

# **Laboratory Safety Manual including Chemical Hygiene Plan Lewis-Clark State College August 2018**

The purpose of this plan is to delineate a common set of procedures and practices in order to:

- (1) Ensure the safe operation of the laboratories at Lewis-Clark State College.
- (2) Ensure the productive operation of the laboratories at Lewis-Clark State College.
- (3) Comply with the OSHA Occupational Safety and Health Standards on Toxic and Hazardous Substances in accordance with Idaho statute IDAPA 07 Title 04 Chapter 01. OSHA standards governing lab safety are available at

[https://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS  
&p\\_id=10106](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106)

## Table of Contents

- I. Training
  - A. General training requirements
  - B. Specific training requirements
  
- II. Basic rules and procedures
  - A. General laboratory safety
  - B. Personal safety
  - C. Emergency procedures
  - D. Specific equipment rules and procedures
  
- III. General chemical hygiene and safety: policies and recommendations
  - A. Chemical procurement, distribution, and storage
  - B. Housekeeping
  - C. Environmental monitoring
  - D. Medical surveillance
  - E. Personal protection and laboratory safety devices
  - F. Recordkeeping
  
- IV. Laboratory facilities
  - A. Laboratory floor plan
  - B. Safety equipment
  - C. Ventilation

## I. Training

### A. General training requirements

All students, faculty and other personnel who work and learn in the laboratories have the right to do so in a safe, clean and productive environment. At the same time, all users of these areas share in the responsibility of safety and maintenance of the laboratories.

Therefore, the purpose of training all laboratory users is to instill a working understanding of the rules of the laboratory spaces so that the environment is conducive to their work as well as conducive to the work of peers and future users. To this end, all laboratory training should include, at minimum:

1. Basic instructions for safe laboratory use (see the section on Basic Lab Safety Rules and Procedures).
2. Directions on how to acquire and dispose of materials.
3. Directions on how to maintain the cleanliness of the work area(s) and all equipment used.
4. How and when to access laboratory facilities and supplies.

### B. Specific training requirements

There are specific and additional requirements for separate groups, as described below.

#### 1. Stockroom preparatory personnel:

The stockroom manager is responsible for training students to work in the stockroom, itself, in order to prepare solutions and other materials for chemistry and biology laboratories. In this mutually beneficial arrangement, students gain necessary skills in solution preparation, waste disposal and design of laboratory experiments while the stockroom manager garners needed help.

Stockroom preparatory personnel may be enrolled in Chem 353 Laboratory Preparatory Techniques. While the elements of this course are ultimately the joint decision of the stockroom manager and the faculty of record, the course should include the following:

- a. How to apply safety procedures to all types of chemical activities.
- b. Application of the student's knowledge of stoichiometry, solution preparation, and other basic lab skills.
- c. Effective communication with a supervisor concerning the successes and

obstacles encountered in preparing and testing undergraduate chemistry laboratories.

- d. Assessing and suggesting improvements on the effectiveness, efficiency, and educational value of the lab experiments that are being prepared.
- e. Additionally, personnel trained directly by the stockroom manager may be asked to post hours and aid other students needing stockroom materials in the absence of the stockroom manager but during business hours. However, like all students, stockroom preparatory personnel never have direct access to locked chemical supplies.

## 2. Laboratory preparatory personnel

The laboratory preparatory personnel have a similar role as the stockroom personnel but these students are engaged by faculty to prepare materials for a particular laboratory or set of laboratories. The faculty working with these students is responsible for training the students in techniques and safety as outlined in the General Training Requirements and is also responsible for the following:

- a. To arrange working hours for the student that coincide with the faculty's working hours or a specific, named proctor, as well as directions on how to contact the faculty member or proctor. Preferably, the student's working hours should be during business hours to facilitate stockroom and faculty access. Only in exceptional cases, when a student's work and school schedules preclude this, should the student be offered a stockroom key and, then, only with the stockroom manager's agreement and knowledge. Like all students, laboratory preparatory personnel never have direct access to locked chemical supplies.
- b. Introduction of the student to the stockroom manager along with a verbal or written description of the student's responsibilities.

