CHEMICAL HYGIENE PLAN

CENTRALIA COLLEGE
CENTRALIA, WA

October 2021

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CHP REVIEW AND REVISION RECORD

Previous Review and Revision Records are on file and can be obtained upon request.

Date reviewed / revised: October 2019 Initials: _____

Sections affected:
Checked internet links and updated as needed;
Page 1: Added Centralia College logo and corrected date;
Page 3: Corrected Table of Contents numbering;
Section 2.4: Updated Directory and Facilities and Safety Committee members;
Section 3.6.1.b: Changed english to English for grammar;
Section 3.6.2.a: Updated SDS locations for incoming shipments;
Section 3.7.4.d: Added verbiage to clarify chemical storage in fume hoods;
Section 3.11.2: Changed to Remote Locations rather than listing each location, No permanent storage or disposal at remote locations, and chemicals are to be returned to main campus at the conclusion of each quarter;
SOP #9: Revised version dated 03/2019 replaced prior version.

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Checked internet links and updated as needed;
Page 1: Updated version date
Section 2.4: Updated Directory of Facilities and Safety Committee members;

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Sections affected:
Checked internet links and updated as needed;
Page 1: Corrected edit date;
Section 2.4: Updated Directory and Facilities and Safety Committee members;
Removed references to multiple CHOs on campus. Instead changed to CHO, Lab Technician, or Designee. (page 8, 3.8.2,
Section 2.3.1: Updated CHO description to reflect one CHO for the campus.
Section 3.e.v.b. Changed to reflect current practice for preserved specimens,
Section 3.5.1 Removed Lab Tech and added designee to procurement activities.
Section 3.6.2.b. Added Laboratory technician or designee to SDS management
Section 3.8.2 Removed his or hers from the statement,
Section 3.11.3.a.vi Changed from Security to Campus Safety and Security Manager
Section 3.11.3.c.i.ii Updated eye protection statement for custodians.
Section 7.2.2 Removed for each unit (CHO)
Appendix 2: Printed newer versions of OSHA and WISHA Lab Standard to include in paper books.
Appendix 4: Updated to newer version

Section 1: INTRODUCTION

1.1 Goal of the Chemical Hygiene Plan

It is the policy of Centralia College to provide a place of employment free from recognized hazards likely to cause physical harm and one that also complies with all federal, state and local laws and regulations affecting the safety and health of its employees. The Chemical Hygiene Plan (CHP) addresses this goal for the laboratory workplace.

All employees engaged in the laboratory use of chemicals, or who may be exposed to such chemicals, are subject to the Occupational Safety and Health Administration (OSHA) standard titled Occupational Exposure to Hazardous Chemicals in Laboratories (29 CFR 1910.1450). This standard requires that employers protect workers from all hazardous chemicals in use in their work areas. A printed copy is attached to all hard copies of the CHP and may also be found on the internet at (Appendix 2): https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=10106

In addition to the OSHA requirements, the Washington Industrial Safety and Health Act (WISHA) Hazardous Chemicals in Laboratories (296-828 WAC - Laboratory Standard), further defines methods for ensuring employee safety in the laboratory. A printed copy is attached to all hard copies of the CHP and may also be found on the internet at (Appendix 2): https://apps.leg.wa.gov/wac/default.aspx?cite=296-828&full=true&pdf=true

These standards require that employers protect workers through the development and implementation of a Chemical Hygiene Plan (WAC 296-828-20005; http://apps.leg.wa.gov/WAC/default.aspx?cite=296-828-20005) containing work practices and control measures tailored to the individual laboratory workplace which define and provide for protection of employees from safety and health hazards associated with hazardous chemicals in the laboratory.

Many policies and practices may not be part of the Chemical Hygiene Plan as such, and yet they are crucial to the planning process that must be part of maintaining a safe environment for employees and students. Such items as the number of students per class and the amount of physical space available to each student are examples of policies and practices that impact the establishment of a safe environment, but which are not required by OSHA to be part of the Chemical Hygiene Plan.

1.2 Who is Covered by the Laboratory Standard?

Rather than identify the specific types of laboratories that are or are not covered by the Laboratory Standard, the regulations refer to the definitions of "laboratory use of hazardous chemicals" and "laboratory scale". Laboratories subject to this standard are facilities where the "laboratory use of hazardous chemicals" occurs.

“Hazardous chemicals” are any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified. The term "**health hazard**" is classified as posing one of the following hazardous effects: acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenicity; reproductive toxicity; specific target organ toxicity (single and repeated exposure); or aspiration hazard. These include 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.

"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. This definition excludes those workplaces whose function is to produce commercial quantities of materials.

"Laboratory use of hazardous chemicals" refers to the handling or use of such chemicals in which **all** of the following conditions are met:

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

Employees who are to be addressed in the Chemical Hygiene Plan are individuals employed in the laboratory workplace who may be exposed to hazardous chemicals in the course of their assignments. This includes employees who actually work in the laboratory or because of their work assignments, may be required to enter a laboratory where potential exposures may occur (e.g, maintenance or custodial personnel, student employees).

1.3 Who is NOT Covered by the Laboratory Standard?

1) The Laboratory Standard does not apply to:
   a) Uses of hazardous chemicals which do not meet the definition of "laboratory use" even if such occurs in a laboratory; and
   b) Laboratory uses of hazardous chemicals which provide no potential for employee exposure such as:
      i) 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;
      ii) 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.
2) The occasional visitor to the laboratory, such as a guest or sales person, is not included in the definition of "*employee*" and therefore does not need to be addressed in the Chemical Hygiene Plan. It is the policy of Centralia College to expect all guests, sales people and other visitors to use this Chemical Hygiene Plan as a guideline for safe behavior and prudent practices in campus laboratories.

Section 2: CHEMICAL HYGIENE PERSONNEL

2.1 Goal

The successful development and implementation of a Chemical Hygiene Plan is based on focusing authority and responsibility on the individuals who are qualified, by training or experience, to provide technical guidance on the provisions of the CHP. This ensures that responsibility for chemical hygiene in the laboratories is shared at all employee levels.

2.2 Levels of Responsibility

1) **Employer Responsibilities -** The following are responsibilities of Centralia College, who is the employer of record:
   a) Designate one or more Chemical Hygiene Officers (CHOs). Assign the CHO(s) the various responsibilities outlined in Section 2.3, below.
   b) Make manufacturer's Safety Data Sheets accessible to employees.
   c) Provide employees with training and information regarding chemical and physical hazards.
   d) Post "designated areas" if any select carcinogens, reproductive toxins or acute toxins are used in the laboratory.
   e) Measure the concentration of hazardous chemical(s) if it is believed that the action level has been exceeded.
   f) Keep records of employee exposures to hazardous chemicals for a period of 30 years beyond the time of exposure. These records should be filed by the employee, in writing, within two weeks of the exposure.

g) Provide medical consultations and examinations required as a result of exposure to hazardous chemical(s).
h) Provide respirators when necessary. [In general, it is the policy of Centralia College to employ outside expert services if respirators are necessary.]

2) **Employee Responsibilities** - College employees, whose normal work locations include a laboratory area, are responsible for:
   a) Maintaining awareness of health and safety hazards.
   b) Participating in training programs provided by the college within contracted times.
   c) Consulting reference materials related to chemical safety whenever appropriate.
   d) Planning and conducting each operation in accordance with the college chemical hygiene procedures.
   e) Using good personal chemical hygiene habits.
   f) Conducting and submitting routine safety inspections of the assigned laboratory.
   g) Reporting accidents, injuries, unsafe practices and unsafe conditions to the Chemical Hygiene Officer.
3) **Student Responsibilities –**
   a) Students are not specifically covered by the Laboratory Standard. However, as adults they will work with hazardous substances in their daily lives and as a part of their jobs. Therefore 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.
   b) It is the college policy to include the protection and responsibilities of students in the Chemical Hygiene Plan.
   c) Students are not allowed to use school laboratories unless they first obtain permission for specific laboratory activities from the laboratory technician, instructor, or Chemical Hygiene Officer, and are directly supervised during their work.
   d) The student assigned to a class in a laboratory or undertaking an independent study project involving hazardous materials, is responsible for:
      i) Maintaining awareness of health and safety hazards.
      ii) Learning correct procedures and practices, especially those provided by the course instructor and the assigned textbooks.
      iii) Obtaining permission of the instructor before beginning (or modifying) any laboratory procedure.
      iv) Planning and conducting each laboratory operation in accordance with the college chemical hygiene procedures.
      v) Using good personal chemical hygiene habits. This especially includes:
         (1) Correct use of approved eye protection when working with hazardous materials and in hazardous situations.
         (2) Not eating, drinking, placing anything in one's mouth, or applying cosmetics, creams or lotions while in the laboratory.
         (3) Never engaging in horseplay or activities that might distract others while in the laboratory.
         (4) Dressing appropriately for the hazards present.
         (5) Washing hands after working with hazardous materials and before leaving the lab.
         (6) Reporting accidents, injuries, unsafe practices, and unsafe conditions to the instructor or laboratory technician.

2.3 Key Personnel and Their Responsibilities:

Centralia College President
The President, as Chief Executive Officer, has the ultimate responsibility for chemical hygiene within the college.

Chemical Hygiene Administrator:
A college-wide administrative officer will serve as the Chemical Hygiene Administrator for the college and will:
1) Work with the Chemical Hygiene Officer to develop appropriate policies and practices for the college;
2) Make decisions regarding possible use of requested chemicals identified as explosive, carcinogenic, mutagenic, highly toxic or otherwise potentially hazardous.

3) Ensure that adequate records detailing efforts and results of employee exposure monitoring and medical consultations and examinations are maintained;
4) Keep the Campus Facilities and Safety Committee informed of any issues related to the CHP;
5) Ensure that employees are provided with the required and appropriate training to carry out their responsibilities; and
6) Monitor the legal requirements concerning hazardous substances.

Chemical Hygiene Officer:
The college must designate a Chemical Hygiene Officer (CHO), an employee who is qualified by training or experience, to manage the use and storage of hazardous chemicals and to:
1) Provide technical guidance in the development and implementation of the provisions of the CHP;
2) Develop Standard Operating Procedures and Laboratory Safety Rules and ensure awareness by employees;
3) Monitor procurement, use and disposal of chemicals used in the department;
4) Implement appropriate training with regard to chemical hygiene for college employees whose normal work locations include laboratory areas, possible contact with laboratory chemicals, or desire to work with potentially hazardous chemicals in the classroom; those administrators responsible for supervising such employees, and those employees responsible for maintaining the laboratories.
5) Review the CHP annually and update as necessary;
6) Conduct regular, formal chemical hygiene and housekeeping inspections, including routine inspections of laboratory and emergency equipment;
7) Determine the need for personal protective equipment;
8) Seek ways to improve the CHP within the department(s) and on campus;
9) Keep the Chemical Hygiene Administrator and the campus Facilities and Safety Committee informed of issues relating to the CHP.

Laboratory Technician / Faculty: Faculty and/or staff supervising laboratories should take overall responsibility for chemical hygiene in the laboratory including:
1) Ensuring that workers know and follow chemical hygiene rules;
2) Ensuring that protective equipment is available, in working order and used appropriately;
3) Ensuring that appropriate training has been provided;
4) Knowing the current legal requirements concerning regulated substances;
5) Determining the required levels of protective apparel and equipment;
6) Ensuring that facilities and training are adequate for any material being ordered.

Laboratory Employees: Each laboratory employee is responsible for planning and conducting laboratory operations in accordance with the appropriate laboratory procedures and rules outlined in the CHP as well as developing good personal chemical hygiene habits.

2.4 Directory:

The directory in this section identifies the Chemical Hygiene Personnel. Please see section 2.3 for their responsibilities at Centralia College.

Chemical Hygiene Administrator: Joyce Hammer x 8486

Chemical Hygiene Officer: Renae Z'berg x 8669

Campus Safety and Security Manager: Chuck Wallace x 8741

Campus Facilities and Safety Committee (2021):
Leslie Fountain Williams – Ex Officio, Vice President, Finance and Administration
Renae Z'berg, Chair – Lab Representative
Gina Sterner – Assistant Chair, IT Representative
Lisa Welch – Student Services
Madison Tibbetts – Student
Janelle Girt - Instruction

Rick Perkins – Director, Maintenance & Construction
Chuck Wallace – Campus Safety & Security Manager
Casey Rice – Director, Custodial/Parking/Grounds
Denise Costello – Executive Assistant to Vice President, Finance & Administration
Mary Capen – Nursing, Faculty
Adam Dunn – Faculty
Amanda Haines – PIO
Kari Smith – Executive Assistant, Finance & Administration
Carrie Johnson – Faculty
Price Peterson – Student Services
Vacant – Disability Services
Andrea Dulaney – Recorder

Section 3: STANDARD OPERATING PROCEDURES FOR LABORATORIES

3.1 Goal:

Using Standard Operating Procedures (SOP's) protects employees working in the laboratory, others who may be exposed, and the environment from injury due to hazardous chemicals in the workplace.

