

Lansing Community College
Science Department

Chemical Hygiene Plan

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INTRODUCTION

The Science Department at Lansing Community College has developed this Chemical Hygiene Plan to promote the safe operation of the college laboratories for students, faculty and staff; and to promote a culture of safety within the Department and the College.

This Plan is intended to satisfy the requirements of the US Department of Labor, Occupational Safety and Health Administration 29 CFR 1910.1450 *Occupational Exposures to Hazardous Chemicals in Laboratories* and the Michigan Occupational Safety and Health Act (MIOSHA) for the protection of our employees.

In addition, the Plan provides guidance for a safe student experience in our laboratories.

This document is managed by the Science Department Safety Committee. Comments or corrections to this document should be forwarded either to the Chair of the Safety Committee (Nancy Jaehn jaehnn@lcc.edu) or to the Chairperson of the Science Department (Tom Deits deitst@lcc.edu)

I. Standard Operating Procedures

A. General

- 1) This document applies to all Science Department Labs in which chemicals are used at any time. "Chemicals" are defined as non-edible substances (not on FDA GRAS - "Generally Recognized as Safe" List)
- 2) Staff and students shall follow the Chemical Hygiene Plan to promote their health and safety.
- 3) 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 will be clearly marked and free of obstructions to permit quick, safe escape in an emergency.
- 4) Only students enrolled at Lansing Community College in the specific course may participate in laboratory exercises, except when superceded by college policy.
- 5) 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.
- 6) Employees will follow general precautions for handling all laboratory chemicals to minimize all chemical exposures. Specific guidelines found in the appropriate MSDSs, will also be followed.
- 7) Employees shall not underestimate the risk of exposure, and exposure to hazardous substances shall 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 shall be eliminated.
- 8) Chemicals shall 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 MSDS's shall be accessible to employees at all times in the Science Department central preparation room, on the Science Department web page (www.lcc.edu/science) and in the Department of Public Safety. Employees shall be trained to read and use the information found on MSDSs.
- 9) 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.

B. Laboratory Procedures

- 1) Individuals in laboratories:
 - a. Food and drink, gum chewing, application of cosmetics, or manipulation of contact lenses may be permitted in rooms A&S 458, 463, 465, 471, and 475, only when the room is free from chemicals and biological materials. Permission for these activities is at the discretion of the instructor. These activities are not permitted in any other Science Department Labs.
 - b. All persons will conduct themselves in a responsible manner at all times in the laboratory (horseplay, throwing items and pranks are prohibited). Use or retention of laboratory supplies or equipment is prohibited unless specifically authorized by a supervisor or instructor.
 - c. Employees shall 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. Touching, smelling, tasting or other close contact with chemicals is strictly forbidden.
 - e. Never pipette by mouth. Always use a bulb or other device for suction.
 - f. Students should not insert glass tubing into rubber stoppers. Other employees shall use the appropriate lubricant and hand protection when inserting tubing.
 - g. Proper procedures for Bunsen burners or other sources of flame shall be followed. Never leave a flame unattended.
 - h. Dress appropriately for laboratory work. Loose or baggy clothing and dangling jewelry or other accessories are not permitted. Confine or tie back long hair. Sandals or any open toed shoes are not permitted in the laboratory.
 - i. Should a fire alarm or any other evacuation occur during a lab activity, turn off all Bunsen burners and electrical equipment. Leave the room as directed.
 - j. Heating of glass by employees for purposes of softening or melting should only be done with the authorization of a supervisor or instructor. Appropriate eye and hand protection shall be worn. Students may not heat glass for bending or melting.
 - k. Careful storage and handling procedures shall be used to avoid glassware breakage. In the event of breakage of glass not containing chemicals or biological materials, protection for the hands shall be worn when picking up the broken pieces. Small pieces shall be swept up with a brush and pan. Broken glass shall 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. See section G of this Plan for proper procedures.