## 3. Research assistants

Research assistants work with a faculty member either independently or in a small group on a project in the faculty member's area of interest. Students may receive credit and/or a stipend for doing such work, as well as gaining valuable experience in advanced laboratory and research techniques. The faculty member is responsible for training the students in these techniques and safety as outlined in the General Training Requirements and is also responsible for the following:

- a. Assignment of work area or areas. This should include a storage area in addition to a bench.
- b. Protocol for checking out materials from the stockroom and labeling chemicals.
- c. Arrangement of working hours for the student that coincide with the faculty's

working hours or a specific, named proctor as well as providing direction on how to contact the faculty or proctor. Preferably, the student's working hours should be during business hours to facilitate stockroom and faculty access. Only in exceptional cases, when a student's work and school schedule precludes this, should the student be offered a stockroom key and, then, only with stockroom manager's agreement. Like all students, research assistants never have direct access to locked chemical supplies.

- d. Introduction of the student to the stockroom manager along with a verbal description of the student's research work.

#### 4. Students in laboratory classes

Training for students in laboratory classes is carried out by the laboratory instructor and is described in General Training Requirements above. The pedagogy implemented to accomplish this is the instructor's choice. Students in laboratory classes do not have stockroom access under any circumstance.

## II. Basic Laboratory Safety Rules and Procedures:

### A. General laboratory safety

1. All persons working in the laboratory must help keep the area clean and orderly.
2. All personal items must be stored in cubbies or assigned cabinets.
3. Lab benches must be kept free of extraneous debris at all times.
4. Fume hoods should not be used to store chemicals and should be kept free from nonessential items.
5. Any solutions or other chemicals stored in the lab must be properly labeled as to their identity and/or contents.
6. The stockroom manager should be informed of any chemical stored in the lab.
7. All dirty glassware is to be placed in the provided bin for collection by the glass cleaners. Glassware should be rinsed according to the instructor's directions prior to being placed in the bin. The contents of difficult to clean glassware must be labeled so that glass cleaners know how to clean it.

### B. Personal safety

1. Rules. Rules of the laboratory are few, but all users of the laboratory must follow them. Students not following rules will be asked to leave the laboratory by the instructor or stockroom manager and violations may result in additional sanctions.
  - a. Food and beverages are prohibited in the laboratory.
  - b. Safety eyewear must be used when designated necessary by the laboratory instructor.
  - c. Open-toed shoes, short pants or skirts above the knee, and sleeveless shirts or

blouses are not allowed in the labs.

- d. Tie long hair back when working with flames.
- e. Cell phones are only permitted in the laboratories with the permission of the instructor.
- f. Avoid all skin contact with hazardous chemicals by wearing the appropriate gloves, but do not wear gloves outside of the labs.
- g. Wash hands with soap and water upon entering the lab, and before leaving the lab.
- h. Don't taste chemicals.
- i. Don't use damaged glassware, dispose of it in the broken glass receptacle.
- j. Be personally informed of the dangers associated with all chemicals that you are using as directed by your laboratory manual, or by instructor instructions. The MSDS documents for all chemicals are located in the chemical stockroom and on all computers in the laboratories.
- k. Dispose of sharps (needles, lancets, etc.) in the appropriate biohazard container.
- l. Never touch another person's bodily fluids without personal protective gear.

#### C. Emergency procedures

1. Report any unsafe conditions and accidents immediately to the laboratory supervisor or instructor.
2. If there is an injury or other emergency situation, call 911 immediately. Then call campus security.
3. Know the location of and how to use the following emergency equipment (see section II for details)
  - a. Eyewash stations
  - b. First aid kit
  - c. Emergency showers
  - d. Fire extinguishers
4. In the case of a spill, contact the lab supervisor.
5. In the case of a fire, follow the following steps:
  - a. If an individual is on fire, have them Stop, Drop, and Roll.
  - b. Inform lab supervisor, call 911 if necessary, and then follow further instructions from lab supervisor.
  - c. Further instructions may be to exit building, use fire extinguisher, or other safety precautions.
6. Be sure to know location of all emergency exits.

