b. Rubber carriers should be used for transporting smaller quantities kept in glass bottles.
 - c. For larger containers, or several items that cannot safely fit into rubber container, the carts with elevated side panels should be used. Acids and bases should not be transported together in case of breakage of one or both of these types of chemicals.
4. Hot Plates & Heating Mantles
 - a. Reactions and solutions requiring heating should adhere to the following advisements:
 - i. Faculty and students should be aware of various solvents reaching their flash point while being heated



- ii. Caution should be used when using heating plates that are not explosion/fire proof. There are documented instances of the heated solvent's vapors falling down onto the plate and also into the heating plate resulting in ignition of the vapors.
 - iii. When heating solutions/reaction mixtures, appropriate stirring devices should be used to avoid superheating of the contents.
 5. Needles & Syringes
 - a. Syringes and needles should not be stored out in the open. They should be placed in a locked drawer when not being immediately used.
 - b. For schlenk lines bearing needles at the ends (via a luer lock attachment), they should be capped to prevent accidental needle sticks.
 - c. Proper disposal of needles, includes disposable needles and non-disposable needles that have expired, requires they be placed in a sharps container for subsequent transfer to a biohazard bag.
 - d. Especially while using glass syringes, students must be reminded they must keep their safety glasses on at all times.

III. SAFETY / EMERGENCY FACILITIES AND EQUIPMENT

A. Equipment

1. The college should ensure that adequate emergency equipment is available in the laboratory and inspected regularly to ensure that it is functioning properly. All employees should be properly trained in the use of each item.
2. Emergency equipment items that should be available include: eyewash station, fire extinguisher of the appropriate type, safety shower, telephone for emergencies, fire blanket, and identification signs.
3. Each laboratory should have a standard first aid kit appropriately stocked.
4. Multipurpose fire extinguishers should be available in the laboratory. A multipurpose, ABC, fire extinguisher, can be used on all fires EXCEPT for class D fires. Extinguishers should be visually checked monthly and inspected and tested annually.
5. Every eye wash station will be capable of supplying a continuous flow of aerated, tepid, potable water to both eyes for at least 15 minutes. The valve should remain in the open position without the need to hold the valve. (ANSI Z358.1-1990)
6. Safety showers should be capable of supplying a continuous flow of tepid, potable water for at least 15 minutes. The shower should have a quick-opening valve requiring manual closing. (ANSI Z358.1-1990)
7. Eye wash stations and safety shower stations shall be located so they will be accessible within 10 seconds. (ANSI Z358.1-1998)
8. Safety equipment will be tagged following an inspection, showing the date, inspector, and results.
9. Laboratories in which hazardous substances are being used should have spill control kits tailored to deal with the potential risk associated with the materials being used. If there is no immediate danger to employees or students, containment should be accomplished by spill pillows, towels, rolls, inert absorbents, neutralizing agents, or other devices.
10. Each storeroom shall be equipped with a heat sensor, smoke alarm, fire extinguisher, safety shower, eye wash, fire blanket, and first aid kit

B. Facilities

1. Fume hoods
 - a. Laboratory fume hoods are the most important components used to protect laboratory employees and students from exposure to hazardous chemicals and agents used in the laboratory. Functionally, a standard fume hood is a fire and chemical resistant enclosure with one opening (face) in the front with a movable window (sash) to allow user access into interior. Large volumes of air are drawn through the face and out the top to contain and remove contaminants from the laboratory.
 - b. Laboratory fume hoods are not meant for either storage or disposal of chemicals. If a hood must be used for storage, in order to provide adequate ventilation for flammable chemicals, for example, it



