



LAKE FOREST
COLLEGE

CHEMICAL HYGIENE PLAN

IMPLEMENTED

May 8, 2000

REVISED

May 30, 2008

February 24, 2014

Revised by the Chemical Hygiene Committee

- Professor Michael M. Kash
- Professor Shubhik DebBurman
- Associate Professor Karen Lebergott
- Associate Professor Naomi Wentworth
- Associate Professor Jason Cody
- Laboratory Supervisor Beth Herbert
- Laboratory Supervisor Barb Sesterhenn
- Art Department Professor Eli Robb

UPDATED

August 25, 2014 ✂

May 1, 2016

April 20, 2017

April 13, 2018

August 1, 2019 ❖

✂ Structural Plan Revision

❖ Format Revision



CONTENTS

SECTION 1	INTRODUCTION	5
	INTRODUCTION	6
	Purpose of This Document.....	6
	Application of the OSHA Laboratory Standard	6
	Summary of the Chemical Hygiene Plan	7
SECTION 2	RESPONSIBILITIES.....	9
	RESPONSIBILITIES.....	10
	Lake Forest College	10
	President.....	10
	Dean of Faculty	10
	Chemical Hygiene Officer.....	10
	Chemical Hygiene Committee.....	11
	Department Chairperson	11
	Faculty and Staff (In Charge Of Supervising Laboratories/Stockrooms)	12
	College Employees	12
	Students & Student Workers	12
SECTION 3	GENERAL PRINCIPLES	13
	GENERAL PRINCIPLES.....	14
	Be Prepared	14
	Follow the Chemical Hygiene Plan.....	14
	Minimize Exposure to Chemicals	14
	Consider the Risk	14
	Observe PEL and TLV.....	14
	Provide Adequate Ventilation.....	14
	Use Safety Data Sheets (SDS).....	15
SECTION 4	STANDARD OPERATING PROCEDURES.....	16
	STANDARD OPERATING PROCEDURES	17
	General Rules	17
	Working Alone	17
	Personal Protective Equipment and Clothing	17
	Eye Protection	17
	Protective Clothing.....	18
	Gloves.....	18
	Advance Planning.....	18
	Personal Behavior	18
	Personal Hygiene	19
	Housekeeping	19
	Food Handling.....	19
	Glassware.....	20
	Flammability Hazards.....	20
	Electrical Hazards.....	20
	Compressed Gases.....	20



Prior Approval	21
SECTION 5 RECORD KEEPING.....	22
RECORD KEEPING PROCEDURES.....	23
Air Concentration Monitoring.....	23
Training Records	23
Safety Data Sheets (SDS).....	23
Exposure Testing Records	23
Medical Records.....	24
Availability	24
Incident Reports.....	24
Hazardous Chemical Inventory Records	24
Waste Disposal Records.....	24
Safety Inspections and Recommendations.....	25
SECTION 6 LABORATORY SAFETY	26
LABORATORY SAFETY PROCEDURES	27
Employee Exposure Protection and Monitoring.....	27
Laboratory Facilities	27
Laboratory Ventilation	27
Medical Consultations and Medical Examinations	28
Cause for Consultation or Examination	28
Type of Medical Attention.....	28
Information for the Physician.....	28
Physician's Report	29
Hazardous Chemical Purchase	29
Storage and Distribution	29
Inventory Control.....	30
Hazard Identification and Labels.....	30
Safety Data Sheets (SDS).....	30
Waste Disposal.....	31
SECTION 7 INSPECTIONS.....	33
PROCEDURES FOR INSPECTIONS	34
Laboratory Equipment	34
Safety Inspections	34
SECTION 8 SPECIFIC EXPOSURE CONTROL MEASURES	35
SPECIFIC EXPOSURE CONTROL MEASURES	36
Toxic Chemicals.....	36
Flammable Chemicals	36
Reactive Chemicals	37
Corrosive Chemicals and Contact Hazard Chemicals	37
Reproductive Toxins.....	38
Select Carcinogens	38
Exposure Potential	38
SECTION 9 TRAINING	40



TRAINING OPPORTUNITIES.....	41
Information Program	41
Employee Training Program.....	41
Training of Students.....	41
SECTION 10 EMERGENCY PREVENTION AND RESPONSE	43
EMERGENCY PREVENTION AND RESPONSE	44
Standard Emergency Procedures.....	44
Ventilation	44
Fires.....	44
Dealing With a Fire.....	44
Injuries Involving Fires.....	45
General Chemical Spills.....	45
Chemical Spills on Personnel.....	45
Evacuation.....	46
Other Accidents Involving Personal Injury.....	46
Splashes in the Eyes	46
Emergency Contacts	46
Emergency Equipment.....	47
Dealing with Medical Help	47
First Aid	47
Accident Reports.....	47
SECTION 11 SPILL RESPONSE	48
SPILL RESPONSE PROCEDURES.....	49
Identification of the Spill.....	49
Containment of the Spill	49
Cleanup	49
Protective Equipment	50
Disposal.....	50
Personal Injury	50
Training Requirements.....	50
Record Keeping.....	50
SECTION 12 APPENDIX.....	51
APPENDIX A – THE LABORATORY STANDARD.....	52
APPENDIX B – SELECTED BIBLIOGRAPHY.....	60
APPENDIX C – INCIDENT REPORT FORM	62
APPENDIX D – LABORATORY SAFETY EQUIPMENT	63
Personal Clothing and Equipment	63
Laboratory Safety Equipment	63
Laboratory Spill Protection	64
APPENDIX E – RECORD OF TRAINING	65
APPENDIX F – SAFETY INSPECTION REPORT.....	66



LAKE FOREST
COLLEGE

SECTION 1 INTRODUCTION

INTRODUCTION

Purpose of This Document

This Chemical Hygiene Plan is designed to express the policies and procedures adopted by Lake Forest College as they relate to the safe operation of the College's laboratories. The Chemical Hygiene Plan is derived from the Occupational exposure to hazardous chemicals in laboratories. The goal of the Laboratory Standard is to provide a safe laboratory workplace, and it includes requirements on occupational exposures to hazardous chemicals.

The OSHA Laboratory Standard requires that employers protect workers through the development and implementation of a Chemical Hygiene Plan tailored to the individual laboratory workplace. The purpose of the Laboratory Standard and of this Chemical Hygiene Plan is to protect employees from harm due to exposure from hazardous chemicals while they are working in the laboratory.

Many policies and practices may not be part of the Chemical Hygiene Plan. However, they are crucial to the planning process to maintain a safe environment for employees and students. For example, the number of students per class, the number of students per professor or the amount of physical space available to each student is all considerations of policies and practices that affect maintenance of a safe environment but are not required by OSHA to be included in the Chemical Hygiene Plan.

Application of the OSHA Laboratory Standard

The Occupational Safety and Health Act is administered by the Occupational Safety and Health Administration, which is part of the Department of Labor. **OSHA promulgated regulations are found in the Code of Federal Regulations (CFR), Title 29, 1910 (cited as 29 CFR 1910).** Appendix A of this document contains the full text of 29 CFR 1910.1450, "The Laboratory Standard," and this introduction contains a summary of that code.

The Laboratory Standard requires that Lake Forest College have a Chemical Hygiene Plan and a Chemical Hygiene Officer.

What the Laboratory Standard covers

"Laboratories" are defined as facilities where the "laboratory use of hazardous chemicals" occurs. "Laboratory use of hazardous chemicals" refers to the handling or use of such chemicals in which all of the following conditions are met:

- Chemical manipulations are carried out on a laboratory scale.
- Multiple chemical procedures or chemicals are used.
- The procedures involved are not part of a production process, nor in any way simulate a production process.
- Protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

"**Hazardous Chemical**" means a chemical, for which there is statistically significant evidence, based on at least one scientific study, showing that acute or chronic health effects occur in exposed employees. A chemical prepared for the first time and for which safety data is not available should be treated as a

"hazardous chemical" until data is available to show otherwise. The term "health hazard" includes carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, sensitizers, and corrosives.

"Employees" who must abide by this Chemical Hygiene Plan are individuals employed in the laboratory workplace who may be exposed to hazardous chemicals in the course of their assignment. Included are employees who work in the laboratory such as professors, laboratory supervisors, research assistants, and other employees of the College who enter the laboratory to perform their assigned responsibilities such as maintenance and janitorial personnel.

"Laboratory scale" means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person.

What the Laboratory Standard does not cover

The Laboratory Standard is a regulation promulgated for the protection of employees. Since students and student workers (student worker accidents are recorded on the OSHA 300 Log) are not employees, they are not officially covered by provisions of the Chemical Hygiene Plan. However, since this document contains guidance on generally accepted good laboratory practice, it should be used to establish minimal safety instruction and procedures for all students handling chemicals.

The Laboratory Standard does not apply to uses of hazardous chemicals which do not meet the definition of "laboratory use." However, the Hazard Communication Standard may apply in these instances.

Laboratory uses of hazardous chemicals which provide no potential for employee exposure, including procedures using chemically impregnated test media such as Dip and Read tests, are not covered by the Laboratory Standard. The Lab Standard does not cover the use of commercially prepared kits, such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

Visitors and guests must wear the same personal protection as employees and students but are not included in the definition of employee and are not affected by the Chemical Hygiene Plan.

Summary of the Chemical Hygiene Plan

In compliance with the Laboratory Standard, the College has prepared and implemented the Chemical Hygiene Plan. Adherence to the Plan will assure that employees will be protected from health hazards associated with hazardous chemicals in the laboratory, and exposed to regulated substances at a level that will not exceed the permissible exposure limits.

This Chemical Hygiene Plan is composed of the following sections:

- This Introduction which states the goal and basis for the Chemical Hygiene Plan.
- A List of the College Personnel responsible for various aspects of the Plan and its implementation.
- General Principles which outlines the guidelines for working with laboratory chemicals.
- Standard Operating Procedures for Laboratories, the implementation of which will help the Chemical Hygiene Officer and all employees in meeting the goal of the Chemical Hygiene Plan.
- Record Keeping Requirements and procedures for reporting items related to laboratory health and safety.



LAKE FOREST
COLLEGE

- Laboratory Safety Procedures.
- Procedures for Inspecting Laboratories and reviewing the Chemical Hygiene Plan.
- A description of the situations in which employees must use Specific Exposure Control Measures.
- Information regarding Training Opportunities for employees.
- Emergency Response Procedures.
- Spill Response Procedures.
- Appendices which supply references and other useful information.



LAKE FOREST
COLLEGE

SECTION 2 RESPONSIBILITIES

RESPONSIBILITIES

The continuing execution of the provisions of the Lake Forest College Chemical Hygiene Plan is a responsibility of all employees who are involved in the laboratory science program. However, certain employees and entities are specifically charged with the successful execution of the Chemical Hygiene Plan.