1) SOP's describe both mandatory and suggested procedures for the use of hazardous chemicals.
2) Procedures containing the word "must" or "will" reflect a regulatory requirement.
3) SOP's using the word "should" are not required by regulatory agencies. However, they represent prudent laboratory safety practices. If there were an accident, spill, etc. and it was caused by imprudent actions, there could be repercussions by the regulating authority.

3.2 Employee Exposure Protection:

1) Laboratory operations will be conducted in a manner that prevents employee exposure to WISHA regulated substances in excess of permissible exposure limits (PELs) specified in WAC Chapter 296-841-200 or https://lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-841.pdf.
2) WISHA regulated chemicals and their PELs is provided in Appendix 4 of the CHP hard copies or at: https://lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-841.pdf
3) Personal Protective Equipment (PPE) and instructions on proper use of this equipment will be provided to employees, as appropriate, to minimize exposure to hazardous chemicals.
4) Respiratory Equipment:
   a) Proper respiratory equipment will be provided to employees where the use of respirators is necessary to maintain exposure below permissible exposure limits.
   b) Required ***and*** voluntary use must be approved by the Chemical Hygiene Administrator.
   c) Except for the use of filtering face pieces, no respirator will be worn by an employee until all requirements specified in the OSHA Respiratory Protection Standard (29CFR 1910.134; **https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134** and WAC Chapter 296-842 (https://www.lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-842.pdf) are met.
   d) Respirators will be selected and used in accordance with Chapter 296-842 WAC (https://www.lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-842.pdf).

3.3 Laboratory Facilities:

The work conducted in a laboratory and its scale must be appropriate to the physical facilities available and to the quality of the ventilation system.

1) A laboratory facility should include:
   a) An adequate general ventilation system with air intakes and exhausts located so as to avoid intake of contaminated air;
   b) Well-ventilated stockrooms and storerooms;

c) Proper chemical storage for specific hazardous materials (e.g. flammables, corrosives, poisons, etc.);
d) Adequate laboratory hoods and sinks;
e) Emergency equipment including fire extinguishers, spill kits and alarms;
f) First aid equipment including first aid kits, eyewash stations and drench showers;
g) No direct drainage to sewers (storm drains, domestic sewage systems, etc.); and
h) Arrangements for proper waste disposal.

2) Laboratory Ventilation
   a) The general laboratory ventilation system should:
      i) Provide a source of air for breathing and for input to local ventilation devices;
      ii) Ensure that laboratory air is continually circulated and direct air flow into the laboratory from non-laboratory areas and out to the exterior of the building.
      iii) General laboratory ventilation should not be relied on for protection from exposure to hazardous chemicals released into the laboratory.
      iv) A rate of 4-12 room air changes per hour is normally adequate general ventilation if local exhaust systems such as hoods are used as primary method of control.
      v) General air flow should not be turbulent and should be relatively uniform throughout the laboratory.
   b) A laboratory hood with a minimum of 2.5 linear feet of hood space per person should be provided for every two workers if they spend most of their time working with chemicals. Airflow into and within the hood should not be excessively turbulent and hood face velocity should be adequate (typically 60-125 FPM).
   c) Hazardous chemicals stored in cabinets should be fitted with auxiliary ventilation systems. Stockrooms and storerooms should be well ventilated.
   d) The quality and quantity of ventilation should be evaluated on installation, regularly monitored (at least yearly) and reevaluated whenever a change in ventilation devices is made.

3.4 Employee Exposure Determination and Monitoring:

If there is reason to believe that exposure levels for a WISHA regulated substance routinely exceeds the action level (or in the absence of an action level, the PEL), the Chemical Hygiene Administrator will ensure that employee exposure to that substance is measured.

1) Initial Exposure Determination: Factors which might raise the possibility of overexposure and therefore warrant an initial measurement of employee exposure include:
   a) The manner in which the chemical procedures or operations involving the particular substance are conducted (e.g. use of an open vessel instead of a closed system).
   b) The existence of historical monitoring data which shows elevated exposures to the particular substance for similar operations.
   c) The use of a procedure which involves significant quantities or is performed over an extended period of time.
   d) Signs or symptoms of exposure (e.g. skin or eye irritation, shortness of breath, nausea, headache, etc.) which are experienced by the employee.
2) Exposure Monitoring: If the initial exposure determination described above discloses employee exposure over the action level for a particular substance (or in the absence of an action level, the PEL), the college will immediately comply with the exposure monitoring requirements of the WISHA standard for that substance (see Section 9: Exposure Monitoring and Medical Attention).
3) Monitoring airborne concentrations of individual hazardous chemicals should be conducted in the following circumstances
   a) In testing or redesigning the hoods or other local ventilation devices in the laboratory
   b) When a specific substance that is highly toxic is regularly and continuously used.
   c) When requested by a laboratory employee because of a documented health concern or suspicion that a PEL may be exceeded.
4) Record-keeping
   a) An accurate record of any measurements taken to monitor employee exposures must be kept, transferred, and made available to each employee in accordance with WISHA's Access to Employee Exposure and Medical Records requirements (https://www.lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-842.pdf).

b) The employee will be notified of any monitoring results within 15 working days after receipt of the results either individually or posting the results in an appropriate location that is accessible to employees.
c) Exposure testing procedures and results should be sent to the Chemical Hygiene Administrator to maintain these records.

3.5 Chemical Procurement:

1) Purchasing Approval: The Chemical Hygiene Officer or designee for each department shall approve the purchase of any new hazardous chemicals.
2) Receiving Shipments:
   a) Before a substance is received, information on proper handling, storage, and disposal should be available and known to employees involved in shipping, receiving and distribution of laboratory chemicals.
   b) Stockroom personnel should know about the hazards, handling equipment, protective apparel and relevant regulations of purchased hazardous chemicals.
   c) All substances shall be received by Central Services and sent to the CHO or laboratory technician who ordered it.
   d) No container should be accepted without an adequate identifying label and access to the SDS.

3.6 Hazard Identification:

Laboratory chemicals and facilities should be properly labeled to identify any hazards associated with them for employee information and protection.

1) Container Labels:
   a) Labels on incoming containers of hazardous chemicals must not be removed or defaced.
   b) When chemicals are being transferred from one container to another, employees should be sure that the new container is compatible with the chemical and is labeled with the English name of that chemical and the hazards. All secondary containers should be labeled in this manner unless they are intended for the immediate use of the person who dispensed the chemicals.
   c) Unlabeled bottles of chemicals should not be opened; such materials should be disposed of promptly as outlined in the Waste Disposal Procedures below.
2) Safety Data Sheets (SDS):
   a) SDS received with incoming shipments of hazardous chemicals must be maintained and made readily available to laboratory employees at their request.
   b) The CHO or laboratory technician should maintain a file of SDS for all chemicals in their laboratory inventory.
3) Laboratory Signage:
   a) Laboratory areas that have special or unusual hazards (e.g. biohazard, radiation, and designated areas) should be posted with warning signs.
   b) Signs should be posted to show the location of the safety showers, eyewash stations, exits, first aid kits, fire extinguishers, etc.
   c) Fire extinguishers should be labeled to show the types of fire for which they are intended.
   d) Waste containers should be labeled to show the type of waste that can be safely deposited.
   e) Consumption of food and beverages is not permitted in areas where laboratory operations are being carried out.
   f) Areas where food is permitted should be marked and a warning sign (e.g., EATING AREA – NO CHEMICALS) should be posted.
4) Areas and equipment should be properly labeled to identify any hazards associated with them for employee information and protection.

3.7 Material Handling:

The storage, distribution and methods of handling hazardous chemicals will be conducted in a manner that minimizes the potential for accidents and employee exposure.

1) Stockrooms / Storerooms:

a) Hazardous chemicals should be segregated in a well-identified area with local exhaust ventilation.
b) Stockrooms/storerooms should be under the control of one person who is responsible for the safety and inventory control.
c) Stored chemicals should be examined at least annually by the CHO or lab personnel for replacement, deterioration and container integrity.

2) Distribution
   a) When hazardous chemicals are hand-carried, they should be placed in a secondary container or acid-carrying bucket to protect against breakage and spillage.
   b) To avoid exposure to other persons, chemicals should be transported using the least-traveled routes, whenever possible.
   c) Compressed gas cylinders should never be rolled or dragged. Cylinders should be transported with a suitable hand cart and the cylinder strapped in place.
3) Laboratory Storage
   a) Quantities of chemicals stored in the laboratory should be kept at a minimum.
   b) Chemicals should be stored away from heat sources and direct sunlight.
   c) Periodic inventories should be conducted, with unnecessary items being returned to the storeroom/stockroom.
   d) Incompatible materials should be segregated for storage.
4) Use of a Hood
   a) A hood should be used for operations that might result in releases of toxic chemical vapors or dust.
   b) In general, the hood should be used when working with any appreciably volatile substance with a threshold limit value (TLV) of less than 50 ppm.
   c) Storage of chemicals in the hood should be kept at a minimum.
   d) The hood should be kept on if chemicals are temporarily stored there. It is not acceptable to use the fume hood for long-term storage of chemicals.
5) Working Alone:
   a) Experiments that are hazardous should not be conducted by a worker who is alone in a laboratory.
   b) Under normal working conditions, arrangements should be made between individuals working in separate laboratories or work areas to check in periodically.

3.8 Laboratory Operations / Activities Requiring Approval:

Employees should be informed of those lab procedures and operations that require prior approval from the CHO. This will ensure that these activities are carefully monitored for adherence to the CHP and regulatory requirements.

1) Laboratory Operations Requiring Prior Approval:
   a) Non-routine procedures for which the employee has not been trained;
   b) Analytical work with an unknown substance;
   c) Disposal of chemical wastes;
   d) Operations or activities for which there are currently no written procedures;
   e) Purchase of hazardous chemicals;
2) Unit-specific Prior Approval Activities: The Chemical Hygiene Officer for the college will determine if there are additional unit-specific laboratory activities which require prior approval. Employees should be informed of when prior approval is needed before initiating an activity.
3) Prior Approval for the Chemistry and Biology Units:
   a) Approval to proceed with a laboratory task should be obtained from the Chemical Hygiene Officer or Chemical Hygiene Administrator when:
      i) There is a new procedure, process or test, even if it is very similar to older practices;
      ii) There is a change or substitution of any of the ingredient chemicals in a procedure;
      iii) There is a substantial change in the amount of chemicals used (usually one should review safety practices if the volume of chemicals used increases by 20 or 25%);
      iv) There is a failure of any of the equipment used in the process, especially safeguards such as fume hoods or clamp apparatus;
      v) There are unexpected test results. When a test result is different than predicted, a review of how the new result impacts safety practices must be made; and

vi) Where members of the laboratory staff become ill, suspect exposure, smell chemicals, or otherwise suspect a failure of engineered safeguards.

b) Because prior consultation can ensure that appropriate measures are taken to establish safety protocols, minimize exposure, and establish proper waste disposal procedures, prior approval must be obtained from the Chemical Hygiene Officer before laboratory procedures can be undertaken involving the following:
   i) A newly introduced hazardous chemical substance of moderate chronic or high acute toxicity.
   ii) Working with substances of known chronic toxicity.

c) Certain laboratory operations that are of special concern because of the potential hazards associated with them. In these instances, laboratory personnel unfamiliar with these operations are instructed to obtain prior approval from the principle investigator, CHO, or supervisor before commencing the operation or experiment. This is to assure that personnel follow procedures, understand the hazards and use safeguards. Examples may include the following: vacuum pumps, vacuum operations, electrophoresis, NMR Spectrophotometer, cryogenic liquids, centrifuge operation, rotary evaporator operation, compressed gases, and gas chromatographs.

d) The toxicity of the chemicals used, the hazards of the procedures to be done, and the knowledge and experience of the laboratory workers must be considered in deciding which work will be allowed with pre-approval.

3.9 Emergency Prevention and Response:

Laboratory employees should be familiar with emergency response, first aid and accident reporting procedures in the campus safety plan in order to prevent and reduce the impact of laboratory accidents.