#### D. Specific equipment rules and procedures

1. Equipment alarms: If an alarm associated with a piece of equipment is ringing, then please contact your lab supervisor, the stockroom manager, or campus security.
2. Laminar flow hood: Caustic chemicals cannot be used in this type of hood.

3. Fume hoods: The hood should be turned on, and the sash should be at the height indicated by the arrows found on the side of the hoods.
4. Analytical Instrumentation
  - a. Never turn on or use analytical instrumentation without a supervisor's guidance. If you are already familiar with the operation of an instrument, the lab supervisor must be aware of your plans for using the instrument.
  - b. When using an instrument an entry must be made in the log book located in the lab.
  - c. When using the atomic absorption instrument, always turn on the flame venting hood.
  - d. Be aware of the levels of waste containers that collect effluent from the instrument (e.g. HPLC) and dispose of properly.
  - e. Never place your eyes in the path of an ultraviolet light source.
  - f. When shutting down instrumentation, make sure all associated gas flows are closed, and all flames (e.g. atomic absorption) are extinguished.
  - g. Make sure all syringes used for sample injection are properly stored before leaving the lab.

### III. General chemical hygiene and safety: policies and recommendations

It is prudent to minimize all chemical exposure. OSHA Occupational Health Standards have established Limits for Air Contaminants for many of the chemicals that are in our laboratories ([https://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9992](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9992)). Exposure must be within these limits. Additionally, the Standards provide guidelines on chemical storage, first aid management and issues pertaining to chemical hygiene. The rules set here reflect those standards and in the case of inconsistency, the State Standards have precedence.

Laboratory safety is the responsibility of everyone that enters laboratory spaces. All students, faculty, and staff must participate in maintaining a clean and safe environment and receive training as indicated in this document.

#### A. Chemical procurement, distribution, and storage

##### 1. Chemical procurement

- a. All chemicals will be ordered and received by the stockroom manager.
- b. Before a chemical is received, information about its proper storage, handling and disposal should be known by the person who requested the chemical. If unusual precautions need to be taken, then the person requesting the chemical should inform the stockroom manager.
- c. Chemicals that lack proper labeling (identity of chemical, date of purchase,

manufacturer and hazards) will not be accepted by the stockroom manager for storage in the stockroom.

- d. Material Safety Data Sheets (MSDSs) for chemicals must be immediately accessible for all chemicals that are acquired and maintained in the labs.

## 2. Chemical distribution

- a. The stockroom manager will maintain control over the distribution of all chemicals in the labs.
- b. Following use of any chemicals or materials, items should be returned to a pre-determined location and returned to its storage location by the stockroom manager. If a material is to be used for an extended period of time, the stockroom manager must be notified.
- c. When possible, transferring large quantities of hazardous chemicals should be avoided and, rather, distributed into smaller aliquots and transported. Concentrated acids should be placed in a protective carrier when moved from room to room. When necessary to move large volumes of hazardous chemicals, proper transportation equipment should be used.

## 3. Chemical storage

- a. Chemicals are to be stored in a locked stockroom. Only designated personnel will be issued a key (i.e. stockroom manager and faculty cleared for access).
- b. All chemicals must be labeled with name, manufacturer, and date of arrival (information regarding toxicity and expiration may be included when appropriate).
- c. All solutions must be labeled with their complete name, concentration, name of the preparer, and date of preparation. Date of expiration and toxicity/hazards may be included when appropriate.
- d. All spills should be picked up immediately and placed in the proper disposal area.
- e. Only those areas of the storage room specifically designed for chemical storage and meeting other requirements of this section will be used for chemical storage. Floors, benches, and hoods are to be unobstructed and not to be used as a storage area. Chemicals are not to be stored near, over, or under a sink or hood.
- f. Access to exits, stairways, emergency equipment, and controls must never be obstructed.
- g. Heavy bottles and large bottles of acids shall be stored near the floor and protected from breakage.
- h. Strong acids are to be isolated from toxic substances, all metals, flammable substances, organic materials, and substances that may react and release other corrosive, toxic, or flammable fumes as a result of reaction. Nitric acid is not to be stored with other acids unless the storage cabinet is provided with a

separate compartment specifically for nitric acid.