Lake Forest College

The responsibilities of the College include the following:

- Maintaining a Chemical Hygiene Officer and verifying completion of their various responsibilities outlined below.
- Making manufacturer's Safety Data Sheets accessible to employees.
- Providing employees with training and information regarding chemical and physical hazards.
- Posting "Designated Areas" if any select carcinogens, reproductive toxins, or acute toxins are used in the laboratory.
- Measuring the concentration of hazardous chemical(s), if there is any reason to believe that the action level has been exceeded.
- Keeping records of employee exposure to hazardous chemicals for a period of 30 years beyond the time of exposure. These records should be filed by the employee, with the Business Office, in writing, within two weeks of the exposure.
- Providing medical consultations and examinations required as a result of exposure to hazardous chemical(s).

President

The President has the ultimate responsibility for chemical hygiene at Lake Forest College. The president should, with other administrators, provide continuing support for chemical hygiene programs, including the development and enforcement of the Chemical Hygiene Plan.

Dean of Faculty

The Dean of Faculty is responsible for

- The Chemical Hygiene programs at Lake Forest College.
- Monitoring compliance with the Chemical Hygiene Plan
- Making budget arrangements for health and safety improvements.

Chemical Hygiene Officer

The Chemical Hygiene Officer is appointed by the Dean of Faculty. A designated Auxiliary Public Safety Officer will serve in this position for Lake Forest College.

The Chemical Hygiene Officer is qualified by training and experience to provide technical guidance in the development and implementation of the Chemical Hygiene Plan. The Chemical Hygiene Officer reports directly to the Dean of Faculty.

The responsibilities of this position require the Chemical Hygiene Officer to:

- Develop and implement the Chemical Hygiene Plan for the College.
- Work with administrators, faculty, and staff to develop and administer the Chemical Hygiene Plan
- Assure that inspections of equipment and space in the laboratory are performed when appropriate and that records of inspections are maintained.
- Provide technical assistance to employees on the Chemical Hygiene Plan.
- Assure that the Chemical Hygiene Plan is reviewed annually and revised as needed, so that it remains in compliance with current regulations.
- Implement appropriate training with regard to chemical hygiene for all College employees whose normal work locations include laboratory areas.
- Annually arranging for the safe removal of chemicals for disposal in the department. These arrangements should be made in consultation with the Department Chairpersons (or their representative), and may require a budgetary request by the Chairperson.

Chemical Hygiene Committee

- Develop the Chemical Hygiene Plan for the College.
- Work with administrators, faculty, and staff to implement the Chemical Hygiene Plan.
- Assist with the annual review of the Chemical Hygiene Plan and revise as necessary to assure the plan remains in compliance with current regulations.
- The committee shall be comprised of the Chemical Hygiene Officer, Department Chairs from Biology, Chemistry, Physics, Psychology, Art and lab assistants from Chemistry and Biology.

Department Chairperson

The Department Chairperson is responsible for

- Chemical hygiene in the department.
- Ensuring that employees have access to the Department's Chemical Hygiene Plan, safety data sheets (SDS) and other suitable reference materials.
- Raising awareness of chemical safety issues within the department by
 - arranging a meeting of departmental faculty with the Chemical Hygiene Officer (or their representative), early each academic year, in order to review the classes of hazardous chemicals used in the department, and the safe handling and disposal procedures for each class.
 - encouraging all faculty personnel within the department to read the SDS that accompanies chemicals shipped to them (a practice especially needed for chemicals that have never before been used by an individual faculty member).
 - encouraging faculty to consult with the Chemical Hygiene Officer (or their representative), the Department Chairperson or other resident faculty experts on the safe use, storage and disposal of hazardous chemicals (especially needed for chemicals that have never before been used by an individual faculty member).
 - communicating directly to all departmental faculty that they are responsible for employing safe use, storage and disposal procedures for hazardous chemicals used in their respective teaching and research laboratories.

- Communicating to the Provost, annually, the department's budgetary needs that are aimed at maintaining safe practices, and, as programmatic needs change, enhancing safe practices in chemical hygiene in the department.

Faculty and Staff (In Charge Of Supervising Laboratories/Stockrooms)

All faculty and staff in charge of supervising laboratories or stockrooms have overall responsibility for chemical hygiene for that area, including responsibility to

- Ensure that employees know and follow the chemical hygiene rules.
- Ensure that protective equipment is available and maintained in working order.
- Ensure that employees have received appropriate training.
- Determine the need for personal protective equipment beyond that specified for general laboratory use.
- Ensure regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment.

College Employees

All employees, who normally work in a laboratory area, are responsible for

- Participating in training programs provided by the College.
- Familiarity with, and understanding of the Chemical Hygiene Plan
- Maintaining awareness of health and safety hazards.
- Planning and conducting each operation in accordance with the College's chemical hygiene procedures.
- Consulting reference materials, including Safety Data Sheets, related to chemical safety whenever appropriate.
- Using good personal chemical hygiene habits.
- Reporting accidents, injuries, unsafe practices, and unsafe conditions to the Department of Public Safety.

Students & Student Workers

Students & student workers are not specifically covered by the Laboratory Standard. However, good personal chemical hygiene habits should be taught to all students at every reasonable opportunity, particularly to those who use the laboratory while enrolled in science courses. Students shall not use school laboratories outside of regular science or photography course classes unless they first obtain permission from the professor or lab supervisor.



LAKE FOREST
COLLEGE

SECTION 3 GENERAL PRINCIPLES

GENERAL PRINCIPLES

The following statements and explanations are general principles for the use of those handling laboratory chemicals. While the list is not complete, these concepts provide the fundamental underpinning for laboratory work at Lake Forest College.

Be Prepared

Lake Forest College will train employees how to find and use information from SDS's, this Chemical Hygiene Plan, and other safety publications. Employees shall familiarize themselves with the hazards associated with the chemicals they expect to use and should take appropriate steps to minimize their exposure to those chemicals.

Follow the Chemical Hygiene Plan

The Chemical Hygiene Plan provides specific laboratory practices designed to minimize employees' exposure to hazardous substances. Employees shall follow the practices specified in the Chemical Hygiene Plan to minimize their health and safety risks.

Minimize Exposure to Chemicals

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 SDS's, will also be followed.

Consider the Risk

Employees should not underestimate 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.

Observe PEL and TLV

The permissible exposure limit (PEL) and threshold limit value (TLV) of a typical chemical used in the laboratory are available on the SDS for that chemical. Employee exposure to hazardous chemicals should not exceed those limits.

Provide Adequate Ventilation

The best way to prevent exposure to airborne substances is to prevent their escape into the laboratory by using hoods or other ventilation devices. Those devices should be kept in good working condition and free of excess storage in order to provide employees with a safe working area. The later section on Inspections in the laboratory establishes procedures for ensuring that equipment is working properly.



LAKE FOREST
COLLEGE

Use Safety Data Sheets (SDS)

The College should not accept a chemical from a supplier unless it is accompanied by the corresponding SDS, or unless a SDS from that supplier for that chemical is already on file. All SDS's should be accessible to employees at all times. Employees should be trained to read and use the information found on SDS's.



LAKE FOREST
COLLEGE

SECTION 4 STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURES

The goal of the Chemical Hygiene Plan is to protect employees (and student workers) who work in the laboratory, others who may be exposed, and the environment from injury due to hazardous chemicals. This section is written in several parts and is meant as a guide for the College and its employees. Other specific safety rules for a particular laboratory may be added as needed.

It is recommended that these same standards be communicated to students, expected of students, and promoted by the College and laboratory personnel.

General Rules

Instructors shall review laboratory instructions, safety procedures, and reagents prior to each laboratory activity. They should be aware of the following:

- The chemical hazards for each chemical, as determined from the SDS or other appropriate reference.
- Appropriate safeguards for using each chemical, including personal protective equipment.
- Location and proper use of emergency equipment.
- Proper storage of chemicals.
- Appropriate personal hygiene practices.
- Correct methods for transporting chemicals within the laboratory facility.
- Appropriate procedures for emergencies, including evacuations, spill cleanup procedures, and fire control.
- Proper procedures for the disposal of hazardous substances.
- Procedures for notifying supervisory persons in the case of an accident or injury.

Working Alone

Employees should not work alone in a laboratory or chemical storage area unless other employees are in the vicinity and are aware that someone is in the laboratory, in which case periodic checks should be made. At no time will a student ever work alone in a laboratory without an instructor or laboratory supervisor's permission.

Personal Protective Equipment and Clothing

The employee shall use appropriate protective clothing and equipment. 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.

EYE PROTECTION

Everyone, including visitors to the laboratory, shall wear eye protection when appropriate.

Protective eyewear should provide splash and impact protection and should conform to ANSI Standard Z87.1 1989. Eyeglasses, even with side shields, are not acceptable protection against chemical splashes.

Equipment should be available with which to clean and disinfect goggles and should be used whenever two or more persons use the same goggles.

Contact lenses are not necessarily prohibited in the laboratory. If contact lenses are permitted, protective eyewear must also be worn at all times. Because there may be a need to remove contacts quickly, contact lens wearers must inform the appropriate personnel of the contacts before an emergency arises. Approved standing shields or face shields should be used when there is potential for explosions, implosions, or splashes, or when corrosive liquids are used.

PROTECTIVE CLOTHING

Protective clothing worn in the laboratory shall offer protection from splashes and spills, should be easy to remove in case of an accident, and should be fire resistant. Nonflammable, nonporous rubber or plastic aprons offer the least expensive protection. They should be long enough to cover from the neck area to the knees. Clean chemical and fire resistant laboratory coats may be worn. They should be long sleeved and long enough to cover the knees. Snap fasteners or Velcro closures are better than buttons, because the laboratory coat is more easily removed in an emergency.

When working with corrosive liquids, wear low heeled shoes with fully covered "uppers." There should be no open toes or uppers constructed of woven material.

GLOVES

When gloves are required, it should be remembered that no one kind of glove is suitable for all situations. The SDS should be consulted for information regarding the proper type of gloves to be used.

Gloves that resist permeation by chemicals that are allergenic, sensitizing, or toxic should be worn when appropriate.

Gloves should be removed before leaving the laboratory or touching door knobs, telephones, or laboratory notebooks and be checked before each use to ensure the absence of cracks and small holes and should always be worn with the same side out.

Advance Planning

The instructor or employee should not rely solely on the textbook, laboratory manual, or other instructional material for safety precautions required for a particular experiment. Consult the SDS's for chemicals and safety references for equipment, particularly when the anticipated experiment is new to the instructor. The instructor should review potential hazards and specifically describe them to all classes and all students immediately before each experiment. The scale of the procedure should be reduced as much as possible to bring to a minimum the generation of waste chemicals. Use only those chemicals for which the ventilation system is adequate.