- must not be used for laboratory experiments or transfer of chemicals. In that event, it must be used only for storage.
- c. Laboratory activities that may release airborne contaminants above the Permissible Exposure Limit (PEL) or Thresholds Limit Value (TLV) concentrations must be carried out in the fume hood. Also, if laboratory activities produce potentially hazardous vapors or gaseous substances, the laboratory activities should be conducted in the fume hood.
 - d. In most cases, the recommended face velocity is between 80 and 100 feet per minute (fpm).
 - e. Fume hoods should be positioned in the laboratory so that air currents do not draw fumes from the hood into the room.
 - f. The exhaust stack from a fume hood shall be in a vertical-up direction at a minimum of 10 feet above the adjacent roof line and so located with respect to openings and air intakes of the laboratory or adjacent buildings to avoid reentry of the exhaust into the building. (ANSI/AIHA Z9.5 – 1992)
 - g. Fume hoods or other local ventilation devices should be used when working with any appreciably volatile substance with a TLV of less than 50 ppm.
 - h. All biohazard and fume hoods shall be inspected annually by the Chemical Hygiene Officer. Any hood not passing inspection must be taken out of service immediately and not be used until such time as the hood has passed inspection. It is the responsibility of the College to purchase the parts and replace the unit in a timely fashion so as not to endanger the health and well being of the employee or place the facility at risk.
 - i. Fume hood air velocity should be tested one time per year by the Department. Facilities Management is responsible for maintaining the fume hoods.
 - j. Students should be instructed in the proper use of the hoods including desired flow rates, height of
 - k. Hoods should not be used for long term storage of chemicals.
 - l. Hoods should not be cluttered so as to maintain maximum flow across the surface of the hood.
 - m. Hoods should be on a preventive maintenance schedule.
 - n. When a reaction is to be run in a hood overnight (or over the weekend), the reaction must be clearly labeled as to the reaction that is being performed and who should be contacted in case of an emergency regarding the reaction. A sign with this information should be posted on the lab door.
2. Ventilation
 - a. General laboratory ventilation should not be relied on for protection from exposure to hazardous chemicals. A rate of 4 - 12 room air exchanges per hour should be the accepted standard when local exhaust systems, such as hoods, are used as the primary method of control. Laboratory airflow should not be turbulent and should flow continuously throughout the laboratory.
 - b. Any alteration of the ventilation system should be made only if thorough testing indicates that employee and student protection from airborne toxic substances will continue to be adequate.
 - c. Exhaust from the fume hoods should be vented directly to the outside.
 3. Flammable Storage
 - a. Chemicals with a flash point below 93.3° C (200° F) should be considered "fire hazard chemicals". Any chemical whose MSDS or label states "Flammable" is in this category.
 - b. Fire hazard chemicals in excess of 500 mL should be stored in a flammable solvent storage area, safety cans, or in storage cabinets designed for flammable materials.
 - c. Flammable materials should be stored in a flammable liquid storage cabinet or other appropriate location. When transferring significant quantities of flammable liquids from one container to another, it is particularly important that they be properly grounded to prevent accidental ignition of flammable vapors and liquids from static electricity or other sources of ignition. Large quantities of flammable chemicals stored outside cabinets should be in flame-proof storage cans which conform to NFPA guidelines. NFPA 30, Flammable and Combustible Liquids code, and NFPA 45, Fire protection for Laboratories Using Chemicals, and/or the applicable local fire codes should be followed.
 4. Electrical
 - a. All electrical outlets should have a grounding connection accommodating a three-prong plug.
 - b. Employees should know how to cut-off electricity to the laboratory in case of emergency.



- c. Laboratory lighting should be on a separate circuit from electrical outlets.
- d. All electrical outlets should be checked for continuity after initial occupancy or whenever electrical maintenance or changes occur.
- e. If electrical equipment shows evidence of undue heating, it should be immediately unplugged.
- f. Ground-fault circuit interrupters (GFCIs) should be installed as required by code to protect users from electrical shock, particularly if an electrical device is hand held during a laboratory operation.