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- l. The quantities of flammable liquids used in the laboratory shall not exceed the amount that can be consumed in the current experiment.
 - m. Chemical and biological materials shall be stored only in the chemical preparation and storage areas. Quantities sufficient for the current experiment cycle are permitted in laboratories when properly labeled. See section II.B.2 for proper labeling procedures.
- 2) Students in the laboratory:
- a. Must read lab directions ahead of time and follow all verbal and written instructions.
 - b. Shall perform only authorized experiments.
 - c. Shall report all accidents, injuries, chemical spills, glass breakage or equipment malfunctions to the instructor at once, no matter how trivial they may seem. The Department of Public Safety will evaluate cuts, burns, accidental ingestion of chemicals, or inhalation of fumes.
 - d. Shall only carry out laboratory work under the direct supervision of an instructor or designated staff member.

C. Housekeeping Practices

- 1) Individuals in the laboratory:
- a. All laboratory areas must be kept clean and orderly.
 - b. Place all chemical and biological wastes in appropriate, segregated receptacles that are properly labeled. See Section I.F. for labeling and disposal procedures.
 - c. Sinks are to be used only for disposal of water and those solutions designated in section I.F.5. Other solutions must be placed in the appropriate labeled waste container.
 - d. Tabletops are to be swept clean and washed at the end of any lab activity that utilizes chemical or biological materials.
 - e. Clean up all chemical spills according to Section I.G., as soon as they occur. Chemicals and cleanup materials shall be disposed of according to Section F.
 - f. Never block access to emergency equipment, showers, eyewashes, or exits .
 - g. Store chemicals and equipment properly. Chemicals shall not be stored in aisles, on the floor, in stairwells, on desks, or laboratory tables.
 - h. Operating hotplates, running water and open flames shall not be left unattended.
 - i. Keep all cabinets and drawers closed when not in use to avoid catching and bumping hazards.

D. Chemical Procurement

- 1) Efforts should be made to order chemicals in quantities that are likely to be consumed in one year and shall be purchased only in the quantity sufficient for the declared use.
- 2) A chemical shall not be accepted without an adequate identifying label.
- 3) The container shall be marked with the full level and date(s) it is received and opened.
- 4) Laboratory chemicals not in the inventory listing (see II.B.1.) may not be stored or brought into the laboratory or other areas of the College.
- 5) Donated chemicals shall only be accepted, with the approval of the Safety Committee.
- 6) Chemicals shall be inventoried as described in section II.B.1.

E. Storage and Distribution

- 1) All chemicals shall be in tightly closed, sturdy, and appropriate containers.
- 2) If the chemical has been transferred to a secondary container, the new container shall have an adequate identifying label.
- 3) Chemicals shall be stored based on the reactive nature and compatibility group of the chemical.
- 4) Large containers and containers with reactive chemicals, such as acids and bases, shall be on low shelves.
- 5) Flammable chemicals shall be stored in approved storage containers and in approved flammable chemical storage cabinets.
- 6) No combustible material, such as paper products, shall be stored in A&S 406 (Chemical Storage Room). No trash/recycling receptacles shall be kept in A&S 406.
- 7) All storage areas shall be securely locked when not in use. Storage and preparation areas shall be accessible only to those persons authorized to access the chemicals.
- 8) 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.
- 9) Chemicals shall not be distributed for purposes other than instruction within the Science Department without the prior approval of the Chemical Hygiene Officer. Chemicals

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transferred to other locations off of the main campus, but within the college, shall be accompanied by their applicable MSDS information. All college employees who transfer and receive chemicals shall have appropriate training in their use, storage and disposal.

- 10) Refrigerators used to store flammable chemicals shall be labeled and shall be of explosion proof or of lab safe design.
- 11) Chemicals transported in elevators shall be protected from breakage and carried in secondary containers that will contain spills, such as unbreakable tubs. All chemicals transported in elevators shall be carried by cart, not by hand. The elevator shall not be used by the public during transportation of significant quantities (over 100 grams) of chemicals.

12) 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 shall only be moved from one location to another with the protective cap securely in place. A wheeled gas cylinder carrier will be used when moving a cylinder. Moving cylinders by rolling is prohibited.
- c. Both full and empty cylinders shall only be stored where they may be securely restrained by straps, chains, or a suitable stand.
- d. A cylinder shall be considered empty when there is still a slight positive pressure and an "EMPTY" label placed on it.
- e. An empty cylinder shall be returned to the supplier as soon as possible after having been emptied or when it is no longer needed.
- f. Cylinders shall not be exposed to temperatures above 50 °C.
- g. Store flammable gases separately from oxidizer gases.