Personal Behavior

Horseplay, pranks, or other acts of mischief shall not be tolerated in chemical work areas and laboratories. Additionally, activities using unauthorized chemicals shall not be performed by employees or students.

Every precaution shall be taken to ensure that chemicals are never removed from the laboratory by unauthorized persons.

Personal Hygiene

All employees shall use appropriate personal hygiene practices, including the following:

- Wash promptly whenever any hazardous chemical has contacted the skin, except in those few cases in which chemicals will react dangerously with water.
- Never pipette by mouth and always use a bulb or other device for suction, except when so directed by a professor.
- Avoid inhalation of chemicals used for an experiment, including gases, vapors, and aerosols.
- "Wafting" to test chemical odors should only be done with extreme caution and only when specifically directed to do so in the written experimental procedure.
- Wash hands well with soap and water before leaving the laboratory, even if gloves have been worn.
- Avoid washing hands with organic solvents.
- Never smoke in the laboratory. Be aware that tobacco products in opened packages can absorb chemical vapors.
- Do not apply or store cosmetics in the chemical laboratory.
- Seek immediate and appropriate medical treatment whenever signs or symptoms of exposure to a hazardous chemical are manifested.

Housekeeping

Because many accidents may be attributed to sloppy work areas, all laboratory spaces must be kept clean and contain only those items needed for the task at hand. Cleanup should immediately follow the completion of each operation and at the end of each day.

- Place all wastes in appropriate receptacles that are correctly labeled.
- Store all equipment and chemicals properly. Chemicals should not be stored in aisles, in hoods, on the floor, in stairwells, on desks or laboratory tables.
- Never block access to emergency equipment, showers, eye washes, or exits.
- Clearly label all chemical containers with the identity of the contents.
- Keep all cabinets and drawers closed when not in use to avoid catching and bumping hazards.
- Clean all working surfaces and floors on a regular basis. Keep the floor clear of slipping hazards such as ice, spilled liquids, glass beads, or other small items.
- Clean up all chemical spills as soon as they occur. Chemicals and cleanup materials should be disposed of correctly.

Food Handling

No food or beverages not intended and marked for specific experiments should be stored, handled, prepared, or consumed in the laboratory or other areas where chemicals are used or stored.

Additionally, laboratory chemicals and laboratory equipment should not be brought into eating areas.

Glassware or utensils that have been used for laboratory operations should never be used to prepare or

consume food. Laboratory refrigerators, ice chests, microwave ovens, and cold rooms should not be used for consumable food storage or preparation.

Glassware

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.

Flammability Hazards

Open flames should not be used to heat a flammable liquid or to carry out a distillation under reduced pressure. Before lighting a flame, all flammable substances should be removed from the immediate area of the flame. All containers of flammable substances in the area should be checked to ensure that they are tightly closed.

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 (National Fire Protection Association) guidelines. NFPA Standards 30, Flammable and Combustible Liquids Code, and 45, Fire Protection for Laboratories Using Chemicals, and/or the applicable local fire codes should be followed.

Electrical Hazards

All electrical outlets should have a grounding connection accommodating a three prong plug. Most electrical equipment is wired with a three prong plug. The grounding post should never be removed from such a plug. Some equipment is designed for safe use with two prong plugs. If the appliance comes with a two prong plug, there is no need to change as it will work in a three prong socket.

All laboratories should have circuit breakers readily accessible. Employees should know how to cut off electrical service to the laboratory in case of emergency. Laboratory lighting should be on a separate circuit from electrical outlets so that electric service can be cut off during an emergency. All electrical outlets should be checked for continuity after initial occupancy (upon new construction or when first used by an employee) and whenever electrical maintenance or changes occur. If electrical equipment shows evidence of undue heating, it should be immediately unplugged.

Compressed Gases

If compressed gas cylinders are used in the laboratory, procedures for their use should be in accordance with guidelines established by the Compressed Gas Association, particularly CGA P-1 919965, Safe Handling of Compressed Gases. Some of the more important considerations in using gas cylinders correctly are the following:



- No cylinder should be moved from one location to another until the protective cap is securely in place.
- Both full and empty cylinders should only be stored where they may be securely restrained by straps, chains, or a suitable stand.
- All cylinders should be used with a correct regulator.
- An empty cylinder should be returned to the supplier as soon as possible after having been emptied, or when it is no longer needed.
- Cylinders should not be exposed to temperatures above 50°C (122°F).

Prior Approval

At Lake Forest College, all instructional and research laboratories are supervised by faculty holding master's or doctor's degrees in their fields. These individuals are likely to know the most about the appropriate safety measures for executing their procedures and handling their chemicals, and are required to see that these safety regulations are followed. If questions arise about prudent safety practices for new protocols or chemicals, the faculty member is expected to seek advice from other knowledgeable individuals such as the Chemical Hygiene Officer or the department chairperson.



LAKE FOREST
COLLEGE

SECTION 5 RECORD KEEPING

RECORD KEEPING PROCEDURES

The College shall maintain specific records to verify safety practices.

Air Concentration Monitoring

Regular instrumental monitoring of airborne concentrations is not usually justified or practical in college laboratories. Monitoring may be appropriate when toxic materials are used or stored, or when ventilation devices are tested or redesigned. Monitoring is required after each documented incident of exposure to toxic chemicals.

Should air concentration monitoring become necessary, the College requires that records be maintained for at least 30 years and that they remain accessible to employees and/or their representatives. Such monitoring should be done as recommended by the Chemical Hygiene Officer and follow generally accepted monitoring techniques.

Training Records

Records of training in chemical hygiene safety should be maintained for three years from the date of training. The following information should be documented:

- The dates of the training sessions;
- An outline describing the material presented including the applicable details of this written Chemical Hygiene Plan;
- The names and qualifications of persons conducting the training;
- The names and job titles of all persons attending the training sessions.
- Methods and observations that may be used to detect the presence or release of a hazardous chemical;
- The physical and health hazards of chemicals in the work area; and,
- The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

All training records will be kept in the Department of Public Safety.

Safety Data Sheets (SDS)

The College should maintain a file of manufacturers' SDS's and shall make them accessible to employees in the laboratory. It is recommended that SDS's be within the Department where the chemical is located.

Exposure Testing Records

Records of exposure assessments should be maintained for at least 30 years, and they should be made available to employees and/or their representatives upon request. Exposure testing procedures and results of that testing should be sent to the Business Office, who is responsible for maintaining these records.

Should exposure testing become necessary, an accurate record of any measurements taken to monitor employee exposures should be kept, transferred, and made accessible to each employee. Each employee shall be notified of any monitoring results within 15 working days after receipt of the results, either individually, in writing, or by posting the results in an appropriate location that is accessible to employees.

Medical Records

Medical records shall be maintained in accordance with OSHA Standard 29 CFR 1910.20. These records shall be kept confidential, and must be maintained for at least the duration of employment plus 30 years. The records shall include the following:

- The name and social security number of the employee.
- A copy of all results of examinations, medical testing, and follow-up procedures.
- A copy of the information provided to the healthcare professional, including a description of the employee's duties as they relate to the exposure incident, and documentation of the routes of exposure and circumstances of the exposure.

All current year medical records will be kept in the Business Office vault and all prior years will be kept in the College's archives.

AVAILABILITY

All employee records shall be made available to the employee in accordance with 29 CFR 1910.20. All employee records shall be made available to the Assistant Secretary of Labor for the Occupational Safety and Health Administration and the Director of the National Institute for Occupational Safety and Health upon request

Incident Reports

Each incidence of an accident of injury or "near miss" in the laboratory shall be reported to the Department Chair and the Chemical Hygiene Officer in writing in accordance with Worker's Compensation rules. In all cases, the Department of Public Safety shall be notified and the Incident Report Form (appendix C) completed. If staff or students were witnesses to the accident of injury, they should also complete the appropriate form found in Appendix C. The College shall keep records for 30 years from the time of the event resulting from an exposure to a hazardous chemical or a job related accident.

Hazardous Chemical Inventory Records

All records of hazardous chemicals shall be maintained and updated annually by the Chemical Hygiene Officer.

Waste Disposal Records

The College shall maintain records of waste chemicals and products from reactions or processes that are transferred to an authorized and/or certified chemical disposal agent, and chemicals that are transported to a new site. These records shall conform to requirements of the Environmental



LAKE FOREST
COLLEGE

Protection Agency and Department of Transportation, either of which may have jurisdiction over these types of transfers. The records shall also conform to state requirements.

Safety Inspections and Recommendations

The College, and in some cases the departments, shall keep records of the regular safety inspections, including the date of the inspection and the person conducting the inspection. The College shall keep records of permanent safety equipment, showing the dates of inspection and the results of any inspection. Examples of equipment to be inspected are fire extinguishers, drench showers, eye wash fountains, and fire blankets.

Safety suggestions from employees should be reported to their immediate supervisor and if necessary to the Chemical Hygiene Officer.



LAKE FOREST
COLLEGE

SECTION 6 LABORATORY SAFETY

LABORATORY SAFETY PROCEDURES

Employee Exposure Protection and Monitoring

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 shall ensure that employee exposure to that substance is measured.

Factors which may raise the possibility of overexposure and therefore warrant an initial measurement of employee exposure include:

- The manner in which the chemical procedures or operations involving the particular substance are conducted.
- The existence of historical monitoring data which shows elevated exposures to the particular substance for similar operations.
- The use of a procedure which involves significant quantities or is performed over an extended period of time.
- There is reason to believe that an exposure limit may be exceeded.
- Signs or symptoms of exposure (e.g., skin or eye irritation, shortness of breath, nausea, or headache), which are experienced by employees. (Some of these symptoms are very general and can be due to many other causes including emotional stress or hysteria.)

If the initial exposure determination described above indicates employee or student exposure over the action level for a particular substance, the College should immediately comply with the exposure monitoring requirements for that substance.

Laboratory Facilities

The type and scale of work conducted in a laboratory should be appropriate to the physical facilities available and to the quality of the ventilation system. A laboratory should include, where appropriate:

- An adequate general ventilation system with air intakes and exhausts located so as to avoid intake of contaminated air.
- Well ventilated stockrooms and storerooms.
- Proper chemical storage for specific hazardous materials such as flammables, corrosives, carcinogens, and highly toxic chemicals, so far as they are likely used.
- Adequate laboratory hoods and sinks.
- Emergency equipment, including proper fire extinguishers, spill kits, alarms, access to a telephone, eye wash, safety shower, and fire blanket.
- First aid equipment including first aid kits.
- Arrangement for proper waste storage and disposal.

Laboratory Ventilation

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 should not be used for laboratory experiments or transfer of chemicals. In that event, it should be used only for storage.