- i. Chemicals are to be stored in chemically compatible families. Chemicals which react with each other are not to be stored in close proximity to each other. Flammables and oxidizers are not to be stored near each other.
- j. Flammables are to be stored in approved flammable storage cabinets only. Flammable liquids are not to be stored in refrigerators unless the refrigerator is designed and approved for flammable storage.
- k. Adequate shelving must be provided to prevent the chemicals from becoming overcrowded and inaccessible.
- l. Chemicals are not to be stored above the eye level of the person handling the chemicals.
- m. Chemical storage is to be on shelving with protective safety lips.
- n. A chemical inventory, including the name of the chemical, the quantity available and its location, is to be maintained by the stockroom manager.
- o. Only small amounts of hazardous, explosive, or dangerous chemicals are to be kept on hand.
- p. Unlabeled, used, contaminated, or undesirable chemicals are to be disposed of in accordance with approved practices. Chemicals are to be disposed of upon expiration of their shelf life.

#### B. Housekeeping

1. The laboratories are to be maintained and cleaned by those using the space. Equipment (e.g. glassware) requiring cleaning is to be placed in a pre-determined location and will be cleaned and put away by the stockroom manager or assistants.
2. Materials currently in use, or prepared for future use, must be labeled and stored in spaces determined for research or instruction for each class/faculty. When finished, materials should be disposed of as quickly as possible.
3. Chemical spills are to be immediately cleaned using appropriate methods as determined by the nature of the spill.
4. Custodial staff will clean floors and remove garbage placed in the appropriate receptacles. Cardboard boxes must be broken down and placed near the garbage cans in the stockroom where custodial staff will remove.

#### C. Environmental monitoring

1. All exposure to chemicals must be lower than the acceptable maximum exposures listed in the OSHA Standards for Toxic and Hazardous Substances - Regulation 1910 Subpart Z  
[https://www.osha.gov/pls/oshaweb/owasrch.search\\_form?p\\_doc\\_type=STANDARD&p\\_toc\\_level=1&p\\_keyvalue=1910](https://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARD&p_toc_level=1&p_keyvalue=1910)
2. Overexposure may be indicated if

- a. A hazardous substance leaked, spilled or was otherwise released in an uncontrolled manner.
- b. Direct skin or eye contact with a chemical occurred.
- c. Students, faculty or staff manifests symptoms of headache, nausea, coughing, tearing, redness of eyes, irritation of throat, dizziness, loss of motor dexterity or judgment and these symptoms are alleviated when the person is removed from the exposure area. Also, if two or more people working in the same area experience similar effects, overexposure is indicated.

#### D. Medical surveillance

1. All students, faculty and staff have an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines necessary, under the following circumstances:
  - a. Whenever signs or symptoms associated with hazardous chemicals or substances to which personnel may have been exposed in the laboratory are experienced.
  - b. When overexposure is indicated.
2. All students, faculty and staff who have need for emergency care should go to the nearest emergency room (St. Joseph Regional Medical Center) or call 9-911.

#### E. Personal protection and laboratory safety devices

1. Emergency equipment should be accessible and maintained by the stockroom manager, LCSC physical plant, or appropriate equipment supplier. Included are first aid kits, showers, eyewashes, fire extinguishers, spill kits, and emergency kits.
2. During preparation, distribution, and disposal of chemicals/solutions, all personnel should wear appropriate safety equipment and attire. Included, when necessitated by hazardous chemicals, is safety goggles, laboratory coat, gloves, and shoes with protective covering.
3. Faculty, staff, and students returning chemicals and solutions to the designated sites for disposal or re-shelving by stockroom personnel must ensure that materials are left with proper labeling and any necessary instructions for their safe disposal or redistribution.

#### F. Record keeping

1. A current chemical inventory must be maintained so that the inventory is accessible on case of emergency. In order to facilitate the inventorying of chemicals, all chemicals must include on their label the product name, the manufacturer's name and hazard warnings. If the chemical is transferred to a secondary container, the new container should also be labeled in this manner.
2. Materials safety data sheets (MSDSs) for all chemicals in the inventory are available

on the computer in each laboratory as well as in the stockroom. MSDS data is available on ANY computer with access to the Internet by typing MSDS and the chemical name into any search engine.