3.10 Waste Disposal:

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

1) Waste Handling:
   a) Unlabeled containers of chemicals and solutions should undergo prompt disposal, and, if partially used, they should not be opened.
   b) Chemical wastes should be removed from the laboratory to a central storage area at least once a week by the faculty member from whose class the waste was generated or by laboratory staff.
   c) Chemical wastes should be removed from the central storage area at regular intervals.
   d) Waste must be categorized as to its identity, constituents, and hazards so that it can be safely managed. For information on characterizing waste for disposal, refer to https://fortress.wa.gov/ecy/publications/publications/96436.pdf and Chapter 8.B.2 in Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards (2011)
2) Disposal / Recycling:
   a) Laboratory wastes should be recycled whenever possible.
   b) Before disposing of any laboratory waste materials, the disposal method will be determined by consulting the pertinent SDS and reference material.
   c) Chemicals that are deemed suitable for disposal into the city water system will first be carefully diluted and neutralized.
   d) Hoods should not be used as a waste disposal method for volatile chemicals.
   e) Chemicals requiring removal as hazardous waste from Centralia College will be disposed of according to regulations, using an approved state contractor for such disposal.
   f) All laboratory waste generated must be recorded on a waste accumulation log. Record must include the date of accumulation, waste type, amount, and hazards associated with the waste. If waste is neutralized, this activity must be recorded on an elementary neutralization log. The waste type, treatment used, pH before and after, and amount discharged to municipality must be included on the log.

3.11 College-Specific Standard Operating Procedures:

1) **Science Department:** Labeling and Storage of Chemicals for Chemistry and Biology Laboratories:
   a) Chemicals will be labeled and stored according to a system combining the color-code system of the J.T. Baker Mallinkrodt Co. and the numerical classification system of the Flinn Scientific Co.
      i) Chemicals will be sorted first by color code and within each color code, they will be sorted and stored by numerical classification;
      ii) Organics will be separated from inorganics;
      iii) The color code storage system is:
         (a) Red – Flammable
         (b) Red stripe – Flammable, *and* must be kept separated from all other solid color red-coded chemicals
         (c) Blue – Health hazard
         (d) Yellow – Reactive
         (e) Yellow stripe – Reactive, *and* must be kept separated from all other solid color yellow-coded chemicals
         (f) White – Corrosive
         (g) White stripe (white with black or silver) – Corrosive, *and* must be kept separated from all solid color white-coded chemicals.
         (h) Orange – General storage; no serious hazard identified
      iv) Within each color code, chemicals will be separated based on their chemical nature, primarily the anion (for inorganics) or functional group (for organics) in the order noted below:
         (1) Inorganic:
            (a) I1 – Metals and hydrides
            (b) I2 – Acetates, Halides, iodides, sulfates, sulfites, thiosulfates, phosphates, halogens
            (c) I3 – Amides, nitrates (except ammonium nitrate), nitrites, azides
            (d) I4 – Hydroxides, oxides, silicates, carbonates, carbon
            (e) I5 – Sulfides, selenides, phosphides, carbides, nitrides
            (f) I6 – Chlorates, bromates, iodates, chlorites, hypochlorites, perchlorates, perchloric acid, peroxides, hydrogen peroxide
            (g) I7 – Arsenates, cyanides, cyanates
            (h) I8 – Borates, chromates, manganates, permanganates
            (i) I9 – Acids (except nitric, which is isolated and stored by itself).
            (j) I10 – Sulfur, phosphorus, arsenic, phosphorus pentoxide
            (k) I11 – Inorganic miscellaneous
         (2) Organic
            (a) O1 – Acids, amino acids, anhydrides, peracids
            (b) O2 – Alcohols, glycols, sugars, amines, amides, imines, imides
            (c) O3 – Hydrocarbons, esters, aldehydes, oils
            (d) O4 – Ethers, ketones, ketenes, halogenated hydrocarbons, ethylene dioxide
            (e) O5 – Epoxy compounds, isocyanates
            (f) O6 – Peroxides, hydroperoxides, azides
            (g) O7 – Sulfides, polysulfides, sulfoxides, nitriles
            (h) O8 – Phenols, cresols
            (i) O9 – Dyes, stains, indicators
            (j) O10 – Organic miscellaneous
   b) Whenever possible, classes which follow in the above list will be stored on shelves below those that precede them on the list.
   c) Within each color/numerical code combination, chemicals will be stored alphabetically;
   d) Coded groups will be separated by distance or barrier so that none will come into contact with each other if one of the containers is broken;
   e) Incompatible categories will also be separated by barrier or distance.
   f) All hazardous chemicals will be stored in WSC 304 (Chemistry Storeroom), WSC 305 (Biology Storeroom), WSC 304B (Biohazard Room).
   g) Labels

i) Each chemical container will be identified with a numeric code on color-coded tape (i.e. an amino acid with no identified serious hazard would have an O1 on an orange label).
ii) Each container will be further identified as to the degree of hazard for health, flammability and reactivity.

h) Hazardous waste and chemicals requiring off-site disposal will be stored in WSC 104C until transferred to a qualified Hazardous Chemical Waste contractor or taken to the Lewis County Solid Waste HazoHut.
i) The Science Department Safety Library is in WSC 306.
j) Specific SOP's for the following may be found in Appendix 5:
i) Evacuation Plan for the WSC Third Floor Lab Areas
ii) Disposal of Chemical Waste from Science Classes
iii) Hot Plate Safety
iv) Formaldehyde Exposure Control Plan
v) Using Formaldehyde to Preserve Fish in the Centralia College Science Department
vi) Hazardous Waste Disposal in Instructional Areas
vii) Aerosol Can Disposal
viii) Compressed Gas Cylinder Use
ix) Full Spectrum Laser Engraver Safety
x) Laboratory Fume Hoods – Performance Criteria and Certification Procedure
xi) Microwave Safety
xii) Rotary Evaporator Safety

2) **Remote Location Science Activities**:

a) Science courses with laboratories taught at remote campus locations are subject to the Laboratory Standard.
b) General Policies for Science laboratories taught at Remote Locations:
i) Chemical Storage
(1) The Science Department does not permanently store chemicals at remote locations.
(2) Chemicals are stored temporarily at remote locations in a controlled, locked area. The chemicals are returned to main campus at the conclusion of each quarter.
(3) All chemicals are transported to and from main campus for each laboratory course.
(4) Chemicals must be transported in secondary containers.
(5) Special attention will be given to separation of incompatible compounds (such as acids and bases).
(6) Labeling – requirements are the same as those for the main campus; refer to section 3.11.1g.
ii) Waste
(1) There is no permanent storage or disposal of hazardous waste at the remote locations;
(2) All materials are returned to the main campus after each quarter and the policies in Section 3.11.1 apply.
iii) Ventilation – instructor must ensure that the ventilation is adequate for the chemicals and laboratory exercises utilized.
iv) Safety glasses or splash goggles are worn in all laboratories.
v) An eye wash and safety shower shall be available.
vi) Instructor will ensure that a first aid kit is available.
vii) Instructor will ensure a container for broken glass is available.
c) On the main campus, when potentially hazardous substances are being used, the Science Department will work with other areas to locate their laboratory classes in a safe location.

3) **Facilities, Operations and Maintenance:**

The job responsibilities in Facilities, Operations and Maintenance (FOM) involve general maintenance and operational service to the campus community. Most employees in this department will be associated with work within the laboratories and activities involving handling, use or mixing of hazardous chemicals both within the physical plant and when involved in work in various other departments. The use and/or mixing of chemicals by employees of Facilities and Operations is also covered by other general safety rules and regulatory agencies.

In addition to following the Centralia College Chemical Hygiene Plan, FOM abides by all OSHA, WISHA and Department of Agriculture regulations involving work with chemicals.

a) General Policies:
   i) New employees will receive hazardous materials training.
   ii) Employees will read, know and practice the "Employee Right To Know" code.
   iii) Employees are not to open any chemical container without first reading the label.
   iv) If in doubt about any task involving the mixing of chemicals, the employee is expected to contact the supervisor.
   v) Each employee is reminded of the importance of always keeping her/his mind on the task when working with chemicals in order to avoid accidents and injury.
   vi) In case of a spill, the supervisor and Campus Safety and Security Manager ext. 8888 will be notified.
   vii) Custodial workers are not to move chemical containers.
   viii) If a spill is identified, employees are to consult their supervisor who will authorize further action. Emphasis will be on identifying the problem, reporting it and taking minimal steps to prevent further contamination.
   ix) In transferring material from large, marked containers, employees are to transfer only enough to be used during their work shift.

b) Guidelines for work in the Science Lab areas:
   i) 'Science Lab Areas' consist of the laboratories, preparation areas and storerooms where chemical or biological hazards may exist or where sensitive equipment is located. These include WSC rooms 301, 301a, 302, 302a, 303, 304, 304a & b, 305, 305a, 307, 308, 314 and 314a.
   ii) FOM personnel (or other college personnel) may not enter the Chemical Storeroom (WSC 304) without permission from the CHO or a full-time Chemistry faculty member.
   iii) FOM personnel will receive training from the science department on their special handling needs.
   iv) All stock bottles of chemicals on counters and lab benches will be put away at the end of the day by the faculty responsible for their use. If a lab exercise must be left set up overnight, chemicals must be in small containers, fully labeled and in secondary containment. Custodial staff should not proceed into a lab if there are chemicals visible that do not meet the above description. Instead, custodial staff will locate a Chemistry faculty member or the Chemical Hygiene Officer (CHO) to assess the hazard. If the CHO or a Chemistry faculty member is not available, the lab will not be cleaned that day.
   v) Custodial staff will be responsible for regular sweeping of floors and trash pick-up. The exact schedule will be agreed upon quarterly by the CHO, Chemistry faculty members and FOM personnel; and will be dependent upon the classes offered and related lab use.
   vi) For project cleaning and tasks other than the agreed upon daily and/or weekly custodial activities, FOM personnel should notify the CHO or appropriate Science faculty member prior to performing operations in the Science Lab areas. The CHO or appropriate faculty will:
      (a) Assess laboratory condition before allowing work to be done.
      (b) If hazards are present or in question for any area, a time will be scheduled for the job to be completed when there is a knowledgeable person available.
   vii) Except in the case of emergency, FOM personnel should not perform duties in Science Lab areas after 5 PM, or alone, unless prior arrangements have been made with the CHO or Science faculty member.

c) Eyewear
   i) **Eye Protection is required in the Science lab areas. Splash Googles or Safety Glasses must be worn depending on the hazards encountered.** Custodians will be issued both types of protection for this purpose. They will be responsible for having them available when entering the building. The type of eye protection worn will be dependent on the hazards you encounter. Contact your supervisor if you question which type to use.
   ii) Carpenters, maintenance personnel, plumbers, mechanics, and electricians should wear chemically resistant splash googles when entering Science Lab Areas. These should be standard equipment for FOM personnel.
   iii) Additionally, the following eyewear should be used for specific tasks:

(a) Indirect vent, chemical resistant goggles if anyone in the area is handling corrosive chemicals or chemicals that have the potential to splash.
(b) Chemical and impact resistant face shields + indirect vent, chemical resistant goggles if anyone in the area is using liquid corrosive substances in amounts of 50 milliliters (or 1.5 ounces) or more, or substances that can implode or explode.
(c) Face shields when performing tasks where projectiles may result.

d) Gloves
   i) **Vinyl disposable gloves should be worn to empty trash containers in Science Lab Areas.** Vinyl gloves for this purpose are located in the laboratory in both WSC 302 & 308 (Chemistry labs) and in WSC 301 and 303 (biology labs).
   ii) Hands should always be washed when gloves are removed.
e) Waste Disposal
   i) **Microbiological waste**
      (a) Is autoclaved to sterilize it before disposal.
      (b) Waste that, once sterilized, is to be disposed in the trash is placed in labeled Biohazard bags before autoclaving.
      (c) Labeled biohazard bags (with biohazard symbol):
         (i) Are not to be disturbed until autoclaving is complete.
         (ii) Are twist-tied shut and placed in the autoclave. White indicator tape is attached to the bag. Once autoclaving is complete, this tape has either black diagonal stripes or the word 'Autoclaved' to indicate successful sterilization.
         (iii) NEVER dispose of biohazard bags that does not have taped attached with *black-striped* tape (or black words on white tape) indicating that the contents have been sterilized.
         (iv) Once autoclaved, the biohazard bags will be placed in the regular trash.
   ii) **Broken glass** is placed in designated boxes. When full, the laboratory technician will seal and label the box(es) for disposal. They may then be placed in the dumpster.
   iii) **Containers** are triple-rinsed and the labels defaced. If possible, the items will be rendered unusable by puncturing, crushing, etc.
   iv) **Chemicals** deemed safe for landfill disposal will be tightly sealed, labeled and packed in a box before being placed in the trash.
   v) **Biological waste**:
      (a) Any preserved specimens for disposal will be bagged and sealed before placing in the trash.
      (b) Any preserved specimens used for dissection initially preserved in formaldehyde will be moved to storage in safer solutions which do not require special disposal
      (c) Specimens stored in alcohol: waste fluid must be disposed in accordance with the Department of Ecology Dangerous Waste Regulations (see Ecology Fact Sheet #96-436 https://fortress.wa.gov/ecy/publications/documents/96436.pdf).
f) **Central Receiving:** Employees responsible for receiving and/or handling shipments of chemicals, as well as other employees whose assignments may require that they enter a laboratory where exposure to hazardous chemicals might occur, should be informed of the potential hazards and appropriate protective measures.