A laboratory hood with a minimum of 2 3 linear feet of hood space per person should be provided for every two students if they spend most of their time working with chemicals. Airflow into and within the hood should not be excessively turbulent. Excessive turbulence may be produced when a hood face velocity exceeds 125 linear feet per minute. Fume hoods should provide an adequate airflow at about 60 100 linear feet per minute. The airflow should be measured regularly by the Chemical Hygiene Officer.

Cabinets and rooms which store hazardous chemicals shall be well ventilated.

The quality and quantity of ventilation shall be evaluated when installed, regularly monitored, and reevaluated whenever a change in ventilation devices is made, or the ventilation system is repaired.

Medical Consultations and Medical Examinations

Employees who work with hazardous chemicals shall be provided with an opportunity to receive medical attention when overexposure to a hazardous chemical is reasonably suspected.

In the event that employees' work involves regular and frequent handling of toxicologically significant quantities of a chemical, the Chemical Hygiene Officer shall determine whether consultation with a qualified physician is necessary to set up a plan for routine surveillance.

CAUSE FOR CONSULTATION OR EXAMINATION

In relation to the exposure of hazardous chemicals, medical attention shall be provided to an employee under the following circumstances:

- Whenever an employee develops signs or symptoms of exposure to a hazardous chemical to which the employee may have been exposed in the laboratory.
- Whenever exposure monitoring reveals an exposure level above the action level or permissible exposure level for an OSHA regulated substance.
- Whenever an event such as a spill, leak, or explosion, takes place in a laboratory which results in the likelihood of exposure to a hazardous substance.

TYPE OF MEDICAL ATTENTION

All medical examinations and consultations shall be performed under the direct supervision of a licensed physician and should be provided without cost to the employee, without loss of pay, and at a reasonable time and place. All questions regarding medical consultations and examinations shall be directed to the Chemical Hygiene Officer, who shall arrange for consultation with the College's medical consultant.

INFORMATION FOR THE PHYSICIAN

The following information should be provided to the physician conducting medical consultations and examinations:

The identity of hazardous chemicals to which the employee may have been exposed.

A copy of the Safety Data Sheet for the chemical.

A description of the conditions under which the exposure occurred, including quantitative exposure data when possible.

A description of the signs and symptoms of exposure that the employee is experiencing.

PHYSICIAN'S REPORT

A written opinion from the examining physician for any consultations or examinations performed under this standard should include any recommendation for further medical attention, the results of the medical examination and any associated tests, 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, and 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. The written opinion should not reveal specific diagnoses unrelated to occupational exposure, except as noted above.

Hazardous Chemical Purchase

The purchaser of hazardous chemicals should be guided by the maxim that less is better. The lower the hazardous 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 hazardous chemicals.

- Hazardous chemicals should be ordered in quantities that are likely to be consumed in one year or less.
- All hazardous chemicals should be in tightly closed, sturdy, and appropriate containers.
- A hazardous chemical should not be accepted without being accompanied by the Safety Data Sheet.
- The hazardous chemical container should be marked with the date at the time it is received.
- Hazardous chemicals should not be accepted if the original container has been broken, opened, or has been compromised in some other way.
- The Hazardous Chemical Inventory List should be updated annually.
- Donated hazardous chemicals should be accepted only after approval is obtained from the Chemical Hygiene Officer. It should be established that the donated hazardous chemical is in excellent condition, that an appropriate Safety Data Sheet is available, and that there is a specific use for the donated hazardous material.

Storage and Distribution

- All chemicals shall be in tightly closed, sturdy, and appropriate containers.
- If the chemical has been transferred to a secondary container, the new container shall be appropriately labeled, including all of the hazard information. Specifications for labeling follow in Section 6.8.
- Chemicals storage patterns shall never be based solely on the alphabetical arrangement of chemicals.
- Large containers and containers with reactive chemicals, such as acids and bases shall be on low shelves.

- Flammable chemicals shall be stored in approved storage cans or approved flammable chemical storage cabinets.
- Combustible packaging material shall not be stored near flammable chemical storage cabinets.
- All storage areas shall be securely locked when not in use by the employee. Storage and preparation areas shall be accessible only to those persons authorized to use the chemicals. Such personnel should have had proper training in the handling and use of the chemicals.
- Chemicals which present a fire hazard shall be stored in quantities less than 500 mL, unless metal safety cans are used, or the container is stored in a suitable flammable storage cabinet.
- If approved metal safety cans are used, the spring loaded closure shall not be disabled, the flame arrestor screen should be kept in place, the arrestor screen should be replaced whenever it is punctured or damaged, and the arrestor should never be immersed in the flammable liquid.
- Chemicals should not be distributed to other persons or to areas in which they are not normally used.

Inventory Control

- A Hazardous Chemical Inventory List should be updated each time a hazardous chemical is received or consumed. The list should be audited for accuracy on at least an annual basis.
- The Hazardous Chemical Inventory List should contain the following information about each chemical found in storage: the chemical name, the amount present, the Chemical Abstracts Registry (CAS) number, and the examination date for possible disposal.
- A printed or electronic copy of the most recent hazardous chemical inventory shall be kept by the Chemical Hygiene Officer.

Hazard Identification and Labels

- Laboratory chemicals shall be properly labeled to identify any hazards associated with them for the employees' information and protection.
- 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.
- If a chemical has been transferred to a secondary container for storage, the new container shall be appropriately labeled.
- The contents of unlabeled bottles shall be disposed of promptly, as outlined in the section on disposal procedures.

Safety Data Sheets (SDS)

- The safety data sheets for each chemical used in the laboratory will 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 by the Chemical Hygiene Officer and the principle investigator in determining the safety precautions, control measures, and personal protective equipment that apply when working with that toxic chemical.

- Each SDS received for incoming shipments of chemicals shall be maintained and made readily available to laboratory employees and to students.
- A Safety Data Sheet for each compound on the Chemical Inventory List shall be available in the department, except for those chemicals which predate the Laboratory Standard. Safety data sheets can often be obtained by requesting them from companies that currently sell the chemicals. Chemical manufacturers and suppliers are required to supply one copy of a safety data sheet the first time the chemical is purchased by the College.
- All laboratory employees will be trained to read and understand the SDS's

Waste Disposal

The Chemical Hygiene Officer shall ensure that laboratory chemicals are disposed in compliance with appropriate regulations and in a manner which minimizes damage to human health and the environment.

Every process that uses chemicals has the potential for producing hazardous waste. The purchaser or producer of chemicals should take into consideration the waste that should be produced and the cost of waste disposal. The product of a reaction or process only becomes hazardous waste when it is removed from the reaction system and called waste and it is hazardous material.

Treatment of hazardous waste must be done by a licensed facility. If a process generates a hazardous waste, either that waste should be collected for treatment outside the College or the experimental procedure should be altered to avoid production of the waste.

There are several references concerning the deactivation of hazardous materials that may be used to help devise suitable schemes for modifying experiments. Useful references are in Appendix B.

The following are specific guidelines for hazardous waste disposal:

- Chemicals should be ordered in quantities that are likely to be consumed in one year or less.
- Potential waste materials are surplus, old, and/or unnecessary chemicals. Every attempt must be made to avoid accumulating such chemicals.
- No flammable, combustible, or water immiscible material will be poured down the drain.
- Separate waste containers should be provided for heavy metal compounds, chlorinated hydrocarbons, and non-chlorinated hydrocarbons. Separation of wastes in this manner will make disposal less costly.
- Acids and bases may be neutralized before disposal down the drain.
- Hazardous waste should never be placed in the common solid trash container(s).
- Waste chemicals should be stored in appropriately labeled containers, inside secondary containment.
- The products of projects, experiments, or other chemical procedures should be recycled and/or decontaminated whenever possible.
- When feasible and safe, a large container of a given waste should be used instead of several small containers of the same material for financial reasons.
- Waste materials should not be allowed to accumulate in laboratories or preparation rooms. The sealed containers should be removed to the designated waste storage location. There are regulatory limits depending on quantity which need to be verified with local officials.



LAKE FOREST
COLLEGE

- Waste materials should be identified using a chemical identification form and/or label ensuring sufficient information for their safe transportation, treatment, storage, and disposal.
- The disposal of hazardous wastes should follow the guidelines established by the appropriate local, state, and federal regulations.



LAKE FOREST
COLLEGE

SECTION 7 INSPECTIONS

PROCEDURES FOR INSPECTIONS

All employees should be alert to unsafe conditions and inform the Chemical Hygiene Officer in writing, when an unsafe condition occurs.

Laboratory Equipment

The presence of necessary safety equipment, in proper working condition, a list of which is provided in Appendix D, will be verified that it is present in each laboratory area at least each semester by the Chemical Hygiene Officer or their designee. The following general standards will apply:

- Each hood will have a face velocity of 60-100 linear feet per minute.
- Each shower will be capable of supplying a continuous flow of potable water. (ANSI Standard Z358.1 1990)
- Every eye wash will be capable of supplying a continuous gentle flow of aerated, potable water to both eyes. (ANSI Standard Z358.1 1990)
- Each fire extinguisher will be fully charged.
- Fire equipment will be tagged following the inspection, showing the date, inspector, and results.

Written records of all inspections will be maintained by the Chemical Hygiene Officer.

Safety Inspections

Inspections in the laboratory will be conducted at least twice each year. Inspection records will be kept by the Chemical Hygiene Officer. A form for conducting these inspections is shown in Appendix F.



LAKE FOREST
COLLEGE

SECTION 8 SPECIFIC EXPOSURE CONTROL MEASURES

SPECIFIC EXPOSURE CONTROL MEASURES

This section addresses criteria that would invoke the use of specific exposure control measures, which are more stringent than those procedures specified as standard operating procedures or general laboratory safety rules. These specific exposure control measures are designed to reduce the exposure of instructors, aides, students, and other employees to especially hazardous chemicals. Employees should read and understand these practices before commencing a procedure using one or more of these chemicals.

Toxic Chemicals

The SDS's and labels for many of the chemicals used in the laboratory recommend specific limits for exposure. Other limitations may be specified by OSHA mandated limits. Typical limits are threshold limit values (TLVs), permissible exposure limits (PELs), and action levels. When such limits are stated, they should be used to assist the Chemical Hygiene Officer and the instructor in determining the safety precautions, control measures, and safety apparel.

When a TLV or PEL 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 are available, no work should be performed using that chemical.

If a TLV, PEL, or comparable value is not available, the animal or human median inhalation lethal concentration information, LC₅₀, 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 similar device, equipped with appropriate traps. If none are available, no work should be performed using that chemical.

Whenever laboratory handling of toxic substances with moderate or greater vapor pressures is likely to exceed air concentration limits, work with such liquids and solids should be conducted in a fume hood, glove box, vacuum line, or similar device, equipped with appropriate traps. If none are available, no work should be performed using that chemical.