IV. Training and Information

A. Training for Employees

1. General

- a. The College shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area.
- b. Such information shall be provided at the time of the employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving exposure situations. The frequency of refresher information and training shall be determined by the College.
2. The objective of the employee training and information program is to assure that all individuals at risk are adequately informed about: the physical and health hazards associated with hazardous chemicals present in the laboratory; the proper procedures to minimize risk of exposure; and the proper response to accidents.
3. The College shall provide training opportunities for all individuals at risk. These training opportunities should include information about the hazards of chemicals present in the laboratory and sources of information concerning hazards in the laboratory. In particular, the training program should cover the laboratory standard, material safety data sheets, the chemical hygiene plan, and the responsibilities of the college and the employee.
4. Employees should be trained on the potential chemical hazards in the employees' work areas and on appropriate sections of the chemical hygiene plan. This training should be provided to all employees who actually work in the laboratory as well as to other employees whose assignments may require that they enter a laboratory where exposure to hazardous chemicals might occur. Employees who are responsible for receiving and handling shipments of new chemicals or chemical wastes should also be informed of the potential hazards and appropriate protective measures for chemicals they may receive.
5. Laboratory employees should be trained on the applicable details of the chemical hygiene plan, including a review of the general rules of laboratory safety. The training program should describe appropriate sections of the standard operating procedures, particularly those procedures that require prior approval of the chemical hygiene officer.
6. The training an employee receives should be determined by the nature of the work assignment in the laboratory.
7. Employees should be trained in measures they may take to protect themselves from exposure to hazardous chemicals, including the location and proper use of protective equipment and emergency equipment. In addition, the training must also include a discussion of inventory procedures to be followed, proper storage and ordering rules, and hazardous waste disposal procedures.
8. All laboratory employees will be trained to read and understand MSDSs.
9. All employees shall be trained in labeling and storage practices as outlined in the chemical hygiene plan.
10. All employees should be trained in the methods and observations that may be used to detect the presence or release of hazardous chemicals.

B. Training for Students

1. Instruction in laboratory safety shall be provided to all students involved in laboratory activities.
2. The extent of student training should be based on their grade level, course of study, the laboratory facility, the chemical hygiene plan, and the level of chemical handling and potential exposure to hazardous chemicals.



3. Safety training should include the importance and the content of the label and of MSDSs. As appropriate, the student should also be introduced to other sources of chemical safety information.
4. At the beginning of the school year and prior to laboratory activities, class time shall be devoted to safe laboratory practices.

C. Information

1. Employees shall be informed of the content of the "Laboratory Standard", 29 CFR Part 1910.1450.
2. Employees shall be informed of the location and availability of the chemical hygiene plan.
3. Employees shall be informed of the permissible exposure limits for OSHA regulated substances on site or recommended exposure limits for other hazardous chemicals on site where there is no applicable OSHA standard.
4. Employees shall be informed of the location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals where there is no applicable OSHA standard.
5. Employees shall be informed of the location of material safety data sheets.
6. Employees shall be informed of the location of personal protective equipment and of emergency equipment as outlined in the chemical hygiene plan.
7. Employees shall be informed of the signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.

V. Medical Consultation and Medical Examinations

1. College employees do not regularly handle significant quantities of materials that are acutely or chronically toxic. Therefore, regular medical surveillance is not justified.
2. In the event that an employee is exposed to levels of a hazardous chemical exceeding the established PEL or TLV, or should the employee exhibit signs or symptoms of such exposure, the employee shall be provided an opportunity to receive an appropriate medical examination.
3. All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.
4. The College shall provide the following information to the physician conducting the examination.
 - a. The identity of the hazardous chemical(s) to which the employee may have been exposed.
 - b. A description of the conditions under which the exposure occurred, including quantitative exposure data if available.
 - c. A description of the signs and symptoms of exposure that the employee is experiencing
 - d. A copy of the MSDSs for the chemicals(s) involved.
5. A written opinion from the examining physician for any consultations or examinations performed under this standard should include:
 - a. Any recommendation for further medical attention
 - b. The results of the medical examination and any associated tests
 - c. Any medical condition revealed during the examination which might compromise employee safety during, or as a result of, exposure to hazardous chemicals found in the workplace
 - d. A statement that the employee has been informed by the physician of the results of the consultation or examination and any medical condition that may require further examination or treatment.
 - e. A copy of the physician's report to be retained by the College.
6. The written opinion from the physician should not reveal specific diagnoses unrelated to the occupational exposure.