3. Accident and incident reports are to be maintained by the stockroom manager.
4. Signs must be posted indicating the location of safety equipment such as exits, showers, first aid, fire extinguishers and eye wash stations. Additional warnings should be placed in areas where special hazards exist.
5. Signs prohibiting food and drink in laboratory spaces must be prominently displayed.
6. Individuals present in a laboratory space must be able to immediately contact a supervisor in case of emergency or question. This contact can be by cell phone.

#### IV. Laboratory Facilities

##### A. Floor Plan for Laboratory (see appendix I)

##### B. Safety Equipment (a general list of types of safety equipment found in LCSC teaching and research laboratories, including information on use and maintenance.)

1. Eyewash stations
  - a. Eyewash stations are to be tested and flushed at least once per month. Testing should monitor proper flow rate as well as cleaning eye wash aerators and control valve to ensure proper water flow.
  - b. Plastic float-off covers must remain on outlet heads when the eyewash stations are not in use.
  - c. Laboratory personnel must be able to reach an eyewash station within 10 seconds and be within a travel distance of no more than 50 feet from the lab.
2. Emergency showers
  - a. Safety showers are to be tested by LCSC faculty and/or physical plant staff once per year to ensure the valve is operating, that all debris is removed from the system, and that safety showers have sufficient flow of water.
  - b. Laboratory personnel must be able to reach showers within 10 seconds and be within a travel distance of no more than 50 feet from the lab.
3. Flammable liquid storage cabinets
  - a. Maximum capacity: The quantity of Class I or Class II liquids shall not exceed 60 gallons and the total quantity of all liquids, including Class III, may not exceed 120 gallons.
  - b. Cabinets must be labeled "Flammable – Keep Fire Away".
  - c. Storage of flammable liquids in excess of ten gallons must be stored in an UL listed or Factory Mutual (FM) approved flammable liquid storage cabinet outfitted with approved automatic or self-closing doors.
  - d. A current inventory of chemicals must be displayed on the outside of storage cabinets.

4. Fire extinguishers
  - a. Every laboratory must have a working fire extinguisher (either carbon dioxide, dry chemical, or both). Pressurized water extinguishers should not be located in a chemical laboratory.
  - b. Laboratory fire extinguishers must be tested once per year to ensure proper functionality.
5. First Aid Kits
  - a. A properly stocked first aid kit must be available in each work area. This is particularly important in areas of higher than average risk of injury.
  - b. The location and contents of the first aid kits should be made aware to all students and faculty that will be using the laboratory.

### C. Ventilation

1. Laboratory fume hoods: Dilution, ventilation, or capture of chemical vapors and particles may control chemical exposure by local exhaust ventilation. The laboratory chemical fume hood is designed to remove harmful vapors from chemicals and prevent their escape into the general laboratory atmosphere. The chemical fume hood also provides containment of chemicals and their reactions.
  - a. Fume hood capture velocity is adversely affected by cross-draft and eddy currents. Cross-drafts occur when people walk in front of a fume hood or when nearby windows or doors are open. Eddy currents also occur around the person using the fume hood and around objects inside it. To limit these effects, fume hoods should not contain unnecessary objects, and equipment should be placed as far to the back of the hood as practical.
  - b. Fume hoods should be tested annually to ensure adequate face velocities (typically 80 to 120 linear feet per minute) with the sash fully open.
  - c. In general, fume hoods are not to be used for storage purposes, except when used to store used chemicals in preparation for proper disposal. Otherwise, chemicals and apparatus should be moved from fume hoods to proper storage spaces when not in use.
2. Other ventilation systems
  - a. Room ventilation systems should be maintained in each laboratory space to ensure proper purging of general lab air. Monitoring and necessary maintenance should be performed by the LCSC physical plant once per year.
  - b. In laboratory spaces lacking proper room ventilation, hazardous chemicals should be stored in cabinets fitted with auxiliary local ventilation.