Section 4: GENERAL LABORATORY SAFETY RULES

4.1 Goal

Through training and careful attention to safe operating practices, the goal of this section is to protect the health and safety of laboratory employees who work with hazardous chemicals. For more detailed information on the rules and recommendations below, please refer to Prudent Practices in the Laboratory: Handling and Disposal of Chemicals, National Research Council, National Academy Press, 2011.

4.2 General Rules

1) Know the safety rules and procedures that apply to your work.
2) Before you begin any new operation, determine the potential hazards and appropriate safety precautions.

3) Be familiar with safety procedures.
4) Know the location of and how to use the emergency equipment in your area, as well as how to obtain additional help in an emergency.
5) Know the types of protective equipment that are available and use the proper equipment for each job.
6) Watch out for unsafe conditions and call attention to them so that corrections can be made as soon as possible. Someone else's accident can be a danger to you as well.
7) Do not consume food or beverages in labs or areas where chemicals are being used or stored.
8) Practical jokes or other behavior that might distract, startle, or confuse another worker can be dangerous and must be avoided.
9) Use equipment only for its designed purpose.
10) If you leave an operation unattended for any period of time, leave the lights on, post a sign and take the necessary precautions for an event or a failure due to unknown causes.
11) Notify your supervisor immediately if you have been exposed to a hazardous chemical.

4.3 Rules for Chemical Handling

1) Do not smell or taste chemicals.
2) Always add acid to water, never water to acid.
3) Know the hazards posed by the different classes of chemicals including oxidizers, flammables, corrosives, compressed gases, acutely hazardous and chronically hazardous chemicals.
4) Know the location of the Safety Data Sheet library.
5) Read and understand the Safety Data Sheet (SDS) before using any new chemical.
6) Be aware of the proper waste disposal methods for the chemicals you are handling. Improper disposal may lead to injury to human health, the environment and/or facility equipment, as well as fines.
7) Be sure that equipment is carefully secured before its use.
8) Combine reagents in the proper order.
9) Avoid adding solids to hot liquids.
10) Do not work alone in the laboratory without notifying your supervisor and making arrangements to have someone check on you periodically.
11) When transporting, storing, using or disposing of any substance, be sure that the substance cannot accidentally come into contact with an incompatible substance. This contact could result in explosion or the production of highly toxic or flammable substances
12) When chemicals are being transferred from one container to another, be sure that the new container is compatible with the chemical and is labeled with the identity of the chemical.

4.4 Rules for Health and Hygiene

1) Wear appropriate eye protection at all times in areas where chemicals or glassware are used or stored.
2) Use protective apparel including face shields, gloves and other special clothing as needed. Inspect gloves before each use, wash them before removal and replace them periodically. Avoid contact between gloves and your eyes or mucous membranes during use.
3) Long hair and loose clothing should be confined to avoid accidents.
4) Sandals, cloth sneakers, and perforated shoes should not be worn.
5) Do not use your mouth to suction-pipet chemicals or to start a siphon: a pipet bulb or aspirator should be used to provide a vacuum.
6) Avoid exposure to gases, vapors and aerosols. Use appropriate safety equipment when this type of exposure is likely.
7) Wash well before leaving the laboratory.

4.5 Rules for Food Handling

1) No food or beverages should be stored, handled or consumed in the laboratory or other areas where chemicals are used or stored.
2) Do not bring chemicals or chemical equipment into areas that are designated for food consumption.

3) Glassware or utensils that have been used for laboratory operations should never be used to prepare or consume food.
4) Laboratory refrigerators, ice chests, microwave ovens, cold rooms, etc. must not be used for food or food storage.

4.6 Rules for Housekeeping

1) Work areas should be kept clean and free from obstructions.
2) Clean-up should follow the completion of each operation or at the end of each day.
3) Wastes should be deposited in the appropriate receptacles.
4) Equipment and chemicals should be stored properly and clutter should be minimized.
5) Laboratory accidents and spills should be attended to immediately and the appropriate emergency procedures followed.
6) Chemical and waste containers should be kept labeled at all times.
7) Inform your supervisor immediately of any unlabeled containers.
8) Do not open unlabeled containers.
9) Access to exits, emergency equipment, controls, etc. should not be blocked.
10) Notify your supervisor immediately if equipment is malfunctioning. Discontinue use of the equipment if a safety hazard exists.
11) Chemical storage under the hoods should be kept to a minimum. Leave the hood on when it is not in use if chemicals are stored there.

4.7 Rules for Glassware

1) Accidents involving glassware are the leading cause of laboratory injuries. Careful storage and handling procedures should be used to avoid glassware breakage.
2) Adequate hand protection should be used when inserting glass tubing into rubber stoppers or corks, or when placing rubber tubing on glass hose connections.
3) Tubing should be fire polished or rounded and lubricated and hands should be held close together to limit movement of glass should fracture occur.
4) Vacuum-jacketed glass apparatus should be handled with extreme care to prevent implosions. Only glassware designed for vacuum work should be used for that purpose.
5) Hand protection should be worn when picking up broken glass. Small pieces should be swept up with a brush and a dustpan.
6) Dispose of broken glass in appropriate glass disposal boxes, not in the general garbage bins.

4.8 Rules for Flammability Hazards

1) Do not use an open flame to heat a flammable liquid or to carry out a distillation under pressure.
2) Use an open flame only when it is necessary and extinguish it as soon as it is no longer needed.
3) Before lighting a flame, remove all flammable substances from the immediate area and notify others in the area. Check all flammable containers in the area to ensure that they are tightly closed.
4) Store flammable materials in a flammable cabinet or other appropriate location.
5) Make sure that all flammable cabinets and containers are properly grounded to prevent accidental ignition of flammable vapors and liquids.

4.9 Rules for Hazardous Waste Handling

1) Hazardous wastes should be properly labeled and stored in a separate hazardous waste area.
2) See your supervisor for the proper hazardous waste disposal procedures.

ANY QUESTIONS OR CONCERNS ABOUT LABORATORY SAFETY SHOULD BE BROUGHT UP WITH YOUR SUPERVISOR.

Section 5: SPECIFIC EXPOSURE CONTROL METHODS

5.1 Goal

To address the criteria that would invoke the use of specific exposure control measures, above and beyond the Standard Operating Procedures and General Laboratory Safety Rules which will reduce employee exposure to hazardous chemicals.

5.2 Criteria

Criteria for determining when and what types of specific exposure control measures should be implemented may be based on:

1) The degree of toxicity of a substance to be used,
2) The exposure potential of the procedures to be performed, or
3) The capacity of the engineering controls, administrative practices or personal protective equipment to control employee exposures effectively.

5.3 Degree of Toxicity of Substances

Additional laboratory procedures must be developed by each laboratory or college unit and included in the CHP to protect employees who are working with particularly hazardous chemicals. These include select carcinogens, reproductive toxins and substances with a high degree of acute toxicity.

1) Exposure Potential - The routes of exposure to chemicals may occur by inhalation, ingestion, absorption, or injection.
   a) **Inhalation** of chemical vapors, mists, gases or dusts can produce poisoning through the mucous membranes of the mouth, throat and lungs and can seriously damage these tissues. The degree of injury resulting from exposure to toxic vapors, mists, gases or dusts depends on the toxicity of the material and its solubility in tissue fluids, its concentration and the duration of exposure.
   b) **Ingestion** of many chemicals can be extremely dangerous. The relative acute toxicity of a chemical can be evaluated by determining its LD_{50}, which is defined as the quantity of chemical that will cause death of 50% of the test animals when ingested in a single dose. In addition, many chemicals will directly damage the tissue of the mouth, throat, nose, lungs and gastrointestinal tract.
   c) **Absorption (contact with skin and eyes)** can lead to significant chemical injury. A common result of skin contact is local irritation, but many chemicals can be absorbed through the skin and cause systemic poisoning. The eyes are very sensitive organs and most chemicals are damaging to them. Alkaline materials, phenols and strong acids can cause permanent loss of vision.
   d) **Injection** of chemicals is not a common route of exposure but may occur through mechanical injury from glass or other materials contaminated with chemicals, or with chemicals that are handled in syringes.
2) Other factors to consider in evaluating the degree of exposure potential from the use of a particular chemical or an activity involving the chemical include the chemical:
   a) volatility, flammability and reactivity;
   b) potential for unplanned chemical reactions;
   c) high heat of reaction;
   d) amount of time that a worker will be exposed;
   e) sensitivity of the laboratory worker (e.g. asthma, allergies, pregnancy);
   f) potential for generating aerosols; and
   g) potential for an uncontrollable release.

5.4 Employee Exposure Control Measures

The WISHA Laboratory Standard requires that each employer evaluate the need for specific exposure control measures when employees are working with select carcinogens, reproductive toxins or substances with a high degree of acute toxicity.

1) Designated Areas:
   a) WISHA recommends that the use of select carcinogens, reproductive toxins or substances of high acute toxicity be restricted to “designated areas”, especially when other less toxic chemicals are being used in the same area.

a) A designated area may be an entire laboratory, an area within a lab, or a device such as a fume hood. The goal is to limit exposures and alert all employees in the vicinity to the potential hazard.

2) Containment Devices: Circumstances involving select carcinogens, reproductive toxins or substances of high acute toxicity that may warrant the use of containment devices (such as a fume hood) include:
   a) The use of a volatile substance
   b) Manipulations that may generate an aerosol
   c) Any handling or reaction that may result in an uncontrollable release.
3) Critical fume hoods should have monitoring devices to allow convenient confirmation of adequate hood performance prior to use. If this is not possible, work with substances of high or unknown toxicity should be avoided unless other types of ventilation devices are provided.
4) Decontamination Procedures:
   a) It may be appropriate to establish procedures to adequately address the decontamination required for certain designated areas in the laboratory.
   b) Vacuum pumps and other contaminated equipment including glassware should be decontaminated in the hood before removing them from the designated area.
   c) The controlled area should be decontaminated periodically and always before normal work is resumed there.
5) Safe Removal of Contaminated Waste:
   a) Safe disposal of contaminated waste should be part of the planning process for any laboratory experiment or procedure.
   b) If practical, very hazardous substances should be converted to less hazardous substances in the laboratory rather than being directly placed in containers for disposal. Those picking up contaminated waste should be aware of the hazards and should know what to do in the event of a spill during transport.
   c) To ensure the safe removal of wastes from the laboratory, the Chemical Hygiene Officer should be contacted for the proper disposal methods.
   d) Solid chemical wastes should be placed in suitable containers.
   e) Ensure that all waste containers are properly labeled to identify the associated contents and hazards.
   f) Laboratory employees involved in disposing of the wastes should be aware of the hazards of the wastes, the importance of segregating incompatible materials and the applicable regulatory requirements.

5.5 Procedures for Handling Reproductive Toxins

Definition: Reproductive toxins are chemicals which affect the reproductive capabilities including:
   a) chromosomal damage (mutagens),
   a) effects on fetuses (teratogens),
   b) certain reproductive toxins may cause infertility in females or males.

Examples: Lead compounds, organomercurials, formamide, ethidium bromide

1) Women of child-bearing age should only handle these substances in a hood whose satisfactory performance has been confirmed.
2) Avoid skin contact by using gloves and wearing long sleeves and other protective apparel as appropriate.
3) Always wash hands and arms immediately after working with these materials.
4) Keep records of the amounts of these materials on hand and storage location.
5) Employees should be familiar with the emergency procedures for accidents or spills involving these substances.
6) The Chemical Hygiene Officer should be notified of all incidents of exposure or spills.
7) Unbreakable containers of these substances should be stored in a well-ventilated area and should be labeled properly.

5.6 Procedures for Handling Chemicals with High Acute Toxicity

Definition: Substances with a high degree of acute toxicity are those which may be fatal or cause damage to target organs as a result of a single exposure.

Examples: hydrogen cyanide, hydrogen sulfide, nitrogen dioxide and hydrofluoric acid

1) Use and store these substances in areas of restricted access with special warning signs.
2) Always use a hood or other containment device for procedures which may result in the generation of aerosols or vapors containing the substance. The released vapors should be trapped to prevent their discharge with the hood exhaust.
3) Avoid skin contact by using gloves and wearing long sleeves and other protective apparel as appropriate.
4) Always wash hands and arms immediately after working with these materials.
~~5)~~ Keep records of the amounts of these materials on hand and storage location
6) Employees should be familiar with the emergency procedures for accidents or spills involving these substances.
7) The Chemical Hygiene Officer should be notified of all incidents of exposure or spills.
8) Have at least two people present at all times when a highly toxic compound or compound of unknown toxicity is being used.
9) Breakable containers of these substances should be stored in resistant trays and work and storage surfaces should be covered with removable, absorbent plastic-backed paper.
10) Contaminated clothing should be chemically decontaminated, if possible, or destroyed. Contaminated waste should be stored in suitably labeled impervious containers. Liquids can be stored in glass or plastic bottles containing vermiculite.