VI. Responsibilities

A. Chemical Hygiene Officer

1. Develop and implement the chemical hygiene plan, including training, reporting, and other functions.



2. Assure that inspections in the laboratory are performed when appropriate and that records of inspections are maintained.
3. Monitor the procurement, use, and disposal of chemicals used in the College's laboratory programs.
4. Provide technical assistance on the chemical hygiene plan.
5. Assure that the chemical hygiene plan is reviewed annually and revised as needed.
6. Make decisions regarding requests to use chemicals identified as explosive, carcinogenic, mutagenic, highly toxic, or otherwise unsuitable for general school laboratories.
7. Determine the need for personal equipment beyond that specified for general laboratory use.
8. Implement appropriate training with regard to chemical hygiene for all employees whose normal work locations include laboratory areas.
9. Ensure that employees have received appropriate training.
10. Ensure that employees have access to the chemical hygiene plan, MSDSs, and other suitable reference materials.

B. Department Chair

1. The Department Chair is responsible for chemical hygiene programs within their department. The Department Chair shall monitor compliance with the chemical hygiene plan.

C. Employees who work in laboratories

1. Participate in training programs provided by the College
2. Maintain an awareness of health and safety hazards
3. Plan and conduct each operation in accordance with the chemical hygiene plan procedures
4. Consult reference materials, including MSDSs, related to chemical safety where appropriate
5. Use and model good personal chemical hygiene habits
6. Report accidents, injuries, unsafe practices, and unsafe conditions; if a student is injured in class, faculty member must fill out an Incident Report (found online at www.etown.edu/safety) and forward it to Human Resources.

D. Students

1. Students should practice good personal hygiene habits. They should report accidents and maintain an awareness of health and safety hazards. Students should conduct all activities according to the chemical hygiene plan procedures.

VII. Particularly Hazardous Substances (PHS)

A. General

1. This section of our plan describes the specific and general control measures which are designed to reduce the exposure of instructors, aides, students, and other employees to especially hazardous substances. Employees should read and understand these practices before commencing a procedure using particularly hazardous substances.
2. PHSs include highly toxic chemicals, reproductive toxins, and select carcinogens. In addition, the College includes highly flammable chemicals, highly reactive chemicals, and highly corrosive chemicals.
3. The use of these substances requires prior approval of the Chemical Hygiene Officer.
4. PHSs shall be used in designated areas and in fume hoods.
5. The use of PHSs shall require removal of contaminated waste and the decontamination of contaminated areas.

B. Highly Toxic Chemicals

1. When a PEL or TLV value is less than 50 ppm or 100 mg/m³, the user should use it in an operating fume hood, glove box, vacuum line, or other device equipped with appropriate traps. If none is available, no work should be performed using the chemical.



2. If a PEL, TLV, or comparable value is not available, the animal or human median inhalation lethal concentration information, LC 50, should be used as a guideline. If that value is less than 200 ppm or 2000 mg/m³ when administered continuously for one hour or less, then the chemical should be used in an operating fume hood, glove box, vacuum line, or other device equipped with appropriate traps. If none are available, no work should be performed using that chemical.
3. Examples of highly toxic chemicals (acute or chronic) that were commonly used in the past are benzene, chloroform, formaldehyde, bromine, carbon disulfide, carbon tetrachloride, cyanide salts, and hydrofluoric acid.

Evaluation

The Safety Committee shall be responsible for evaluating this policy annually.

Document History

Created: 7/2006; Audited: 7/2007; Revised: 3/2008; Audited: 7/2009

APPENDIX A
Labels for Hazardous Waste

<p style="text-align: center;">Hazardous Waste</p> <p>Start accumulation date: _____</p> <p>Container fill date: _____</p> <p>Date moved to HW storage area: _____</p>

*For containers that still have original label
(including chemical name & specific hazards)*

<p style="text-align: center;">Hazardous Waste</p> <p>Start accumulation date: _____</p> <p>Container fill date: _____</p> <p>Date moved to HW storage area: _____</p> <p>Chemicals in container: _____</p> <p>Specific Hazards: _____</p>
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For chemicals that are no longer in original containers