F. Waste Minimization and Disposal

- 1) The Lansing Community College Department of Public Safety shall ensure that the disposal of laboratory chemicals is in compliance with the Michigan Department of Environmental Quality, *Hazardous Waste Management Rules*.
- 2) The College is considered a Small Quantity Generator according to the Michigan Hazardous Waste Rules.

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- 3) Waste minimization: Employees shall minimize generation of hazardous wastes by:
 - a. Using microscale labs and selecting less hazardous materials.
 - b. Ordering chemicals in quantities that are likely to be consumed in one year or less.
 - c. Avoiding the inadvertent accumulation of hazardous waste. Potential waste materials are surplus, old, and/or unnecessary chemicals.
 - d. Determining if the material will need to be treated as hazardous waste by referring to the *Hazardous Waste Management Rules* prior to ordering new chemicals.
- 4) Hazardous waste disposal: All hazardous materials shall be disposed of in accordance with Michigan Hazardous Waste Management rules.
 - a. Only non-hazardous aqueous solutions between pH 3 and pH 9 may be poured down the drain.
 - b. Separate hazardous waste containers shall be provided by the head chemistry technician for heavy metal compounds, chlorinated hydrocarbons, and non-chlorinated hydrocarbons or other categories as recommended by the Department of Public Safety.
 - c. Waste chemicals shall be stored in appropriately labeled containers, inside secondary containment.
 - d. Hazardous wastes shall never be placed in any common solid trash container.
 - e. All hazardous waste containers shall have an up-to-date log of the material that is in the container. When any material is added to the container, the chemical name, the amount of the chemical, the date, and the initials of the individual adding the hazardous chemical, shall be recorded in the log for that container. This recording task is the responsibility of the laboratory instructor.
 - f. Upon completion of the laboratory activity cycle, the waste containers shall be returned to the preparation room. Waste materials shall not be stored in the laboratory.
 - g. When the waste containers become full, or 90 days after the container is first used, the containers shall be transferred to the designated waste storage area in room 122A of the Arts and Science building.
 - h. Unlabeled containers apparently containing liquid and/or solid chemicals shall be treated as hazardous waste and disposed of using the procedures describe above.

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 shall be isolated until the Department of Public Safety is contacted and a HAZMAT team arrives.
- 2) If hazardous vapors are present, the area shall be isolated, and the Department of Public Safety contacted. Only Department of Public Safety personnel trained in the use of respirators may enter the area.
- 3) If a volatile, flammable material is spilled, immediately extinguish flames such as Bunsen burners 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 and contact the Department of Public Safety.
- 4) If there is no immediate danger (flammability, toxicity, reactivity, corrosivity) to personnel, and the spill can be contained, containment shall be accomplished by use of spill pillows, towels, rolls, or other devices that will keep the spill from spreading. If a major spill occurs (cannot be cleaned-up safely by yourself), the Department of Public Safety should be immediately contacted.
- 5) If there is no immediate danger, cleanup procedures listed on the MSDS shall be followed. Appropriate personal protective equipment shall be used.
- 6) A spill kit shall be maintained in each laboratory working with chemicals. Spill kits for lab rooms will include kitty litter, gloves, good quality absorbent paper towels, broom, dustpan and bucket. It will be clearly marked "For Safety Emergency Only". Spill kit(s) for Prep Room (AS 408) will be provided by the Department of Public Safety. Kits shall be inspected before the beginning of each semester by the head chemical laboratory technician.
- 7) If the spill material is a hazardous chemical, all of the materials involved in the cleanup will be considered to be hazardous waste and must be disposed of as such.