Examples of toxic chemicals that were commonly used in the past are benzene, chloroform, formaldehyde, bromine, carbon disulfide, carbon tetrachloride, cyanide salts, and hydrofluoric acid. The use of these chemicals has been substantially reduced in the past few years because of their toxicity.

Flammable Chemicals

The flammability of a chemical is determined by its flash point, the lowest temperature at which an ignition source can cause the chemical to ignite momentarily under certain controlled conditions. No container for Class I or Class II flammable liquids shall exceed a capacity of 4 liters (1.1 gallons) unless stored in an approved safety can not to exceed 8 liters (2.1 gallons). Refer to the Safety Data Sheet to determine the class of each flammable chemical.

Chemicals with a flash point below 200°F (93.3°C) should be considered "fire hazard chemicals." Any chemical whose SDS or label states "Flammable" is in this category.

OSHA standards and the National Fire Protection Association (NFPA) guidelines or local fire regulations should be consulted on the proper use of flammable chemicals in the laboratory. Specific references are found in Appendix 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.

Examples of commonly used flammable chemicals are diethyl ether, acetone, methanol, ethanol, glacial acetic acid, heptane, and petroleum ether (ligroine).

Reactive Chemicals

Reactivity information may be given in manufacturers' SDS's and on labels. Useful references are cited in Appendix B.

A reactive chemical is one that

- Is described as such on the label or in the SDS.
- Is known or found to be reactive with other substances.

Reactive chemicals should 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.

Examples of commonly encountered reactive chemicals are ammonium dichromate, nitric acid, perchloric acid, hydrogen peroxide, and potassium chlorate.

Corrosive Chemicals and Contact Hazard Chemicals

Corrosivity, allergen, and sensitizer information is provided in manufacturers' SDS's and on labels. Other guidelines on which chemicals are determined to be corrosive can be found in the publications cited in Appendix B.

A corrosive chemical is one that

- Is described as such on the label or in the SDS.
- Is known to be reactive to living tissue, causing visible destruction of, or irreversible alterations of, tissue at the site of contact.

A contact hazard chemical is an allergen or sensitizer that

- Is so identified or described in the SDS or on the label.
- Is known to be an allergen or sensitizer.

Corrosive and contact hazard chemicals will be handled with all proper safety precautions, including wearing safety goggles, gloves tested for the absence of pinholes and known to be resistant to permeation or penetration by the chemical, and a laboratory apron or laboratory coat.

Examples of corrosive chemicals include: hydrochloric, sulfuric, nitric, phosphoric, and perchloric acids (all acids in greater than 1 Molar concentration), and potassium hydroxide (either solid or in aqueous solution of greater than 1 Molar concentration).

Reproductive Toxins

A reproductive toxin is a compound that

- Is described as such in the applicable SDS or label, or
- Is known to be reproductive toxin.

If such chemicals are used, they should be handled only in a hood and when satisfactory performance of the hood has been confirmed. Skin contact should be avoided by using gloves and wearing protective apparel. Persons using such substances should always wash hands and arms immediately after working with these materials. Unbreakable containers of these substances should be stored in a well ventilated area and will be labeled properly.

Examples of reproductive toxins are organomercurial compounds and ethidium bromide, a reagent used with DNA analysis.

Select Carcinogens

All work with these substances should be conducted in a fume hood, glove box, or portion of a laboratory designated for use of chronically toxic substances.

Any procedure that may result in a generation of aerosols or vapors should be performed in a hood whose performance is known to be satisfactory.

Skin contact should be avoided by using gloves and other protective apparel as appropriate. Any contaminated protective clothing should be removed before leaving the Designated Area and placed in a labeled container. Hands, arms, face, and neck should be washed after working with these materials.

Select carcinogens should be stored in unbreakable containers in a ventilated area with controlled access. All containers should be labeled with the identity and hazard of the substance. Immediately upon completion of the project, all unused reproductive toxin should be disposed of following standard hazardous waste disposal procedures.

Examples of select carcinogens are benzene, nickel metal dust, and vinyl chloride.

Exposure Potential

The routes of exposure to chemicals are inhalation, ingestion, contact with skin or eyes, or injection.

Inhalation of chemical vapors, aerosols, gases, or dusts can produce poisoning through the mucous membranes of the nose, mouth, throat and lungs. The degree of injury resulting from exposure to these chemicals depends on the toxicity of the material, its solubility in tissue fluids, its concentration, and the duration of exposure.

Ingestion is extremely dangerous. The relative acute toxicity can be evaluated by comparing the LD50, which is defined as the quantity of chemical that will cause the death of 50% of the test animals when ingested. Many chemicals will directly damage the tissue of the mouth, throat, nose, lungs, and gastrointestinal tract.



LAKE FOREST
COLLEGE

Contact with skin and eyes can lead to local irritation as well as significant chemical injury. In addition, many chemicals can be absorbed through the skin and may cause systemic poisoning. Alkaline materials, phenols, and strong acids can cause permanent loss of vision upon contact with the eye.

Injection of chemicals can occur through mechanical injection from glass or other materials contaminated with chemicals.



LAKE FOREST
COLLEGE

SECTION 9 TRAINING

TRAINING OPPORTUNITIES

The College shall provide training opportunities for all affected employees. These training opportunities shall include the transfer of information about the hazards of chemicals present in the laboratory. The training program shall cover information found in the Laboratory Standard, manufacturers' Safety Data Sheets and this Chemical Hygiene Plan.

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 should also be informed of the potential hazards and appropriate protective measures for chemicals they receive.

Employees shall receive information and training at the time of their initial assignment to a laboratory and before assignments involving new exposure situations.

Information Program

Laboratory employees shall be informed of at least the following information:

- The contents of appropriate governing standards, as shown in Appendix A.
- The location and availability of the Chemical Hygiene Plan.
- The location and availability of known reference materials on the hazards, safe handling, storage, and disposal of hazardous chemicals found in the laboratory.
- The use and location of Safety Data Sheets.

Employee Training Program

Laboratory employees shall be trained on the applicable details of the Chemical Hygiene Plan, including a review of the general rules for laboratory safety. The training program describes appropriate sections of the standard operating procedures. Employees shall be informed as to the responsibilities of the Chemical Hygiene Officer. Emergency procedures adopted by the College, including response to spills, fires, explosion, evacuation, and decontamination, shall be described.

Employees will be trained in measures they may take to protect themselves from exposure to hazardous chemicals, including the location and proper use of protective apparel and emergency equipment. In addition, the training will also include a discussion of inventory procedures to be followed, proper storage and ordering rules, and the College's hazardous waste disposal procedures.

Training of Students

The College requires that instruction in laboratory safety practices be provided to all students involved in laboratory studies. Such training must be appropriate to their level of chemical handling and potential exposure to hazardous chemicals. The extent of training should be based on their course of study, the laboratory facility, and the policies of the College as stated in the Chemical Hygiene Plan. Instruction in safety should include the importance of the label and the SDS as important reference



LAKE FOREST
COLLEGE

sources. As appropriate, the student should also be introduced to other sources of chemical safety information.



LAKE FOREST
COLLEGE

SECTION 10 EMERGENCY PREVENTION AND RESPONSE

EMERGENCY PREVENTION AND RESPONSE

Standard Emergency Procedures

The emergency procedures address a failure in the ventilation systems, actions to take during a fire or chemical spill, evacuation procedures or the failure of other procedures to limit exposure of employees to hazardous chemicals. These procedures identify appropriate individuals to contact and the telephone numbers of fire, police, ambulance, Poison Control Center and College authorities. Details on emergency equipment, dealing with medical help, first aid and completing accident reports is included in this section.

Ventilation

A failure in any portion of the ventilation system shall require the lab operations to be discontinued until the equipment can be repaired. The ventilation system includes the buildings general ventilation as well as exhaust hoods. Once a failure is identified the employee shall contact facilities management to inspect and arrange for the repair of the ventilation system.

Fires

The best way to fight a fire is to prevent it. Fires can be prevented or their severity considerably reduced by proper housekeeping and by thoughtful reflection about what is being done. This includes the prompt removal of waste, separation of flammable liquids from combustible material, proper storage of flammable liquids, storage of limited quantities of flammable material, and the unobstructed maintenance of aisles and exits.

Dealing With a Fire

Since fires involving laboratory chemicals increase the possibility of explosions, special care should be taken to keep fire or excessive heat from volatile solvents, compressed gas cylinders, reactive metals, and explosive compounds.

If a fire occurs, the following actions should be followed, depending on its severity:

- A fire contained in a small vessel should be suffocated by covering the vessel. The vessel should not be picked up, nor covered with dry towels or cloths.
- Nearby flammable materials should be removed to avoid spread of the fire.
- If a fire burns over a larger area, all persons should evacuate the area, except those trained and equipped to fight structural fires.
- The fire extinguisher should be used only by trained people, and only from a position from which escape is possible.
- Stairs, not elevators, should be used to leave the area of the fire.
- The fire alarm should be activated and the Public Safety Office called (ext 5555).
- Meet the Public Safety Officer outside and provide the location of the fire.
- Firefighters should be informed of what chemicals are involved.

As soon as possible, all extinguishers that were used should be recharged or replaced with full extinguishers.

INJURIES INVOLVING FIRES

Persons whose clothing is ablaze should STOP DROP and ROLL. If a safety shower is immediately available, the individual may be doused with water. Once the fire is out, the individual should be wrapped to avoid shock and exposure. The individual should be kept warm, and medical attention should be promptly sought.

The person should not be wrapped in a fire blanket to avoid the chimney effect.

In all cases, the Department of Public Safety shall be notified and the Incident Report Form (appendix C) completed.

General Chemical Spills

All spills should be cleaned up promptly. If the spill appears to be organic solvents, ammonia, or other volatile reagents, evacuate the area as soon as possible by pulling the fire alarm and meet the Public Safety Officer outside of the building.

If there is no immediate danger to personnel, containment should be accomplished by use of spill pillows, towels, rolls, or other devices that will keep it from spreading.

After the spill has been contained, it can be cleaned up with appropriate tools, including commercial spill control kits, for example. If the spilled material is a hazardous chemical, that chemical and all the cleanup material must be treated as chemical waste and properly disposed.

See Section 11 for further information regarding Spill Response Procedures.

CHEMICAL SPILLS ON PERSONNEL

For spills covering small amounts of skin, the area should be washed immediately with flowing water for 15 minutes. To facilitate cleaning, jewelry should be removed. If there is no visible burn, the 15-minute wash with water is sufficient. If a burn is visible, medical attention should be sought after the washing has been completed. After washing, the SDS should be consulted to determine if any delayed effects should be expected. Depending on the information from the SDS, follow up medical attention may be necessary.