5.7 Procedures for Handling Select Carcinogens

Definition: Select carcinogens are substances meeting one or more of the following criteria:

a) Regulated by WISHA as a carcinogen; or
b) Listed under the category "known to be carcinogens' in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or
c) Listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) latest edition; or
d) 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:
    i) 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/cubic meter;
    ii) After repeated skin application of less than 300 mg/kg body weight per week; or
    iii) After oral doses of less than 50 mg/kg of body weight per day.

2) **Examples**: Benzene, nickel, vinyl chloride, formaldehyde

3) All storage, handling and work with these substances should be conducted in a “designated area” such as a restricted access hood, glove box, or portion of the lab designated for use of chronically toxic substances.
    a) People with access to this area should be aware of the substances used and the necessary precautions to take.
    b) The designated area should be clearly marked with warning and restricted access signs.
4) The use and disposal of these substances should be approved by the CHO prior to this activity.
5) Always use a hood or other containment device for procedures that may result in the generation of aerosols or vapors containing the substance. The released vapors should be trapped to prevent discharge with the hood exhaust.
6) Vacuum pumps should be protected against contamination by scrubbers or other devices and vented into the hood. Vacuum pumps and other contaminated equipment should be decontaminated in the hood prior to removing them from the designated area. The designated area should also be decontaminated before resuming work in the area.
7) Avoid skin contact by using gloves and wearing long sleeves and other protective apparel as appropriate.

8) Remove any protective clothing before leaving a designated area and place it in an appropriate labeled container.
9) Always wash hands, arms, face and neck immediately after working with these materials.
10) Keep records of the amounts of these materials on hand and storage location.
11) Employees should be familiar with the emergency procedures for accidents or spills involving these substances. If a major spill occurs outside of the hood, emergency responders should wear appropriate personal protective equipment and all other workers should evacuate the area.
12) At least two people should be present at all times when a highly toxic compound or compound of unknown toxicity is being used.
13) These substances should be stored in unbreakable containers in a ventilated area with limited access. Work and storage surfaces should be covered with removable absorbent plastic-backed paper. All containers should be labeled with the identity and hazards of the substance.
14) Contaminated clothing should be chemically decontaminated, if possible. If not, it should be disposed of in a manner appropriate for the specific chemical involved. Contaminated waste should be stored in suitably labeled impervious containers. Liquids can be stored in glass or plastic bottles containing vermiculite. Containers of contaminated wastes should be transferred from the designated area in a secondary container.
15) Determine the appropriateness of medical surveillance for employees if they are working with toxicologically significant quantities of these substances on a regular basis.

Section 6: EMPLOYEE INFORMATION AND TRAINING

6.1 Goal

To provide information and training about the hazards of chemicals present in the laboratory work area in a manner and at a frequency which will educate employees on how to protect themselves and others from potential harm in the laboratory.

6.2 Requirements

1) Laboratory employees must be provided with specific information on the chemicals used in their work areas. WISHA's information requirements are summarized in this section under the heading "Information Program". Appendix 2 contains a list of general references which employees may want to review.
2) Employees must be trained on the potential chemical hazards in their work areas and on appropriate sections of the Chemical Hygiene Plan as indicated below.
3) The WISHA Laboratory Standard requires that employees receive information and training at the time of their initial assignment to a work area where hazardous materials are present and prior to assignments involving new exposure situations. Refresher training and information must be provided at least annually.
4) Training should be provided to all employees who actually work in the laboratory as well as to other employees whose assignments may require that they enter a laboratory where exposures might occur, such as maintenance and custodial personnel. Employees who are responsible for receiving and handling shipments of new chemicals or chemical wastes should also be informed of the potential hazards and appropriate protective measures for chemicals they may receive.
5) Training of laboratory personnel should be documented and kept in the employees file. An example of the Laboratory Employee Training Record is provided in this section (pg. 25).

6.3 Information Program

The Chemical Hygiene Administrator will ensure laboratory and other appropriate employees (e.g. receiving and shipping personnel, custodial, maintenance, stockroom personnel, emergency teams) are provided with information and training on the hazards of chemicals present in their work area and what to do if an accident occurs. Laboratory employees will be informed of at least the following information:

1) The contents of the WISHA Standard and its Appendices (see https://app.leg.wa.gov/RCW/default.aspx?cite=49.17
2) The location and availability of the Chemical Hygiene Plan;

3) The permissible exposure limits (PELs) for WISHA regulated substances or recommended exposure limits for other hazardous chemicals (see https://lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-841.pdf);
4) Signs and symptoms of exposure to hazardous chemicals used in the laboratory (see Appendix 1 at the end of this document for references); and
5) The location and availability of known reference materials on the hazards, safe handling, storage and disposal of hazardous chemicals found in the lab including but not limited to Safety Data Sheets received from the chemical supplier. (Appendices 2-4 contain references which employees can review.)

6.4 Employee Training Program

1) Laboratory employees will be trained on the applicable details of the Chemical Hygiene Plan (CHP) including a review of the:
   a) General Rules for Laboratory Safety;
   b) Appropriate sections of the Standard Operating Procedures (SOP's) such as:
      i) Laboratory Operations / Activities Requiring Approval;
      ii) Material Handling (includes dispensing and labeling of chemicals);
      iii) Waste Disposal Methods;
      iv) Chemical Hygiene Personnel;
   c) Emergency procedures as outlined in the Campus Safety Plan, including spills, fires, explosions, evacuation, and decontamination; and
   d) Specific exposure control measures and SOP's to be used in handling particularly hazardous chemicals in their work areas.
2) WISHA requires that the training also address:
   a) Methods and observations that can be used to detect the presence or release of a hazardous chemical (including any monitoring being conducted and the visual appearance or odor of a chemical when released);
   b) The physical and health hazards of chemicals in the work area; and
   c) Measures employees can take to protect themselves from these hazards, including the location and proper use of protective apparel and equipment and the location of emergency equipment and exits.
3) The form for recording laboratory employee training is found on page 25.

Laboratory Employee Training Record	**Employee Name:** **Date:**

Training Requirement: OSHA Laboratory Standard 29 CFR 1910.1450
Washington Industrial Safety and Health Act (WISHA) 49.17 RCW
Prudent Practices in the Laboratory
Centralia College Chemical Hygiene Plan

The following information was covered in the training session:

- ☐ **General Laboratory Safety Rules**
- ☐ **Procedures for Handling and Labeling Chemicals**
- ☐ **Location of Chemical Hygiene Plan and Identity of Chemical Hygiene Personnel**
- ☐ **Emergency Procedures**
- ☐ **Location of Safety Data Sheets (SDS)**
- ☐ **Methods and Observations to Detect the Presence or Release of a Hazardous Chemical including spill kit locations**
- ☐ **Physical and Health Hazards of Chemicals in the Work Place**
- ☐ **GHS Labeling and Pictograms**
- ☐ **Proper Waste Disposal Methods and Reduction Measures**
- ☐ **Accident Reporting**
- ☐ **Other** _____

Employee's Signature _____**Date**_____

Trainer's Signature_____**Date**_____

Section 7: INSPECTIONS

7.1 Goal

To develop a well-organized laboratory inspection program which allows for identifying and correcting the cause of chemical exposures before they occur and:

1) Generates and helps maintain a high level of prevention consciousness;
2) Assists in the education of employees and supervisors as to the merits and methods of detecting and eliminating accident causes;
3) Demonstrates management's sincere interest in its employees' health, safety and welfare;
4) Fosters a better understanding of the responsibilities that each employee must assume in the prevention of accidents; and
5) Helps determine where additional training or instruction may be required.

7.2 Inspection Information:

1) Informal inspections of housekeeping and personal chemical hygiene should be conducted periodically.
2) General safety inspections of the laboratory and annual review of the CHP will contribute to overall laboratory and employee safety. The Chemical Hygiene Officer or designee will ensure that Laboratory safety equipment will be inspected regularly to ensure fitness for use and modified if inadequate, including:
   a) Fume hoods and other protective equipment for environmental controls:
      i) WISHA requires this equipment to be functioning properly to ensure employee protection from chemical exposure.
      ii) Fume hoods in the Centralia College Science Department will be certified annually. They are also included in the monthly inspections, where attention should be given to the following:
         (1) Hoods should not be regarded as a means of disposing of chemicals, but rather as a backup safety device in case dusts or vapors escape from the apparatus being used;
         (2) Hoods should be tested before use to ensure adequate face velocities (typically 60 to 125 fpm) and the absence of turbulent flow, perhaps with the use of a continuous monitoring device;
         (3) Hoods should be kept closed except during manipulations of apparatus in the hoods;
         (4) The placement of equipment and other items in the hood, an open window or door in the lab, or a person walking by the hood can all affect a hood's performance; and
         (5) Chemicals stored in hoods should be kept to a minimum and they should not block air vents or disrupt airflow. If hazardous chemicals must be stored in a hood temporarily, the hood should be kept on.
   b) Emergency equipment (fire extinguishers and spill kits)
   c) First aid kits
   d) Safety showers
   e) Eye wash stations
   f) Personal protective equipment such as gloves, respirators, etc. will be inspected by the wearer before each use.

Section 8: PLAN REVIEW

8.1 Goal

To develop a Chemical Hygiene Plan review process to evaluate the effectiveness of the overall plan and identify the need for updates, ensuring that employees are adequately protected against harmful exposure to hazardous chemicals.

8.2 Review of the Chemical Hygiene Plan

1) The effectiveness of the Chemical Hygiene Plan must be reviewed and evaluated at least annually and updated as necessary. Factors to consider in the review include:
   a) Changes in laboratory procedures, operations or equipment which may affect the potential for employee exposure to hazardous chemicals;

b) The addition or deletion of the use of specific hazardous chemicals which warrant a review of laboratory safety procedures;
c) Changes in laboratory personnel and/or their responsibilities; and
d) The review and evaluation of inspection records, accident investigations, professional research on chemical hygiene techniques, etc.
e) Changes in regulations and how these affect compliance.

2) The Centralia College CHP will be reviewed by the Chemical Hygiene Administrator, Chemical Hygiene Officer(s) and the Campus Facilities and Safety Committee.
3) The results of this review should be recorded, including notes on needed changes, when those changes were made, etc.
4) The CHP will be updated in a timely manner.

Section 9: EXPOSURE MONITORING AND MEDICAL ATTENTION

9.1 Goal

To provide laboratory workers with an appropriate level of exposure monitoring and medical attention to protect them from adverse health effects resulting from potential exposure to hazardous chemicals.

9.2 Monitoring

1) The Laboratory Standard requirements for exposure monitoring are summarized on the following pages. The Chemical Hygiene Administrator will ensure that records of exposure monitoring, including the test method and results, are maintained in the employee's file.
2) If there is a reason to believe that exposure levels for a WISHA regulated substance routinely exceed the action level (or in the absence of an action level, the PEL), employee exposure to that substance will be measured.
3) Initial Exposure Determination: Factors which might raise the possibility of overexposure and therefore warrant an initial measurement of employee exposure include:
   a) The manner in which the chemical procedures or operations involving the particular substance are conducted (e.g., use of an open vessel instead of a closed system);
   b) The existence of historical monitoring data which shows elevated exposures to the particular substance for similar operations;
   c) The use of a procedure which involves significant quantities or is performed over an extended period of time; or
   d) Signs or symptoms of exposure (e.g.; skin or eye irritation, shortness of breath, nausea, headache, etc.) which are experienced by the employee.
4) Exposure Monitoring:
   a) If the initial exposure determination described above discloses employee exposure over the action level for a particular substance (or in the absence of an action level, the PEL), the college will immediately comply with the exposure monitoring requirements of the WISHA standard for that substance.
   b) Monitoring airborne concentrations of individual hazardous chemicals should be conducted in the following circumstances:
      i) In testing or redesigning the hoods and other local ventilation devices in the laboratory, and
      ii) When a specific substance that is highly toxic is regularly and continuously used (e.g.; three times a week).
5) Record-keeping
   a) Exposure testing procedures and results should be sent to the individual designated by the Chemical Hygiene Officer who coordinates and maintains these records.
   b) The employee will be notified of any monitoring results within 15 working days after receipt of the results either individually or by posting the results in an appropriate location that is accessible to employees.
   c) An accurate record of any measurements taken to monitor employee exposures must be kept, transferred, and made available for each employee in accordance with WISHA's Safety Standards for Employee Medical and Exposure Records requirements (Chapter 296-802 WAC).