II. Control Measures

A. Personal Protective Equipment

- 1) It is the responsibility of the College to provide appropriate safety and emergency equipment for employees and students.
- 2) Laboratory aprons or coats, eye protection, and non-permeable gloves are considered standard equipment for College laboratory programs and will be used as specified in the course syllabus. The Science Department safety committee shall annually review protective equipment requirements for all laboratory courses.
- 3) Protective apparel shall be compatible with the required degree of protection for the substances being handled.
- 4) All eye protection devices used in the Science Department shall conform to ANSI Standard Z87.1-2003. Eyeglasses, even with side shields, are not acceptable protection against chemical splashes.
- 5) Any experiment that involves heating or the use of chemicals, or glassware shall require the use of chemical splash safety goggles.
- 6) Wearing contact lenses is acceptable and is not an additional hazard.
- 7) 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 shall also be worn when an operation involves a pressurized or evacuated system. For full protection, safety goggles must be worn with the face shield.
- 8) Standing shields shall be used when there is a potential for explosions, implosions, or splashes, or when corrosive liquids are used. The standing safety shield shall be used with safety goggles and, if appropriate, with a face shield..
- 9) When gloves are required, the MSDS shall be consulted for information regarding the proper type of gloves to be used. The correct type of gloves shall be available in every laboratory for the procedures to be carried on that day.

B. Administrative Controls

1) Inventory Control

- a. A chemical inventory shall be updated regularly. The list shall be audited for accuracy on an annual basis. The person(s) responsible for updating and maintaining this list shall be designated by the Chair of the Science Department as advised by the Science Department Safety Committee
- b. The chemical inventory list shall 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 review for possible disposal.

2) Hazard Identification and Labels

- a. Labels on incoming containers of hazardous chemicals are not to be removed or defaced.
- b. Laboratory chemicals shall 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 shall 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 shall be appropriately labeled with the chemical name, concentration (if in solution), solvent (if in solution other than water), and initials of the person responsible for the transfer.
- e. Unlabeled bottles shall not be opened, and such materials shall be disposed of promptly, as outlined in the section on disposal procedures.

3) Signs and Posters

- a. Emergency telephone number is 911.
- 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, other safety equipment and areas where food and drink are prohibited.

4) Material Safety Data Sheets

- a. MSDS for all chemicals shall be maintained and made readily available. Call Public Safety at 483-1800 for information

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- b. The material safety data sheets 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, shall be used to set laboratory guidelines. These laboratory guidelines shall be used in determining the safety precautions, control measures, and personal protective equipment that apply when working with the toxic chemical.

5) Records

- a. The up-to-date Chemical Inventory List (section II.B.1.) shall be maintained on the Science Department Public workspace.
- b. Inspection Records
 - i) Reports must be completed and retained by the Department of Public Safety
 - ii) Safety equipment shall be marked to indicate the date and the results of the last inspection conducted by the Department of Public Safety.
 - iii) Records indicating the dates of repairs and regular maintenance of safety equipment shall be retained by the Department of Public Safety
- c. Training Records: The College shall maintain records of employee training and records of completed training will be made available to the Science Department.
- d. Incident Report: Incident reports will be completed by the Department of Public Safety.
- e. Medical and Exposure Records: Records of air concentration monitoring shall be maintained by the Department of Police & Public Safety. Exposure assessments, medical consultations, and medical examinations shall be maintained by the College Human Resources Department.
- f. Waste Disposal Records: The Department of Public Safety shall retain records of disposal of hazardous waste. The records shall conform to the requirements of the Michigan Department of Environmental Quality Hazardous Waste Rules.

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 Department of Public Safety shall ensure that the employee or student exposure to that substance is measured.
- b. 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 Department of Public Safety shall be notified.

- c. In the event that an employee is exposed to levels of a hazardous chemical exceeding the established PEL or TLV, or shall the employee exhibit signs or symptoms of such exposure, the employee shall be provided appropriate medical treatment by contacting the Department of Public Safety.