For larger spills, the same procedures should apply, except that it may be appropriate to use the safety drench shower to assure thorough and complete washing.

For spills on clothing and whenever necessary, the clothes as well as shoes and jewelry to facilitate washing should be removed as quickly as possible. The safety drench shower should be used for 15 minutes and any affected skin should be thoroughly flooded for 15 minutes. The washing should be resumed if pain continues. No creams, salves, or lotions should be placed on the affected area, and medical attention should be sought as soon as possible.

Special care should be taken to prevent chemicals from entering the eyes. Contaminated clothes should be washed separately from other personal clothing.

In all cases, the Department of Public Safety shall be notified and the Incident Report Form (appendix C) completed.



Evacuation

If an evacuation is necessary, the employee shall order all persons to leave the lab immediately and pull the fire alarm as they exit the building. The employees shall know the main and alternative routes and account for each person after an evacuation.

When helping another person, employees should evaluate the potential danger to themselves before taking action. Do not move any injured persons unless they are in immediate danger from chemical exposure or fire.

Report the nature and location of the emergency to the Lake Forest College Department of Public Safety.

Other Accidents Involving Personal Injury

Anyone overcome with smoke or fumes should be removed to uncontaminated air and treated for shock. Potential rescuers should evaluate the possibility of harm to themselves before entering or remaining in a toxic environment.

If hazardous chemicals are ingested, the first aid treatment shown on the label or in the Safety Data Sheet should be undertaken.

Bleeding should be controlled by compressing the wound with a clean cloth or other appropriate compress. However, because of the possibility of infection with one or more bloodborne pathogens, such as the HIV virus, adequate personal protection should be used. The injury should be elevated above the level of the heart. After bleeding is controlled, the injured person should be covered to avoid shock. Medical attention should be called for as soon as possible.

If a person is in contact with a live electrical circuit, the power should be shut off at the most convenient switch. The person should not be touched until the power has been disconnected.

In all cases, the Department of Public Safety shall be notified and the Incident Report Form (appendix C) completed.

SPLASHES IN THE EYES

Whenever potentially harmful chemicals enter the eye(s), the eye(s) should be immediately flushed with potable water from a gently flowing source for at least 15 minutes. The eyelids should be held open while the eyeball is moved up, down, and sideways to wash behind the eyelid(s). Assistance is absolutely necessary at this time. If contact lenses are worn, they should be removed as soon as possible to allow complete rinsing of the eye(s).

In all cases, the Department of Public Safety shall be notified and the Incident Report Form (appendix C) completed.

Emergency Contacts

In the event of an emergency during normal working hours, the employee shall notify the Department of Public Safety (extension 5555) who will offer assistance and determine what additional action is necessary. Persons or organizations that may need to be contacted include:



Fire Department, Police, Ambulance	911
Poison Control	800-222-1222
Public Safety	x5555
Dean of Faculty	x5021
Dean of Students	x5200
Vice President for Business Affairs	x5034
Director of Facilities Management	x5040
Chemistry Department Lab Supervisor	x5806

If the emergency situation occurs after-hours the employee shall contact the Department of Public Safety and request immediate assistance from an Officer on duty. The Officer shall also contact Auxiliary Public Safety Officer Bob Boutin at 708-651-7456 who will evaluate the incident to determine what additional action is required.

Emergency Equipment

The Chemical Hygiene Officer shall ensure that adequate emergency equipment is available in the laboratory area and inspected periodically to ensure that it is functioning properly. All personnel should be properly trained in the use of each item. Students should be trained to use safety equipment such as fire blankets, eye wash fountains, safety drench showers, and the telephone for safety purposes where appropriate.

Equipment available to the laboratory area where appropriate includes:

- Eye wash fountain.
- Fire extinguisher of an appropriate type.
- Safety drench shower.
- Fire blanket.
- Identification signs.

Dealing with Medical Help

Medical personnel should be fully informed about the chemical involved in the spill and the circumstances of the spill. Whenever possible a Safety Data Sheet should be provided to the medical person providing assistance.

First Aid

Suitable first aid supplies are readily available to the laboratory area with supplies maintained in labs and in department stock rooms. Public Safety Officers are trained in first aid and are available to render assistance until medical help can be obtained.

Accident Reports

All accidents and near accidents shall be carefully investigated. The results of that investigation and recommendations for the prevention of similar occurrences shall be forwarded to Auxiliary Public Safety Officer Bob Boutin. Accident reports shall be kept on file, as indicated in the record keeping section of this document.



LAKE FOREST
COLLEGE

SECTION 11 SPILL RESPONSE

SPILL RESPONSE PROCEDURES

Identification of the Spill

If the spilled chemical does not present danger to personnel, the employee shall notify Public Safety and follow containment procedures outlined in Section 11.2. The employee, based on their experience and expertise shall continuously evaluate the site conditions and take necessary action to protect themselves and all others from injury. If at any time the conditions warrant, the employee shall evacuate the building following the procedures described below.

If the spill appears to be organic solvents, ammonia, or other volatile reagents, the employee shall evacuate the building as soon as possible by pulling the fire alarm. Before exiting the lab, open windows to ventilate the area, extinguish open flames and turn off electrical switches or other sources of ignition and close the lab door.

Personnel shall meet the Public Safety Officer outside of the building and provide details regarding the location of the spill, the chemical name, quantity spilled and the names of persons involved. If the chemical involved in the spill is judged to present an immediate hazard, the evacuation is to be absolute, and the area isolated until a HAZMAT team arrives.

Containment of the Spill

Containment should be accomplished by use of spill pillows, towels, rolls, or other devices that will keep it from spreading. If practical, a dam to contain the spill may be formed using coarse vermiculite, kitty litter, or other absorbent material. Spill control kits are maintained in the labs and in the stockrooms.

Another inexpensive absorbent can be made from a mixture of sand and sodium carbonate. This is particularly effective with corrosives because the soda will neutralize acids, and the sand improves the footing and minimizes the possibility of slipping and falling into the spill. The use of sodium bicarbonate is also effective, and it will neutralize caustic spills.

Cleanup

If, by employee determination, the chemical spill does not present immediate danger to personnel the employee shall follow proper procedures to clean the contaminated area. The employee shall refer to the SDS for the particular chemical and abide with the listed precautions including the use of any personal protective equipment. Proper ventilation shall be maintained by opening windows and turning on the hood. Mops, shovels, scoops, and buckets can be used in the usual manner. All waste shall be collected in heavy plastic bags, clearly labeled, and isolated for disposal. No one should work alone. The buddy system is essential to protect all persons.

In no case should the cleanup of a major spill be undertaken by persons not trained in safety procedures. Further, the cleanup should not begin before contacting the Chemical Hygiene Officer. To undertake the cleanup of a major or extremely hazardous spill, the Chemical Hygiene Officer or their designee shall contact an outside company to perform the cleanup.

If hazardous vapors are present, the area should be isolated. Only persons trained in the use of respirators may enter the area.

Protective Equipment

Protective equipment to be used in the cleanup process should include chemical splash goggles, face shields, heavy rubber gloves, coveralls or aprons or lab coats, and either rubber boots or plastic over the shoe protectors.

Disposal

If the spilled material was a hazardous chemical, all of the materials involved in the cleanup will usually be considered hazardous waste and must be disposed of as such.

In those few instances in which the cleanup transformed the material to a non-hazardous form, the cleanup residue may be disposed of in a local sanitary landfill. Check with local landfill authorities before disposing in this manner.

Personal Injury

In the event of a spill, the first response should be to determine if anyone has come in contact with the spilled chemical. All persons who have been splashed should be assisted to the deluge shower. A minimum 15 minute rinse is indicated. Remember if clothing is splashed, it must all be removed, since the chemical must be rinsed from the skin. Any suggestion of splash in the eyes requires a 15 minute rinse at the eye wash. Hold the eyelids open and allow the water to rinse the eye surface. If contact lenses are worn, they should be removed as soon as possible to allow complete rinsing of the eye. In the event of personal injury, the Public Safety Office must be contacted and an Officer requested to respond to the incident.

Training Requirements

Training for all laboratory workers shall include awareness level training.

The "First Responder at the Awareness Level" must understand the nature of hazardous materials and the associated risks, recognize the presence of hazardous materials in an emergency, and understand the first responder's role in this Chemical Hygiene Plan, which is:

- Determine risk,
- Evacuate the building,
- Assist injured, and
- Meet with responding emergency personnel outside of the building.

Record Keeping

Complete records of the incident, including injuries, witnesses, response and cleanup procedures, waste disposal, additional assistance, and final evaluation will be collected for the College by the Chemical Hygiene Officer.



LAKE FOREST
COLLEGE

SECTION 12 APPENDIX

APPENDIX A – THE LABORATORY STANDARD

1910.1450(a) Scope and application.

1910.1450(a)(1) This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.

1910.1450(a)(2) Where this section applies, it shall supersede, for laboratories, the requirements of all other OSHA health standards in 29 CFR part 1910, subpart Z, except as follows:

1910.1450(a)(2)(i) For any OSHA health standard, only the requirement to limit employee exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions of paragraph (a)(2)(iii) of this section apply.

1910.1450(a)(2)(ii) Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.

1910.1450(a)(2)(iii) Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements paragraphs (d) and (g)(1)(ii) of this section shall apply.

1910.1450(a)(3) This section shall not apply to:

1910.1450(a)(3)(i) Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant standard in 29 CFR part 1910, subpart Z, even if such use occurs in a laboratory.

1910.1450(a)(3)(ii) Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:

1910.1450(a)(3)(ii)(A) Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and

1910.1450(a)(3)(ii)(B) Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

1910.1450(b) Definitions --

Action level means a concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Chemical Hygiene Officer means an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.

Chemical Hygiene Plan means a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meets the requirements of paragraph (e) of this section.



Combustible liquid means any liquid having a flashpoint at or above 100 deg. F (37.8 deg. C), but below 200 deg. F (93.3 deg. C), except any mixture having components with flashpoints of 200 deg. F (93.3 deg. C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

Compressed gas means:

- (i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 deg. F (21.1 deg. C); or
- (ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 deg. F (54.4 deg. C) regardless of the pressure at 70 deg. F (21.1 deg. C); or
- (iii) A liquid having a vapor pressure exceeding 40 psi at 100 deg. F (37.8 C) as determined by ASTM D-323-72.

Designated area means an area which may be used for work with "select carcinogens," reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood.

Emergency means any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

Employee means an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments.