9.3 Medical Consultations and Exams

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

1) Medical attention will be provided to an employee under the following circumstances:
   a) Whenever an employee develops signs or symptoms of exposure to a hazardous chemical to which they have been exposed in the laboratory, the employee will be provided with an opportunity to receive an appropriate medical examination;
   b) When exposure monitoring reveals an exposure level routinely above the action level (or PEL) for a WISHA regulated substance, medical surveillance will be conducted as required by the particular WISHA standard; and
   c) Whenever an event takes place in the laboratory such as a spill, leak, or explosion which results in the likelihood of a hazardous exposure, the affected employee will be provided with the opportunity for medical consultation to determine the need for a medical exam.
2) Type of Medical Attention:
   a) All medical examinations will be performed under the direct supervision of a licensed physician and will be provided without cost to the employee, without loss of pay, and at a reasonable time and place.
   b) All questions regarding medical consultations and examinations should be directed to the Chemical Hygiene Administrator.
3) Information for the Physician: The following will be provided to a physician conducting medical consultations and exams:
   a) The identity of hazardous chemicals to which the employee may have been exposed;
   b) A description of the conditions under which the exposure occurred, including quantitative exposure data if available;
   c) A description of the signs and symptoms of exposure that the employee is experiencing, if any.
4) Physician's Report: A written opinion from the examining physician for any consultations or exams performed under this Operating Procedure must include:
   a) Any recommendation for further medical follow-up;
   b) The results of the medical examination and any associated tests;
   c) Any medical condition revealed during the course of the exam which might compromise employee safety during, or as a result of, exposure to hazardous chemicals found in the workplace; and
   d) A statement that the employee has been informed by the physician of the results of the consultation or medical exam and any medical condition that may require further examination or treatment.
   e) The written opinion should not reveal specific diagnoses unrelated to occupational exposure, except as noted above.
5) Record-keeping
   a) The Chemical Hygiene Administrator must ensure that an accurate record for each laboratory employee undergoing medical consultations or medical examinations (as required by the Laboratory Standard) is maintained. (Medical examinations are to be provided at no cost to the employee.)
   b) Records for each employee must be transferred and made available as specified under WISHA's Access to Employee Exposure and Medical Records requirements (Chapter 296-802-400 WAC).
   c) Information that should be kept in an employee's file includes, where appropriate, the:
      i. Exposure monitoring test methods and results;
      ii. Safety Data Sheets of the hazardous chemicals involved;
      iii. Accident Report; and
      iv. Information submitted to, and received from, the physician.

Appendix 1

References for Signs and Symptoms Of Hazardous Chemical Exposure

1. American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes, P.O. Box 1937, Cincinnati, OH 45201 (latest edition).

2. Annual Report on Carcinogens, National Toxicology Program, US Department of Health and Human Services, Public Health Service, US Government Printing Office, Washington D.C., (latest edition).

3. Best Company, Best's Safety Directory, Volumes I and II, Oldwick, NJ, 1989.

4. Bretherick, L., Hazards in the Chemical Laboratory, Royal Society of Chemistry, London, 1981.

5. Bretherick, L., Bretherick's Handbook of Reactive Chemical Hazards, 7th Edition, 2 volume set, 2006.

6. Code of Federal Regulations, 29CFR part 1910 subpart Z, US Government Printing Office, Washington D.C., 20402 (latest edition).

7. International Agency for Cancer Research (IARC), Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, World Health Organization, Publications Center, 49 Sheridan Avenue, Albany, NY 12210, (latest edition).

8. Safety Data Sheets.

9. NIOSH/OSHA Pocket Guide to Chemical Hazards, NIOSH Pub. No. 85-114, US Government Printing Office, Washington D.C., 1985 (or latest edition).

10. Occupational Health Guidelines, NIOSH/OSHA, NIOSH Pub. No. 81-123, US Government Printing Office, Washington D.C., 1981.

11. Patty, F.A., Industrial Hygiene and Toxicology, John Wiley & Sons, Inc., New York, NY, latest edition, multiple volumes).

12. Registry of Toxic Effects of Chemical Substances, US Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Superintendent of Documents, US Government Printing Office, Washington D.C. 20402, (revised annually).

13. Sax, N.I., Dangerous Properties of Industrial Materials, Van Nostrand Reinhold, NY, (latest edition).

14. Sittig, Marshall, Handbook of Toxic and Hazardous Chemicals and Carcinogens, Noyes Publications, Park Ridge, NJ, 1992, (2 volumes).

15. The Merck Index: An Encyclopedia of Chemicals and Drugs, Merck and Company, Inc., Rahway, NJ, (latest edition).

Appendix 2

General Reference List

1. Furr, A. Keith, Ph.D. CRC handbook of Laboratory Safety, 5th edition, CRC Press, 2000.

2. National Research Council, Prudent Practices for Handling Hazardous Chemicals in Laboratories, updated edition, National Academies Press, 2011.

3. American Conference of Government Industrial Hygienists (ACGIH), Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes, P.O. Box 1937, Cincinnati, OH 45201 (latest edition).

4. Annual Report on Carcinogens, National Toxicology Program, US Department of Health and Human Services, Public Health Service, US Government Printing Office, Washington D.C., (latest edition).

5. International Agency for Cancer Research (IARC), Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, World Health Organization, Publications Center, 49 Sheridan Avenue, Albany, NY 12210, (latest edition).

6. National Institute of Occupational Safety and Health, NIOSH/OSHA Pocket Guide to Chemical Hazards, NIOSH Publication No. 81-123, US Government Printing Office, Washington D.C., 2005

7. Patty, F.A., Industrial Hygiene and Toxicology, John Wiley & Sons, Inc., New York, NY, latest edition, multiple volumes).

8. The Merck Index: An Encyclopedia of Chemicals and Drugs, Merck and Company, Inc., Rahway, NJ, (latest edition).

9. Sax, N.I., Dangerous Properties of Industrial Materials, Van Nostrand Reinhold, NY, (latest edition).

10. Registry of Toxic Effects of Chemical Substances, US Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Superintendent of Documents, US Government Printing Office, Washington D.C. 20402, (revised annually).

OSHA and WISHA Laboratory Standard and Appendices

Copies of these standards are included in every hard bound version of the Chemical Hygiene Plan or can be found at the following links:

Occupational Safety and Health Administration (OSHA) standard titled Occupational Exposure to Hazardous Chemicals in Laboratories (29 CFR 1910.1450). https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1450

Washington Industrial Safety and Health Act (WISHA) Safety Standards for Hazardous Chemicals in Laboratories (296-828 WAC - Laboratory Standard).
https://lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-841.pdf

Appendix 3

College-Specific References

1. American Chemical Society, Safety in Academic Chemistry Laboratories, Volume 1, 7th edition, 2003.

2. American Chemical Society Task Force, Laboratory Waste Management, AQ Guidebook, 1994

3. National Research Council, Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academy Press, 2011.

4. Flinn Scientific Company, Flinn Scientific Chemical and Biological Catalog and Reference Manual, 2011, pp. 1123-1205.

5. McCann, Michael, Ph.D., Artist Beware, Watson-Guptill Publications, 1979.

6. Shaw, Susan, Overexposure, Health Hazards in Photography, Friends of Photography, 1983.

7. Budaveri, Susan et al, Editors, The Merck Index, Merck and Company, Inc., 1989.

8. Weast, Robert C., Editor, CRC Handbook of Chemistry and Physics, 5th Edition, CRC Press, Inc. 1978.

9. Ryan, Esq., Kelly, Science Classroom Safety and the Law, A Handbook for Teachers, Flinn Scientific, Inc, 2001.

10. Meyer, Eugene, Chemistry of Hazardous Materials, Prentice-Hall, Inc., 1977.

11. Green, Michael and Amos Turk, Safety in Working with Chemicals, MacMillan Publishing Company, Inc., 1978.

12. Armour, M.A., L.M. Browne, and G.L. Weir, Hazardous Chemicals Information and Disposal Guide, 3rd Edition, University of Alberta, 1987.

13. U.S. Department of Health and Human Services, Pocket Guide to Chemical Hazards, J.J. Keller and Associates, 1997.

Appendix 4

Carcinogen Lists

WISHA Carcinogens: https://lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-62.pdf#WAC_296_62_073and https://lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-841.pdf

OSHA Select Carcinogens Basis of OSHA Carcinogen Listing for Individual Chemicals (epa.gov)

IARC Carcinogens: List of Classifications – IARC Monographs on the Identification of Carcinogenic Hazards to Humans (who.int)

National Toxicology Program Carcinogens: RoC Listed Substances (nih.gov)

RCRA and CERCLA Carcinogens: https://www.epa.gov/sites/production/files/2015-03/documents/list_of_lists.pdf

California Proposition 65 Carcinogens: October 26, 2018 List of P65 chemicals

Permissible Exposure Levels for WISHA Regulated Substances

Copies of this standard are included in every hard bound version of the Chemical Hygiene Plan or can be found at the following link: https://lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-841.pdf

Appendix 5

Science Department Standard Operating Procedures

Standard Operating Procedure #1:

Evacuation Plan for WSC Third Floor Lab Areas

The preferred plan of evacuation from the third floor lab areas is outlined below. Since each emergency is different, no one evacuation plan will be the best plan in all circumstances. If it is not safe to follow the steps below, please take the shortest, safest, most direct marked exit to your assembly point.

- Lab Techs:
  - Turn off/unplug any equipment staff and/or students are using.
  - Quickly stow away any unsecured hazardous chemicals and/or bacterial cultures present in labs or prep rooms (in a nearby metal cabinet if necessary).
  - If gas is in use, turn it off at the wall shut-off.
  - If lab aides are working, make sure they evacuate to the nearest stairwell (not an elevator).
  - Do not set the security alarm in the prep room or instrument room.
  - Check for stragglers:
    - Chemistry Lab Technician: Chemistry prep room, store room, labs, instrument room, and bathroom.
    - Biology Lab Technician: Biology prep rooms, specimen room and labs 301, 303, 307, A&P lab, cadaver room, and greenhouse.
  - Lock doors to the hallway as you leave.
  - Proceed to the nearest stairwell and exit per evacuation instructions below*****. DO NOT use the elevators.

- Faculty:
  - Have students set down glassware, chemicals and any other materials and turn off/unplug their equipment.
  - Gather students and instruct them to stay with you as you exit the lab.
  - Lock the doors to the hallway as you leave.
  - Proceed with your students to the nearest stairwell exit. DO NOT use the elevators.
  - Students who have mobility issues (or disabilities) are to remain at the intercom area at the stairwell. (This area has special reinforcement for their safety until first responders arrive).
  - Exit per evacuation instructions below*****

***** Exit the building to the designated assembly area (WSC parking lot across from KNOLL outdoor learning area).
***** Account for the students and/or staff who are in your area of responsibility.
***** Call 911, then Facilities, Operations and Maintenance (x8888), if needed.
***** Follow the instructions of the Administrator in charge or his designee.

Standard Operating Procedure #2:

Disposal of Chemical Waste from Science Classes

The Centralia College Chemical Hygiene Plan specifies in Section 3.10 Waste Disposal:
"The Chemical Hygiene Administrator will ensure that laboratory chemicals are disposed of in compliance with appropriate regulations and in a manner which minimizes damage to human health and the environment.

1. Waste Handling:
    a. Waste containers should be labeled to show the type of waste that can be safely deposited.
    b. Chemical wastes should be removed from the laboratory to a central storage area at least once a week by the faculty member from whose class the waste was generated or by laboratory staff.
    c. Chemical wastes should be removed from the central storage area at regular intervals.
2. Disposal / Recycling:
    a. Laboratory wastes should be recycled whenever possible.
    b. Before disposing of any laboratory waste materials, the disposal method will be determined by consulting the pertinent SDS and reference material.
    c. Chemicals that are deemed suitable for disposal into the city water system will first be carefully diluted and neutralized.
    d. Hoods should not be used as a waste disposal method for volatile chemicals.
    e. Chemicals requiring removal as hazardous waste will be disposed of according to regulations, using an approved state contractor for such disposal.
    f. All laboratory waste generated must be recorded on a waste accumulation log. Record must include the date of accumulation, waste type, amount, and hazards associated with the waste. If waste is neutralized, this activity must be recorded on an elementary neutralization log. The waste type, treatment used, pH before and after, and amount discharged to municipality must be included on the log.

Additionally, the Centralia College Science Department maintains the following procedures for disposing of chemical waste:

1. Chemistry:
    a. Students are instructed to put no chemicals down the drains unless specifically instructed to do so in the laboratory procedure for the lab being performed.
    b. Class chemicals are collected and removed from the lab at the end of the class.
    c. The faculty/staff then make the determination as to how the waste will be disposed based upon the Federal/State regulatory guidelines and consulting the SDS.
2. Other Science Department classes:
    a. Generally use only non-hazardous chemicals that are safe for disposal in the city water system.
    b. When chemicals deemed hazardous by the SDS are occasionally used, the experimental process must include the waste procedure specified above for chemistry classes.

Standard Operating Procedure #3:

Hot Plate Safety

Hot plates (and hot plate / stirrer combinations) can easily be the cause of burns. The Chemistry Lab has several types of hot plates. Some do not have a light to indicate the hot plate is on and / or hot*****. Some do not have ON / OFF switches*****.