III. SAFETY / EMERGENCY FACILITIES AND EQUIPMENT

A. Equipment

- 1) The Department of Public Safety shall ensure that adequate emergency equipment is available in the laboratory and inspected periodically to ensure that it is functioning properly. Records of these inspections will be held in the Department of Public Safety. All employees shall be properly trained in the use of each item.
- 2) Emergency equipment items that shall be available include: eyewash station, fire extinguisher of the appropriate type, safety shower, telephone for emergencies, fire blanket, and identification signs.
- 3) Each laboratory shall have a standard first aid kit inspected and stocked according to Department of Public Safety policy .
- 4) Multipurpose fire extinguishers shall be available in the laboratory. A multipurpose, ABC, fire extinguisher, can be used on all fires EXCEPT for class D fires. Extinguishers shall be visually checked monthly and inspected and tested annually by the Department of Public Safety.
- 5) Every eye wash station will be capable of supplying a continuous flow of aerated, tepid, potable water to both eyes for at least 20 minutes. The valve shall remain in the open position without the need to hold the valve. Eyewashes shall be inspected and operated at least twice a year, and marked to document this inspection and use by the Department of Public Safety.
- 6) Safety showers shall be capable of supplying a continuous flow of tepid potable water for at least 20 minutes. The shower shall have a quick - opening valve requiring manual closing. (ANSI Z358.1-1990) . The valve shall remain in the open position without the need to hold the valve. Safety showers shall be inspected and operated at least twice a year, and marked to document this inspection and use by the Department of Public Safety.
- 7) Laboratories in which hazardous substances are being used shall have spill control kits. Kit contents are described in section 1.G.6.

B. Facilities

1) Fume hoods

- a. Laboratory classroom fume hoods are not to be used for either storage or disposal of chemicals.
- b. 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 shall be conducted in the fume hood.
- c. All fume hoods shall be inspected annually and certified by the Department of Public Safety. 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.

2) Ventilation

- a. Ventilation systems shall be constructed and maintained to comply with MIOHSA or other applicable standards. Inspection and certification of ventilation systems will be carried out by the Department of Public Safety

3) Flammable Storage

- a. Chemicals with a flash point below 93.3 ° C (200 ° F) shall 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 shall be stored in a flammable solvent storage area, safety cans, or in storage cabinets designed for flammable materials.
- c. Flammable materials shall 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 (by touching hand to work surface prior to pouring) 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 shall be in flame-proof storage cans which conform to NFPA guidelines and/or the applicable local fire codes.

4) Electrical

- a. All building electrical systems shall be constructed and maintained in accordance with state and local applicable standards.
- b. In the event that power needs to be immediately turned off at the circuit breaker, contact the Department of Public Safety.

IV. Training and Information

A. Training for Employees

- 1) The College shall provide employees with information and training to ensure that they are aware of the hazards of chemicals present in their work area.

- 2) The College shall provide Right-To-Know training opportunities for all laboratory employees at risk. The Science Department shall provide training opportunities for all laboratory employees at risk about the hazards of chemicals present in the laboratory and sources of information concerning hazards in the laboratory. In particular, the training program shall cover the Chemical Hygiene Plan, material safety data sheets, and the responsibilities of the Science Department and the employees.
 - a. Employees shall be trained on the potential chemical hazards in the employees' work areas and on appropriate sections of the chemical hygiene plan. This training shall 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 shall also be informed of the potential hazards and appropriate protective measures for chemicals they may receive.
 - b. Laboratory employees shall be trained on the applicable details of the chemical hygiene plan, including a review of the general rules of laboratory safety. The training program shall describe appropriate sections of the standard operating procedures, particularly those procedures that require prior approval of the Science Department Safety Committee. The training an employee receives shall be determined by the nature of the work assignment in the laboratory.
 - c. Employees shall 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 district hazardous waste disposal procedures.
 - d. All laboratory employees will be trained to read and understand MSDSs.
 - e. All employees shall be trained in labeling and storage practices (see section II.B.2.).

- 3) Training shall be carried out as designated by the Science Department Laboratory Safety Committee.

B. Access to Information

1) Employees shall be informed of the location, availability, content and use of:

- the "Laboratory Standard" 29 CFR Part 1910.
- the Chemical Hygiene Plan.
- personal protective equipment and emergency equipment as outlined in the chemical hygiene plan.

C. Training for Students

Faculty shall provide a safe environment for student learning by providing safety training to students.

- 1) At the beginning of the term and prior to laboratory activities, class time shall be devoted to safe laboratory practices and to the student safety agreement.
- 2) Instruction in laboratory safety shall be provided to all students enrolled in laboratory classes. Students enrolling after safety instruction has taken place shall receive instruction prior to being permitted to engage in laboratory activities.
- 3) The extent of student training shall be based on their course of study, the laboratory facility, College policies, the chemical hygiene plan, and the level of chemical handling and potential exposure to hazardous chemicals.
- 4) Safety training shall include the importance and the content of the label and of material safety data sheets. As appropriate, the student shall also be introduced to other sources of chemical safety information.