Explosive means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

Flammable means a chemical that falls into one of the following categories:

- (i) **Aerosol, flammable** means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame protection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;
- (ii) **Gas, flammable** means: (A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or
(B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit.
- (iii) **Liquid, flammable** means any liquid having a flashpoint below 100 deg F (37.8 deg. C), except any mixture having components with flashpoints of 100 deg. C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.
- (iv) **Solid, flammable** means a solid, other than a blasting agent or explosive as defined in § 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

Flashpoint means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

- (i) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24 - 1979 (ASTM D 56-79)) - for liquids with a viscosity of less than 45 Saybolt

Universal Seconds (SUS) at 100 deg. F (37.8 deg. C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or

(ii) Pensky-Martens Closed Tester (See American National Standard Method of Test for Flashpoint by Pensky-Martens Closed Tester, Z11.7 - 1979 (ASTM D 93-79)) - for liquids with a viscosity equal to or greater than 45 SUS at 100 deg. F (37.8 deg. C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

(iii) Setaflash Closed Tester (see American National Standard Method of test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)).

Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

Hazardous chemical means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.

Appendices A and B of the Hazard Communication Standard (29 CFR 1910.1200) provide further guidance in defining the scope of health hazards and determining whether or not a chemical is to be considered hazardous for purposes of this standard.

Laboratory means a facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

Laboratory scale means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person.

"Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.

Laboratory-type hood means a device located in a laboratory, enclosure on five sides with a movable sash or fixed partial enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms. Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

Laboratory use of hazardous chemicals means handling or use of such chemicals in which all of the following conditions are met:

- (i) Chemical manipulations are carried out on a "laboratory scale;"
- (ii) Multiple chemical procedures or chemicals are used;
- (iii) The procedures involved are not part of a production process, nor in any way simulate a production process; and
- (iv) "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

Medical consultation means a consultation which takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

Organic peroxide means an organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

Oxidizer means a chemical other than a blasting agent or explosive as defined in § 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

Physical hazard means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer pyrophoric, unstable (reactive) or water-reactive.

Protective laboratory practices and equipment means those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

Reproductive toxins means chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

Select carcinogen means any substance which meets one of the following criteria:

- (i) It is regulated by OSHA as a carcinogen; or
- (ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP)(latest edition); or
- (iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for research on Cancer Monographs (IARC)(latest editions); or
- (iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
 - (A) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m³;
 - (B) After repeated skin application of less than 300 (mg/kg of body weight) per week; or
 - (C) After oral dosages of less than 50 mg/kg of body weight per day.

Unstable (reactive) means a chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

Water-reactive means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

1910.1450(c) Permissible exposure limits. For laboratory uses of OSHA regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the permissible exposure limits specified in 29 CFR part 1910, subpart Z.

1910.1450(d) Employee exposure determination --



1910.1450(d)(1) Initial monitoring. The employer shall measure the employee's exposure to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance routinely exceed the action level (or in the absence of an action level, the PEL).

1910.1450(d)(2) Periodic monitoring. If the initial monitoring prescribed by paragraph (d)(1) of this section discloses employee exposure over the action level (or in the absence of an action level, the PEL), the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.

1910.1450(d)(3) Termination of monitoring. Monitoring may be terminated in accordance with the relevant standard.

1910.1450(d)(4) Employee notification of monitoring results. The employer shall, within 15 working days after the receipt of any monitoring results, notify the employee of these results in writing either individually or by posting results in an appropriate location that is accessible to employees.

1910.1450(e) Chemical hygiene plan -- General. (Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan).

1910.1450(e)(1) Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan which is:

1910.1450(e)(1)(i) Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and

1910.1450(e)(1)(ii) Capable of keeping exposures below the limits specified in paragraph (c) of this section.

1910.1450(e)(2) The Chemical Hygiene Plan shall be readily available to employees, employee representatives and, upon request, to the Assistant Secretary.

1910.1450(e)(3) The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure laboratory employee protection;

1910.1450(e)(3)(i) Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;

1910.1450(e)(3)(ii) Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;

1910.1450(e)(3)(iii) A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment;

1910.1450(e)(3)(iv) Provisions for employee information and training as prescribed in paragraph (f) of this section;

1910.1450(e)(3)(v) The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation;

1910.1450(e)(3)(vi) Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section;



1910.1450(e)(3)(vii) Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer, and, if appropriate, establishment of a Chemical Hygiene Committee; and

1910.1450(e)(3)(viii) Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:

1910.1450(e)(3)(viii)(A) Establishment of a designated area;

1910.1450(e)(3)(viii)(B) Use of containment devices such as fume hoods or glove boxes;

1910.1450(e)(3)(viii)(C) Procedures for safe removal of contaminated waste; and

1910.1450(e)(3)(viii)(D) Decontamination procedures.

1910.1450(e)(4) The employer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.

1910.1450(f) Employee information and training.

1910.1450(f)(1) The employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area.

1910.1450(f)(2) Such information shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training shall be determined by the employer.

1910.1450(f)(3) Information. Employees shall be informed of:

1910.1450(f)(3)(i) The contents of this standard and its appendices which shall be made available to employees;

1910.1450(f)(3)(ii) the location and availability of the employer's Chemical Hygiene Plan;

1910.1450(f)(3)(iii) The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;

1910.1450(f)(3)(iv) Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and

1910.1450(f)(3)(v) The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Safety Data Sheets received from the chemical supplier.

1910.1450(f)(4) Training.

1910.1450(f)(4)(i) Employee training shall include:

1910.1450(f)(4)(i)(A) Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

1910.1450(f)(4)(i)(B) The physical and health hazards of chemicals in the work area; and

1910.1450(f)(4)(i)(C) The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to

hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

1910.1450(f)(4)(ii) The employee shall be trained on the applicable details of the employer's written Chemical Hygiene Plan.

1910.1450(g) Medical consultation and medical examinations.

1910.1450(g)(1) The employer shall provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances:

1910.1450(g)(1)(i) Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee shall be provided an opportunity to receive an appropriate medical examination.

1910.1450(g)(1)(ii) Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the PEL) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected employee as prescribed by the particular standard.

1910.1450(g)(1)(iii) Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee shall be provided an opportunity for a medical consultation. Such consultation shall be for the purpose of determining the need for a medical examination.

1910.1450(g)(2) 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.

1910.1450(g)(3) *Information provided to the physician.* The employer shall provide the following information to the physician:

1910.1450(g)(3)(i) The identity of the hazardous chemical(s) to which the employee may have been exposed;

1910.1450(g)(3)(ii) A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and

1910.1450(g)(3)(iii) A description of the signs and symptoms of exposure that the employee is experiencing, if any.

1910.1450(g)(4) Physician's written opinion.

1910.1450(g)(4)(i) For examination or consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following:

1910.1450(g)(4)(i)(A) Any recommendation for further medical follow-up;

1910.1450(g)(4)(i)(B) The results of the medical examination and any associated tests;

1910.1450(g)(4)(i)(C) Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous workplace; and

1910.1450(g)(4)(i)(D) A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.



1910.1450(g)(4)(ii) The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

1910.1450(h) Hazard identification.

1910.1450(h)(1) With respect to labels and Safety Data Sheets:

1910.1450(h)(1)(i) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.

1910.1450(h)(1)(ii) Employers shall maintain any Safety Data Sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees.

1910.1450(h)(2) The following provisions shall apply to chemical substances developed in the laboratory:

1910.1450(h)(2)(i) If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the employer shall determine if it is a hazardous chemical as defined in paragraph (b) of this section. If the chemical is determined to be hazardous, the employer shall provide appropriate training as required under paragraph (f) of this section.

1910.1450(h)(2)(ii) If the chemical produced is a byproduct whose composition is not known, the employer shall assume that the substance is hazardous and shall implement paragraph (e) of this section.

1910.1450(h)(2)(iii) If the chemical substance is produced for another user outside of the laboratory, the employer shall comply with the Hazard Communication Standard (29 CFR 1910.1200) including the requirements for preparation of Safety Data Sheets and labeling.

1910.1450(i) Use of respirators. Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide, at no cost to the employee, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of 29 CFR 1910.134.

1910.1450(j) Recordkeeping.

1910.1450(j)(1) The employer shall establish and maintain for each employee an accurate record of any measurements taken to monitor employee exposures and any medical consultation and examinations including tests or written opinions required by this standard.

1910.1450(j)(2) The employer shall assure that such records are kept, transferred, and made available in accordance with 29 CFR 1910.1020.

1910.1450(k) [Reserved]

1910.1450(l) Appendices. The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

APPENDIX B – SELECTED BIBLIOGRAPHY

Access to Medical and Exposure Records; OSHA Publication 3110; OSHA Publications Office: Washington, DC.

Air Contaminants: Permissible Exposure Limits; OSHA Publication 3112; OSHA Publications Office: Washington, DC.

American National Standard for Emergency Eye wash and Shower Equipment: Standard Z358.1 1990; American National Standards Institute: New York, 1990.

Armour, M. A. *Hazardous Laboratory Chemicals: Disposal Guide*; CRC Press: Boca Raton, FL, 1991.

Berberich, N.; Howard, F.; Stevens, J.; Henderson, S.; Ochs, D.; Reed, K. *Manual of Safety and Health Hazards in the School Science Laboratory*; Council of State Science Supervisors: Lancaster, PA, 1980.

Bretherick, L. *Handbook of Reactive Chemical Hazards*, 5th ed.; Butterworths: London, 1995.

Bretherick, L. *Hazards in the Chemical Laboratory*, 4th ed.; Royal Society of Chemistry: London, 1986.

Chemical Catalog Reference Manual; Flinn Scientific: Batavia, IL, 1992.

Chemical Hazard Communication; OSHA Publication 3084; OSHA Publications Office: Washington, DC.

Chemical Health & Safety [magazine]; American Chemical Society: Washington, DC.

Chemical Hygiene Plan; Kentucky Department of Education: Frankfort, KY, 1990.

DiBerardinis, L. J., et al. *Guidelines for Laboratory Design: Health and Safety Considerations*, 2nd ed.; Wiley: New York, 1992.

Fawcett, H. H. *Hazardous and Toxic Materials: Safe Handling and Disposal*, 2nd ed.; Wiley/Interscience: New York, 1988.

Fire Protection for Laboratories Using Chemicals: NFPA Standard 45; National Fire Protection Association: Quincy, MA, 1991.

Fire Protection Guide to Hazardous Materials [contains NFPA 325M, NFPA 49, NFPA 491M and NFPA 704], 10th ed.; National Fire Protection Association: Quincy, MA, 1991.

Flammable and Combustible Liquids Code: NFPA Standard 30; National Fire Protection Association: Quincy, MA, 1991.

Gerlovich, J.; Downs, G. *Better Science Through Safety*; Iowa State University Press: Ames, 1981.

Hazard Communication Guidelines for Compliance; OSHA Publication 3011; OSHA Publications Office: Washington, DC.

IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans; International Agency for Research on Cancer: Lyon, France [distributed by WHO Publications Center, USA, Albany, NY].