For safe operation of any hot plate:

INSPECT your equipment and work space:

- When approaching a hot plate always consider it hot, checking the surface for heat by holding your hand just above it before touching the unit.
- Ensure there is a grounded outlet to plug in the unit.
- Check to make sure the unit is placed on a stable, flat surface.
- Place the unit a minimum of 6 inches from any vertical surface.
- Keep papers and other combustibles away from the unit.
- Take care that hair, clothing, and hands are a safe distance from the hot plate at all times.
- Do not store volatile flammable materials near a hot plate
- Be aware of the locations of all fire extinguishers, fire blankets, eye wash stations, and safety showers in case of an accident.

HEATING INSTRUCTIONS:

- With the heating knob in the 'off' or extreme counterclockwise position, plug the power cord into a 3-pronged grounded outlet.
- Place a flat-bottomed glass vessel containing the solution to be heated in the center of the top plate.
- To heat the vessel, turn the heat control knob to the desired relative temperature.
- CAUTION: the heating surface will become very hot.
- Do not touch the top of the hotplate when it is plugged in.
- Always operate the unit with a vessel on the top plate.
- To stop heating, turn the heat knob to the "Off" or extreme counterclockwise position and unplug the unit.
- Always unplug hot plates and hot plate/stirrer units when not in use and wrap the cord around the base of the unit.
- ***ADDITIONAL INSTRUCTIONS for the VWR mini-hotplates:** these units do not have ON/OFF switches or lights indicating when they are turned on. You MUST unplug the hot plate to ensure the heating element is off. Each unit has a rod holder in the back. The rods are stored with the hot plates. Whenever you use a VWR Mini-Hot Plate, be sure to place the rod in the holder to indicate that the top plate may be hot.

CLEANING AND MAINTENANCE:

- Best performance will be obtained if the unit is kept as clean as possible.
- Remove spills from the surface as soon as it is cool.
- Accumulated deposits on the top plate will retard the uniform distribution of heat.
- Care should be taken to prevent corrosive materials from entering the housing.
- Routinely clean the surface of the stirring hotplate with a non-abrasive cleaner.
- Make sure unit is dry before plugging it in.

Standard Operating Procedure #4:

Formaldehyde Exposure Control Plan

Background: Formaldehyde is a colorless gas with a strong, pungent, irritating odor. It is available commercially as 37% formaldehyde (usually stabilized in methanol) in a water solution. This solution is further diluted for various uses. 3-10% formalin is typically used for preservation of specimens. Once preserved, the specimens are moved to alcohol for long-term storage to reduce the risk of employee exposure over the life of the specimen.

Exposure to formaldehyde in the air at levels exceeding 0.1 ppm, may cause individuals to experience adverse effects such as watery eyes; burning sensations in the eyes, nose, and throat; coughing; wheezing; nausea; and skin irritation. In some individuals, repeated skin exposure to formaldehyde can cause sensitization that may result in allergic dermatitis.

The International Agency for Research on Cancer (IARC) classifies formaldehyde as a human carcinogen. In 2011, the National Toxicology Program (NTP), an interagency program of the Department of Health and Human Services, named formaldehyde as a known human carcinogen in its *12th Report on Carcinogens*.

Purpose: To establish a process, following regulatory guidelines, to use formaldehyde/formalin to preserve fish in the Science Department at Centralia College. In order to ensure the safe use, storage and disposal of formaldehyde and formalin, this SOP outlines the procedures to be followed whenever using greater than 0.1% formaldehyde in the science laboratories at Centralia College.

Definitions

Chemical Hygiene Officer: an employee designated by the employer, who is qualified by training or experience, to provide technical guidance in the development and implementation of the Chemical Hygiene Plan.
Formaldehyde – The chemical substance HCHO, C.A.S. #50-00-0.
Formaldehyde Exposure Assessment – A quantitative determination of employee exposure to formaldehyde in the workplace.
Hazardous chemicals: any chemicals that have been found to cause acute or chronic health effects in at least one scientific study.
Hazardous wastes: Wastes designated and regulated as hazardous by the US EPA and/or the WA Dept. of Ecology.
OSHA Action Level (AL) – An exposure to airborne concentration of 0.50 parts per million (ppm) of formaldehyde as an eight hour time-weighted average (TWA).
OSHA Permissible Exposure Limit (PEL) - an exposure to airborne concentration of 0.75 parts per million (ppm) of formaldehyde as an eight hour time-weighted average (TWA).
OSHA Short Term Exposure Limit (STEL) - an exposure to airborne concentration of 2.00 parts per million (ppm) of formaldehyde over a 15-minute duration.
Regulated Area – Any area where the concentration of formaldehyde exceeds the OSHA PEL or STEL.

Roles and Responsibilities

1. The Science Department Chemical Hygiene Officer is responsible for:
    a. Identifying tasks where the exposure to formaldehyde has the potential to exceed the OSHA AL of .50 ppm or the OSHA STEL of 2.00 ppm.
    b. Working with the faculty member to perform exposure monitoring of personnel having the potential to exceed the OSHA AL or STEL.
    c. Performing follow-up exposure monitoring, should it be necessary, semi-annually for any employee exposed above the AL and annually for any employee exposed above the STEL
    d. Recommending work practices, engineering controls, and/or personal protective equipment (PPE) to reduce employee exposure to formaldehyde below the TWA or STEL.
    e. Defining regulated areas where formaldehyde concentrations may exceed the TWA or STEL and ensuring that appropriate signs are posted.
    f. Performing annual training (initial and refresher) of workers having any exposure to formaldehyde.

   g. Employee notification of monitoring results.
   h. Maintaining all formaldehyde hazard assessment and sampling records.
2. The faculty member conducting the research is responsible for:
   a. Keeping CHO apprised of the project.
   b. Following the rules and regulations of the Centralia College Chemical Hygiene Plan, the Formaldehyde Exposure Control Plan and all other applicable rules and regulations.

Procedures

1. Initial Determination of Employee Formaldehyde Exposure – The Chemical Hygiene Officer will assess formaldehyde exposure on all tasks suspected of having the potential for exposure above the OSHA TWA (.50 ppm) and STEL (2.00 ppm). Gastec passive dosimeter tubes for formaldehyde will be clipped to the employee's lab coat and work practices and engineering controls will be observed.
2. If engineering controls and work practices are not sufficient to reduce exposure below the PEL or STEL, alternative work practices will be required.
3. Follow-up sampling – Any employee whose formaldehyde exposure exceeds the OSHA AL shall be monitored semi-annually. Any employee whose formaldehyde exposure exceeds the OSHA STEL shall be monitored annually.
4. Designation of regulated areas – shall be established in any area where the concentration of formaldehyde exceeds either the TWA or STEL. All entrances and access ways to the regulated area shall be posted with signs bearing the following information:

DANGER
FORMALDEHYDE
IRRITANT AND CANCER HAZARD
AUTHORIZED PERSONNEL ONLY

Labeling and Storage

5. Formaldehyde gas, and all mixtures or solutions composed of greater than 0.1% formaldehyde and materials capable of releasing formaldehyde into the air, under reasonably forseeable conditions of use, at concentrations reaching or exceeding 0.1 ppm must be labeled with hazard warning labels.
6. The original manufacturer labels are sufficient and should not be removed. Where the original manufacturer labels are not present, new labels must be applied to the containers indicating that the product contains formaldehyde and include the words "Sensitizer" and "Cancer Hazard" on the label. List the name and address of the responsible party, and state that physical and health hazard information and SDS are available as well as where they are located.
7. Chemicals that produce formaldehyde gas must be stored in an area within the laboratory that is conspicuously labeled as a "Designated Area".

Recordkeeping

Formaldehyde exposure control plan records shall be kept in the Log of Hazardous Waste Activities and shall be maintained indefinitely.

SH 7-18-2012

Standard Operating Procedure #5:

Using Formaldehyde to Preserve Fish In the Centralia College Science Department

Summary: Formaldehyde has been the traditional preservative for specimens in the life sciences. As health concerns have surfaced and state and federal regulations have tightened, changes have been made in its use, but formaldehyde is still the preservative of choice for fish. Once preserved, the specimens are moved to alcohol for long-term storage to reduce the risk of employee exposure over the life of the specimen.

Purpose: To establish a safe process that follows regulatory guidelines to use formaldehyde/formalin to preserve fish in the Science Department at Centralia College. In order to ensure the safe use, storage and disposal of formaldehyde and formalin, this SOP outlines the procedures to be followed whenever using greater than 0.1% formaldehyde in the science laboratories at Centralia College.

Definitions:
Chemical Hygiene Officer (CHO): an employee designated by the employer, who is qualified by training or experience, to provide technical guidance in the development and implementation of the Chemical Hygiene Plan.
Designated Area – A location in the laboratory where acutely toxic, carcinogenic or reproductively toxic are handled and stored.
Formaldehyde – The chemical substance HCHO, C.A.S. #50-00-0.
Formaldehyde Exposure Assessment – A quantitative determination of employee exposure to formaldehyde.
Hazardous chemicals: any chemicals that have been found to cause acute or chronic health effects in at least one scientific study.
Hazardous wastes: wastes designated and regulated as hazardous by the US EPA and the WA Dept. of Ecology.
OSHA Action Level (AL) – an exposure to airborne concentration of 0.50 parts per million (ppm) of formaldehyde as an eight hour time-weighted average (TWA).
OSHA Permissible Exposure Limit (PEL) - an exposure to airborne concentration of 0.75 parts per million (ppm) of formaldehyde as an eight hour time-weighted average (TWA).
OSHA Short Term Exposure Limit (STEL) - an exposure to airborne concentration of 2.00 parts per million (ppm) of formaldehyde over a 15-minute duration.

Responsibilities:
Employee: Ensure safety of students, employees and the community by understanding and complying with state and federal regulations when using, storing and disposing of hazardous chemical products.
Chemical Hygiene Officer: Ensure compliance and safety with chemical use and disposal, oversee hazardous waste room use and keep records of hazardous waste disposal activities.
Chemical Hygiene Administrator: Ensure compliance by employees in Instructional areas.

Setting Up:
1. All work with formaldehyde will be confined to WSC 304B, the area designated for select carcinogens and other extremely toxic chemicals.
2. Once specimens are preserved, they will be transferred to alcohol for research and storage. They will then be moved out of the designated area for use in labs.
3. The CHO and principal investigator will follow the procedures outlined in the Formaldehyde Exposure Control Plan to ensure that the engineering controls and work practices are sufficient to reduce exposure below the STEL.
4. Follow-up sampling will be done if needed.

Procedure:
5. Consult the Formaldehyde SDS to determine and understand the potential safety hazards, recommended personal protection equipment and disposal considerations.
6. Wear splash goggles, lab coat and 2 pairs of nitrile or butyl rubber gloves.

7. Label all solution containers with the chemical name in English, hazard information, date made and preparer's initials.
8. All formaldehyde solutions will be kept in secondary containers large enough to hold the contents of the primary containers stored within them.
9. Prepare a container and supplies for any solid waste from spill clean-up so that it is ready if it is needed.
10. All waste formaldehyde solutions must be treated as hazardous waste
    a. Ensure your waste container is suitable for liquids and formaldehyde, has a tight-fitting lid and a hazardous waste label;
    b. Store waste container in a secondary container large enough to hold the contents of the waste container, should it spill.
    c. Keep a log with the date and amount of waste added to your waste container.

Records Management:
The Science Department Chemical Hygiene Officer shall keep indefinitely all records related to Chapter 296-856 WAC (Formaldehyde Standard) in the Centralia College Log of Hazardous Waste Activities.

Quality Control: Procedure will be reviewed annually and updated as needed.

References:
1. Guidance for the Preparation of Standard Operating Procedures. U.S. EPA. April 2007.
2. Formaldehyde. Chapter 296-856 WAC. September 2006 Edition..
3. Prudent Practices in the Laboratory. National Research Council. 2011.

Written by: _____
Suzanne Hostetter

Approved by: _____
John Martens, Chemical Hygiene Administrator & V.P Instruction

_____
T.R. Gratz, Dean of Instruction, Academic Transfer

_____
Dr. Stephen Norton, Biology Professor

Standard Operating Procedure #6:

Hazardous Waste Disposal in Instructional Areas

Purpose: To establish a uniform process for the disposal of hazardous chemical waste in all Instructional areas of Centralia College.

Summary: The use and disposal of hazardous chemicals is regulated by the state and federal government. Over-the-counter products are included, unless used exactly as described on the label and with the same frequency as a home consumer. The end user is responsible for any hazardous waste generated. This waste cannot be dumped down the sink, in the trash or end up in the sewer, creek or landfill. It must be labeled and stored appropriately until it is disposed. Centralia College must keep a record of the disposal.