V. Approval of Experimental Design

Prior approval shall be obtained from the Science Department Safety Committee whenever a new laboratory experiment or test is to be carried out. Approval is also required if there is a significant change in an existing experiment, such as the amounts or identities of materials being used or the conditions under which the experiment is to be conducted. Existing laboratory experiments will be reviewed by the Safety Committee on an on-going basis. The criteria for approval of laboratory experiments will be based on the best available knowledge of the hazards of the substance and the availability of proper handling facilities and equipment. Important factors to consider when reviewing should include:

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- Is use of the chemical pedagogically sound?
- Are adequate safeguards in place to assure proper use of the substance?
- Is the exposure time of the employees and students to the substance minimal and acceptable?

VI. Responsibilities

A. Department of Public Safety

The Department of Public Safety has primary responsibility for the implementation and enforcement of the Chemical Hygiene Plan.

B. Science Department Safety Committee

The Science Department Safety committee will make recommendations to the Department of Public Safety which will include:

- The adequacy and currency of the chemical inventory
- The safety of new and existing laboratory procedures used in laboratory courses
- Personal Protective equipment requirements
- Training content for students and employees
- Annual review of the Chemical Hygiene plan

C. Chemical Hygiene Officer

- 1) The Chemical Hygiene Officer is appointed by the Chair of the Science Department.
- 2) The Chemical Hygiene Officer shall be qualified by training and experience to provide technical guidance in the development and implementation of the Chemical Hygiene Plan.
- 3) The Chemical Hygiene Officer has the responsibility to:
 - a. Work with administrators and teachers to develop and implement the safety program.
 - b. Assure that inspections in the laboratory are performed when appropriate and that records of inspections are maintained.
 - c. Provide technical assistance to employees and laboratory supervisors on the chemical hygiene plan .

D. Employees

Employees who normally work in a laboratory are responsible for:

- Participating in required training programs provided by the College.
- Maintaining an awareness of health and safety hazards.
- Planning and conducting each operation in accordance with the Science Department chemical hygiene plan procedures.
- Consulting reference materials, including MSDSs, related to chemical safety where appropriate.
- Using and modeling good personal chemical hygiene habits.
- Reporting accidents, injuries, unsafe practices, and unsafe conditions.

E. Students

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

APPENDIX A

Definitions and Procedures for Use of 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 shall 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 Science Department 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 shall use it in an operating fume hood, glove box, vacuum line, or other device equipped with appropriate traps. If none is available, no work shall 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, shall 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 shall be used in an operating fume hood, glove box, vacuum line, or other device equipped with appropriate traps. If none are available, no work shall 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.

C. Highly Flammable Chemicals

- 1) The Science Department will define Class 1A liquids as highly flammable chemicals. Class 1A liquids have a flashpoint of less than 73 ° C and a boiling point of less than 100 ° C.
- 2) Highly flammable chemicals shall be used only in approved fume hoods, and shall be kept away from sources of possible ignition (such as sparks, flames, hot surfaces, etc...)
- 3) Examples of highly flammable chemicals are diethyl ether, acetone, pentane, petroleum ether, acetaldehyde, and ligroines.

D. Highly Reactive Chemicals

- 1) Reactivity information may be given in a manufacturers' MSDSs and on labels. The most complete and reliable reference on chemical reactivity is the current edition of *Bretherick's Handbook of Reactive Chemical Hazards*.
- 2) A reactive chemical is one that:
 - . Is described as such on the label, in the MSDS, or by Bretherick.
 - . Is ranked by the NFPA as 3 or 4 for reactivity.
 - . Is identified by the Department of Transportation (DOT) as an oxidizer, an organic peroxide, or an explosive (Class A, B, or C).
 - . Fits the Environmental Protection Agency definition of reactive in 40 CFR 261.23.
 - . Is known or found to be reactive with other substances.
- 3) Reactive chemicals shall be handled with all proper safety precautions, including segregation in storage, and prohibition of mixing even small quantities with other chemicals without prior approval and appropriate personal protection and precautions.
- 4) Examples of commonly encountered highly reactive chemicals are ammonium dichromate, nitric acid, perchloric acid, hydrogen peroxide, and potassium chlorate, azides, organic nitrates, and acetylides.