Improving Safety in the Chemical Laboratory: A Practical Guide, 2nd ed.; Young, J. A., Ed.; Wiley/Interscience: New York, 1991.

Laboratory Safety Guidelines [periodical]; Laboratory Safety Workshop: Milton, MA.

Lunn, G; Sansone, M. *Destruction of Hazardous Chemicals in the Laboratory*, 2nd ed.; Wiley: New York, 1994.



- Methods of Testing Performance of Laboratory Fume Hoods*: ANSI/ASHRAE Standard 110 1985; American Society of Heating, Refrigerating, and Air Conditioning Engineers: Atlanta, GA, 1985.
- Personal Protective Equipment*; OSHA Publication 3077; OSHA Publications Office: Washington, DC.
- Phifer, R. W.; McTigue, W. R. *Handbook of Hazardous Waste Management for Small Quantity Generators*; CRC Press: Boca Raton, FL, 1988.
- Pine, H.; Phifer, R. W. *Laboratory Waste Management: A Guidebook*; American Chemical Society: Washington, DC, 1994.
- Prudent Practices for Handling Hazardous Chemicals in Laboratories*; National Academy of Sciences: Washington, DC, 1981. [2nd edition to be published in 1995.]
- Safety in Academic Chemistry Laboratories*, 6th ed.; American Chemical Society: Washington, DC, 1995.
- Sax, N. I.; Lewis, R. J. *Dangerous Properties of Industrial Materials*, 9th ed.; VNR: New York, 1993.
- School Science Laboratories: A Guide to Some Hazardous Substances*; U.S. Consumer Product Safety Commission: Washington, DC, 1984. [Check with your state science supervisor.]
- "*Standard for Occupational Exposures to Hazardous Chemicals in Laboratories*"; 29 CFR 1910.1450 [also subpart Z]; 55 Fed. Register. 3327 (January 31, 1990); Superintendent of Documents: Washington, DC.
- Understanding Chemical Hazards: A Guide for Students*; American Chemical Society: Washington, DC, 1995.
- Young, J. A.; Kingsley, W. R.; Wahl, G. H. *Developing a Chemical Hygiene Plan*; American Chemical Society: Washington, DC, 1990.
- Young, J. A. *Improving Safety in the Chemical Laboratory: A Practical Guide*, 2nd ed.; Wiley: New York, 1991.



APPENDIX C – INCIDENT REPORT FORM

Incident Report Form

Date of Incident _____ Time _____ am /pm

Location of Incident _____ Department _____

Name of Injured Person _____ [] Faculty [] Staff [] Student

Was First Aid Administered? [] Yes [] No

By Whom _____ Department _____
[] Faculty [] Staff [] Student

Was Public Safety Contacted? [] Yes, Incident Report # _____ [] No

Description of the Incident (be as specific as possible, use additional pages if necessary)

Suggestions for Corrective Action (describe what you feel should be done to avoid repeat occurrences)

Complete Names of All Witnesses and Persons Involved (A written statement from each should be obtained and submitted)

Signature _____ Date _____

Person Filing Report - [] Faculty [] Staff [] Student

Submit completed report to Auxiliary Public Safety Officer Bob Boutin

Signature _____ Date _____

Auxiliary Public Safety Officer

Revised December 2016

APPENDIX D – LABORATORY SAFETY EQUIPMENT

Personal Clothing and Equipment

Aprons, rubber or plastic	Extends to or below the knees.
Gloves	The material from which the glove is made must be carefully chosen so that the glove is not permeable to the liquids or vapors anticipated for the experiment.
Chemical splash goggles	Meets ANSI Standard Z87.1 for chemical splash proof goggles. Indirect ventilation. NOT the same as most goggles sold in hardware stores!
Face shield	When used, should be worn with goggles.
Laboratory Coat	Has long sleeves. Dacron, Tyvek or cotton. Has Velcro or snap fasteners. Extends to or below the knees.
Self-contained breathing apparatus	Use restricted to professionals who have been properly trained and have maintained certification.

Laboratory Safety Equipment

Drench shower	Ceiling and wall mounted showers should operate by chain pull valve. Should deliver tepid, potable water for at least 15 minutes without need to hold valve.
Eye wash fountain	Should deliver tepid, potable water to both eyes. Should provide a steady, gentle flow for at least 15 minutes without need to hold valve.
Fire blanket (wool)	Most useful to keep a victim warm while waiting for medical attention. A blanket should be available but not on a roller. The purpose of the blanket is to cover the victim, not encircle. Wrapping a burning victim may cause additional burns to neck and face due to the chimney effect.
Fire extinguisher	Should be suitable for Class A, B & C fires.
First aid kit	Any good, general purpose first aid kit is suitable.
Flammable storage cabinet	May be made of wood or metal. Should be vented directly to the outside. Check local fire codes.
Fume Hood	Should have a face velocity of 60 100 linear feet per minute. Should be vented to the outside. May have a vertical or horizontal sash. Should be kept clean and uncluttered.

Safety cans

Some occasions demand that volatile, flammable or combustible solvents be stored in safety cans. Each can should have a flame arrestor in good working order. Check local fire codes and NFPA standards 30 and 45.

Signs

Signs are useful for designating the location of safety equipment, means of ingress and egress, etc. Signs should be chosen to be in conformity with state guidelines and recommendations.

Smoke alarm

Check local fire codes.

Laboratory Spill Protection

General purpose

A general purpose adsorbent, such as a mixture of kitty litter, sand, and vermiculite is suitable for containing many chemical spills.

Acid spills

Best treated with sodium bicarbonate, which may be mixed with kitty litter and/or sand.

Base spills

Best treated with sodium bisulfate, which may be mixed with kitty litter and/or sand.

Halogen spills

Best treated with sodium thiosulfate, which may be mixed with kitty litter and/or sand.

APPENDIX E – RECORD OF TRAINING

Record of Training

Employee Name: _____

Job Assignment: _____

Job Location: _____

The above-named employee has received training, as specified in the applicable Chemical Hygiene Plan, in the following areas:

Topic	Training Date	Training Location	Trainer Name(s)	Verified By
Federal & state chemical hygiene Standards	_____	_____	_____	_____
Location and content of the Chemical Hygiene Plan	_____	_____	_____	_____
Hazards of chemicals in the Workplace	_____	_____	_____	_____
Labeling and storing practices, and information to interpret labels	_____	_____	_____	_____
Location and content of MSDS's	_____	_____	_____	_____
Location and proper use of protective apparel & equipment	_____	_____	_____	_____
Appropriate first aid techniques	_____	_____	_____	_____
Procedures for responding to chemical exposures	_____	_____	_____	_____
Procedures for reporting accidents	_____	_____	_____	_____
Methods to detect presence or release of hazardous chemicals used in the laboratory	_____	_____	_____	_____
Proper operation of fire extinguisher	_____	_____	_____	_____



APPENDIX F – SAFETY INSPECTION REPORT

Safety Inspection Report

Inspector _____
 Department _____
 Lab # _____
 Instructional _____
 Active _____

Date _____
 Building _____
 Faculty _____
 Research _____
 Inactive _____
 Clinical _____

General Safety

- Housekeeping orderly
- No tripping hazards
- Floor condition acceptable
- Acceptable condition of tables
- Acceptable condition of chairs
- Emergency phone numbers posted
- Emergency protocol posted
- Common chemical MSDS's on clipboard
- Acceptable lighting level
- Acceptable temperature level
- Acceptable humidity level
- Acceptable noise level
- No food or drink sign posted
- No food or drink observed
- Emergency shower unobstructed
- Emergency eyewash unobstructed
- NFPA 704 diamond
- Radiation warnings
- Biohazard warnings
- UV/laser warnings

Approved	Declined	NA

Action Item

Fire Safety

- Egress pathways unobstructed
- Doors function properly
- Emergency light functions
- Fire extinguisher present with current tag
- First aid kit properly stocked
- Fire Blanket present
- Gas lines marked
- Bunsen burner tubes free of defects
- Combustible materials clear of heat

Approved	Declined	NA

Action Item

Mechanical Safety

- Mechanical hazards guarded
- Stop switch is easily accessible
- Equipment secured to prevent movement
- Electrical disconnect unobstructed

Approved	Declined	NA

Action Item



Safety Inspection Report (Continued)

Electrical Safety

- Clear access to electric panels
- Electrical circuits marked
- Electrical equipment grounded
- Outlets within 6' of water have GFCI
- Cords equipped with third prong
- Cord condition acceptable
- No overloaded outlets

Approved	Declined	NA

Action Item

Physical Safety

- Compressed gas cylinders secured
- Compressed gas cylinders labeled
- Safety glasses used
- Protective clothing available
- Protective clothing used
- Flammable liquid storage acceptable
- Under sink storage acceptable
- Shelf storage acceptable
- Work stations not overloaded

Approved	Declined	NA

Action Item

Refrigerator/Freezer Safety

- No food or drink sign posted on appliance
- No food or drink observed in appliance
- No flammables sign posted on appliance
- No flammables stored in appliance

Approved	Declined	NA

Action Item

Biohazard Safety

- Bioagents/pathogens present
- Bioagents/pathogens controlled
- Animals controlled
- Biosafety cabinets certified (room 240)
- Autoclave condition acceptable
- Negative ventilation to hallway
- Mutagens present & controlled
- Sharp containers available/used
- Universal precautions posted
- Acceptable student behavior

Approved	Declined	NA

Action Item

Chemical Safety

- Chemicals properly stored by reactive class
- Incompatible chemicals separated
- Storage elevated from floor
- Chemicals properly labeled
- Storage containers acceptable
- Hazardous liquid storage below eye level
- Acid storage in compatible container
- Regulated carcinogens present/controlled
- No old chemicals present
- Explosive chemicals present/controlled
- Picric acid present/controlled
- Peroxides present/controlled
- Perchloric acid present/controlled

Approved	Declined	NA

Action Item



Safety Inspection Report (Continued)

Chemical Fume Hoods

Hood # _____

Measured air flow _____ lfpm

	Yes	No
Acceptable	<input type="checkbox"/>	<input type="checkbox"/>

Comments _____

- Hood functions properly
- Condition of hood acceptable
- Sash functions properly
- Switches function properly
- No excess storage

Approved	Declined	NA

Action Item

Hood # _____

Measured air flow _____ lfpm

	Yes	No
Acceptable	<input type="checkbox"/>	<input type="checkbox"/>

Comments _____

- Hood functions properly
- Condition of hood acceptable
- Sash functions properly
- Switches function properly
- No excess storage

Approved	Declined	NA

Action Item

Lab occupant safety concerns: _____

Date report Emailed to Faculty member _____

Date report Emailed to Department Chair/Representative _____

Date report Emailed to Chemical Hygiene Officer _____