E. Highly Corrosive Chemicals and Contact Hazard Chemicals

- 1) Corrosivity, allergen, and sensitizer information is provided in manufacturers' MSDSs and on labels.

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- 2) A corrosive chemical is one that:
 - a. Fits the MIOSHA definition of corrosive
 - b. Fits the EPA definition of corrosive in 40 CFR 262.22 (has a pH greater than 12 or a pH less than 2.5)
 - c. Is known to be reactive to living tissue, causing visible destruction, or irreversible alterations of the tissue at the site of contact.
- 3) A contact - hazard chemical is an allergen or sensitizer that:
 - a. Is so identified or described in the MSDS or on the label.
 - b. Is so identified or described in medical or industrial hygiene literature.
 - c. Is known to be an allergen or sensitizer.
- 4) Corrosive and contact hazard chemicals will be handled with all proper safety precautions, including wearing safety goggles, using gloves tested for the absence of pinholes and known to be resistant to permeation or penetration by the chemical, and wearing a laboratory apron or laboratory coat.
- 5) Examples of highly corrosive chemicals are hydrochloric, sulfuric, nitric, phosphoric, and perchloric acids (all acids in greater than 1 Molar concentration), and potassium hydroxide (either solid or in aqueous solution greater than 1 Molar concentration).

F. Reproductive Toxins

- 1) A reproductive toxin refers to chemicals which affect reproductive capabilities including chromosomal damage (mutations) and which effect fetuses (teratogenesis).
- 2) A reproductive toxin is a compound that:
 - a. Is described as such in the applicable MSDS or label.
 - b. Is identified as such by the Oak Ridge Toxicology Information Resource Center (TIRC), (615) 576-1746.
- 3) No reproductive toxins shall be allowed in the College laboratories without written authorization from the chemical hygiene officer.
- 4) If such chemicals are used:

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- a. They shall be handled only in a hood and when satisfactory performance of the hood has been confirmed.
 - b. Skin contact shall be avoided by using gloves and wearing protective apparel.
 - c. Persons using such substances shall always wash hands and arms immediately after working with these materials.
 - d. Unbreakable containers of these substances shall be stored in a well ventilated area and will be labeled properly.
- 5) Examples of reproductive toxins are organomercurial compounds and ethidium bromide, carbon disulfide, xylene, toluene, benzene, mercury, lead compounds, ethyl ethers, vinyl chloride.

G. Select Carcinogens

- 1) Select carcinogen means any substance which meets one of the following criteria:
 - a. It is regulated by MIOSHA as a carcinogen
 - b. It is listed under the category, "known to be carcinogens," in the National Toxicology Program (NTP) Annual Reports on Carcinogens.
 - c. It is listed under Group 1 "carcinogenic to humans" by the International Agency for Research on Cancer Monographs (IARC).
 - d. It is listed in either Group 2 A or 2 B by IARC or under the category "reasonably anticipated to be carcinogens" and causes statistically significant tumor incident in experimental animals under set criteria of exposure.
- 2) All work with these substances shall be conducted in a designated area, such as a fume hood, glove box, or a portion of a laboratory designated for use of chronically toxic substances. Such a designated area shall be clearly marked with warning and restricted access signs.
- 3) Any procedure that may result in a generation of aerosols or vapors shall be performed in a hood whose performance is known to be satisfactory.
- 4) Skin contact shall be avoided by using gloves and other protective apparel as appropriate. Any protective clothing shall be removed before leaving the designated area and placed in a labeled container. Hands, arms, and neck shall be washed after working with these materials.
- 5) Select carcinogens shall be stored in unbreakable containers in a ventilated area with controlled access. All containers shall be labeled with the identity and hazard of the substance.

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Immediately upon completion of the project, all unused carcinogens shall be disposed of following standard hazardous waste disposal procedures.

- 6) No select carcinogens are allowed without written authorization from the chemical hygiene officer.
- 7) Examples of select carcinogens are benzene, nickel metal dust, vinyl chloride, and formaldehyde.

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