Definitions:
Chemical Hygiene Officer: an employee designated by the employer, who is qualified by training or experience, to provide technical guidance in the development and implementation of the Chemical Hygiene Plan.
Hazardous chemicals: any chemicals that have been found to cause acute or chronic health effects in at least one scientific study.
Hazardous wastes: wastes designated and regulated as hazardous by the US EPA and the WA Dept. of Ecology.

Responsibilities:
Employee: Ensure safety of students, employees and the community by understanding and complying with state and federal regulations when using and disposing of hazardous chemical products.
Chemical Hygiene Officer: Ensure compliance and safety with chemical use and disposal, oversee hazardous waste room use and keep records of hazardous waste disposal activities.
Chemical Hygiene Administrator: Ensure compliance by employees in Instructional areas.

Procedure:
1. When planning to use any type of chemical, consult the SDS ***before*** you order it (contact the CHO if you need help). Determine the following for the chemical(s) and the process planned:
    a. potential safety hazards
    b. recommended personal protection equipment
    c. disposal considerations
2. Determine if the waste from your intended use is regulated as hazardous waste.
3. If hazardous waste will be generated:
    a. Prepare a waste container and a secondary container large enough to hold the contents of the waste container, should it spill.
    b. Prepare and affix a waste label (see page 41 for a Hazardous Waste Label template).
    c. Be prepared to take the waste to the Lewis County Solid Waste Hazo-Hut or other approved facility in a timely manner.
4. Hazardous waste from Instructional areas may be temporarily stored in WSC 104C until disposal. Contact the Chemical Hygiene Officer for more information.
5. Make arrangements with the Lewis County Solid Waste Hazo-Hut (or make arrangements with another approved facility) to determine the fee and to deliver your waste.
6. All waste generated must be recorded on a waste accumulation log. Record must include the date of accumulation, waste type, amount, and hazards associated with the waste. If waste is neutralized, this activity must be recorded on an elementary neutralization log. The waste type, treatment used, pH before and after, and amount discharged to municipality must be included on the log.
7. Forward the receipt from this disposal to the Chemical Hygiene Officer.

Records Management:
All receipts for disposal are forwarded to the Chemical Hygiene Officer of the Science Department for inclusion in the Centralia College Log of Hazardous Waste Activities.

Quality Control: Procedure will be reviewed annually and updated as needed.

References:

1. Guidance for the Preparation of Standard Operating Procedures. U.S. EPA. April 2007.
2. Hazardous Chemicals in Laboratories. WISHA Department of Labor and Industries. September 2010.
3. Prudent Practices in the Laboratory. National Research Council. 2011.

Written by: _____
Suzanne Hostetter

Approved by: _____
John Martens, Chemical Hygiene Administrator & V.P Instruction

_____
T.R. Gratz, Dean of Instruction, Academic Transfer

Hazardous Waste Label

Please fill out completely

HAZARDOUS WASTE

HANDLE WITH CARE!

Generator: Centralia College Phone: (360) 736-9391
Dept.: _____ Building & Room:_____

CONTAINS: _____

Hazardous properties (check all that apply):

- ☐ Toxic
- ☐ Corrosive
- ☐ Ignitable
- ☐ Reactive
- ☐ Other:

- ☐ Solid
- ☐ Liquid
- ☐ Gas

_____

Standard Operating Procedure #7:

Disposal of Aerosol Cans on Campus

Why are we collecting aerosol cans?

In April 2009, the College was inspected by the Washington State Department of Ecology. One of the subjects of concern was how we manage and dispose of aerosol cans. The recommendation was that we set up a collection program for aerosol cans no longer in use to ensure compliance with state and federal hazardous waste regulations.

What should we do with them?

Centralia College will collect and dispose of aerosol cans used in daily operations on campus and no longer in use. Aerosol cans should not be thrown in the regular trash. Many of them are subject to state and federal regulations and must be managed as hazardous waste. Collection containers will be placed in the WAH mailrooms, the WSC 2nd floor supply room (WSC 216A) and FOM. We will then dispose of them through the Lewis County Solid Waste Utility.

What's the deal with aerosol cans?

Cleaners, paints, pesticides, lubricants and polishes are some of the many products on campus that come in aerosol cans (spray cans). These cans contain both the product and a pressurized propellant to distribute the product. In many cases, the product itself may have hazardous characteristics, most commonly ignitability (e.g. paints, lubricants) or toxicity (e.g. pesticides, chlorinated cleaning products). Additionally, most propellants are mixtures of ignitable gases, such as propane and butane. Due to their flammability, these gases can cause fires and explosions if they are sprayed or are released unintentionally due to puncture or damage to the can, or if the contents are exposed to an open flame, pilot light, spark or static electricity.

In a properly functioning aerosol can, the product and the propellant are simultaneously depleted, so that when the can is depressurized it is also empty of product. However, cans will malfunction, leaving product in the can after it is depressurized. Nozzles can also break or become clogged during use, leaving the can unusable but with a significant amount of product and propellant still left inside.

How should we use aerosol cans?

- Whenever possible, choose a product that is *not* in an aerosol can.
- If possible, completely use up the contents of an aerosol can for its intended purpose.
- Do *not* empty aerosol cans by discharging the contents directly into the environment.
- An aerosol can that still contains product and/or propellant should never be placed in the regular trash.
- Please *do* place all aerosol cans that are no longer usable in one of the collection bins on campus.
- Once collected, cans that are completely emptied of non-hazardous product and propellant may be disposed of as scrap metal. The others will be accumulated for disposal with a properly licensed hazardous waste disposal company.

Questions? Please contact the Chemical Hygiene Officer or Chemical Hygiene Administrator.

Standard Operating Procedure #8:

Compressed Gas Cylinders on the Centralia College Campus

Purpose: to ensure that the handling, storage, use and disposal of compressed gas cylinders is safe and consistent with federal and state regulations.

Applicable to: Anyone who may have involvement with compressed gas cylinders on campus.

Requirement:
Those described above must be trained in the safe use of compressed gas cylinders as described in the Centralia College online training module and Safety Manual (available on the intranet). This training shall occur before that time when the individual begins any tasks that in any way involve compressed gas cylinders. Additionally, compressed gas cylinder safety will be part of the Hazard Communication Training.

Required Training must include the following points:

- Most accidents and injuries involving compressed gases occur during the moving or handling of the gas container.
- The greatest physical hazard represented by the compressed gas cylinder is the tremendous force that may be released if it is knocked over and the valve damaged! (It becomes a dangerous projectile, much like a rocket)
- Improper handling of cylinders can result in sprains, strains, falls, bruises, and broken bones.
- Asphyxiation is the primary hazard associated with inert gases such as Helium and Nitrogen
- Do not handle compressed gas cylinders in a confined space without proper ventilation.
- Do not ride in an elevator with a compressed gas cylinder (Because an elevator is a confined space, one person should put the properly secured cylinder in the elevator while a second person waits to receive it at the elevator on the other floor.)
- Personal Protection Equipment (PPE): wear sturdy close-toed shoes and work gloves.
- Cylinders should not be physically carried or dropped or permitted to strike each other.
- The cylinder is heavy -- beware of trapping fingers between containers or crushing toes underneath a cylinder.
- A cylinder must be secured during storage, transfer and use
- Do not store cylinders in areas of ingress / egress.
- All compressed gas cylinders must be clearly labeled with the type of gas, whether they are empty or full, their hazards, etc.
- When moving/transporting a tank, use a gas cylinder hand truck and secure the tank to the hand truck with a support chain or sturdy strap.
- The cylinder cap should be screwed on whenever the tank is moved or not in use.
- Cylinders must be stored with caps in place.
- Only trained personnel should handle compressed gas cylinders.
- Never move a compressed gas cylinder with the regulator attached.
- Never deplete the gas in a cylinder to a pressure lower than 25 psi. At this point, the tank is considered empty. ‘Empty’ tanks must be clearly marked as "empty" or "MT" and be stored separately from full cylinders.

Standard Operating Procedure #9
Full Spectrum Laser Engraver Safety

Purpose: To establish a safety procedure that follows regulatory guidelines to ensure safe use of the Full Spectrum Laser Engraver at Centralia College. This standard operating procedure outlines the safety procedures that must be followed whenever using the laser engraver.

Summary: The laser engraver used at Centralia College is capable of causing eye injury to anyone who looks directly into the beam or its reflections from a specular (mirror-like) surface. In addition, diffuse reflections of a high-power laser beam can produce permanent eye damage. High-power laser beams can burn exposed skin, ignite flammable materials, and heat materials that release hazardous fumes, gases, debris, or radiation. Equipment and optical apparatus required to produce and control laser energy may also introduce additional hazards associated with high voltage, high pressure, cryogenics, noise, and other forms of radiation, flammable materials, and toxic fluids. Thus, operation involving the laser engraver must be evaluated to determine the hazards involved and the appropriate safety measures and controls required.

Definitions:
Laser Operator: an individual who successfully completes two Full Spectrum Training Modules located at https://info.fslaser.com/certification-awaits. Specifically, the Safety and Pro-Series Certification modules. Each training module provides a certificate of completion to be printed out as a hard copy or saved as a PDF.
Chemical Hygiene Administrator: audits overall compliance of Standard Operating Procedure.
Chemical Hygiene Officer: audits compliance and safety procedures to ensure they meet the laser safety guidelines established by local, state, and federal regulatory agencies.
Laser Lab Authority: a Centralia College employee that maintains control of the access to the laser engraver lab.

Responsibilities:
Laser Operator: Ensures safety of all students, employees and the community by understanding and complying with state and federal regulations when operating the laser engraver. Follow all safety procedures outlined in this standard operating procedure. Complete safety training prior to working with laser engraver.
Report any safety concerns or accidents to the Laser Lab Authority immediately.
Laser Safety Program is administered by the Laser Lab Authority, with the assistance of the Chemical Hygiene Officer. The Laser Lab Authority recommends that individuals operating or maintaining the laser engraver to meet the laser safety guidelines established by the American National Standards Institute (ANSI) standard ANSI Z136. 1-2007, American National Standard for the Safe Use of Lasers.

Procedure:
Follow all safety precautions described below prior to operating the laser engraver.
Under the right viewing conditions, the emitted light from a class 3R laser engraver can produce eye injury but the risk of injury actually occurring is relatively low for a momentary or accidental exposure. Class 3R lasers are not considered skin hazards. **Avoid Direct Eye Contact**!

Access:
* Entry into the laser lab is by permission only.
* The correct door and laser ignition keys must be obtained from the Laser Lab Authority or his designee.
* You must have a safe laser operator document on file before operating the laser.
* First time users must show certifications of training modules, be instructed on the physical features of the laser lab and sign the training roster.
* Only individuals with the correct laser safety eyewear are allowed in the laser room when the laser is fired.
* Key set must be returned to the Laser Lab Authority or his designee upon completion of use. * Pre-use inspection check-list must be completed by Laser Operator prior to use of laser engraver.

Operational Precautions

* ALWAYS close and latch the man door into the laser room before firing the laser. This door must remain closed and latched during the entire firing process.
* ALWAYS follow the step by step instruction posted near or on the laser.
* NEVER operate the machine with any of the panels removed.

* ALWAYS use laser rated protective eyewear.
* NEVER fire the laser engraver without a correctly connected and powered water pump.
* NEVER engrave or cut any material containing PVC or vinyl.
* NEVER engrave or cut any unknown material without referring to the Safety Data Sheet from the material manufacturer to determine if the material can be subjected to extreme heat and materials burning/fire hazard.
* NEVER operate machine unattended.
* DO NOT defeat the safety door interlock.
* DO NOT look into the beam of the Alignment Laser (visible red laser).
* DO NOT operate the Alignment Laser without the focus lens in place.
* NEVER operate the machine without a properly operating ventilation system.
* ALWAYS allow the air filtration system to operate at least five minutes after firing the laser.
* ALWAYS use the air assist.
* NEVER disassemble the machine or remove any of its protective vectors while the unit is plugged in.
* DO NOT wear jewelry or reflective clothing when operating the laser.
* NEVER etch or cut through ferrous or non-ferrous metal with the laser engraver without prior approval.

Electrical Safety Precautions

The AC input power to this unit is potentially lethal and is located on the far right within the cabinet. The power supply is capable of outputting DC 20,000V at up to 30mA.

* DO NOT open any of the machine's access panels while the unit is plugged in. Opening a panel may expose the operator to the unit's AC input power.
* DO NOT make or break any electrical connections to the system while the unit is turned on.
* DO NOT access the electronics area with hands or tools unless the unit is disconnected from power.
* ALWAYS make sure you give the supply capacitors adequate time to discharge before accessing the electronics area.
* STOP immediately and notify manufacturer if any bare wires are exposed, as this poses a significant electrical danger.

CAUTION-Use of controls, adjustments, or performance of procedures other than those specified may result in hazardous radiation exposure.

Fire Safety Precautions

Laser cutting and engraving systems represent a significant fire hazard due to the extremely high temperatures generated by the laser beam. While most materials will vaporize without burning, many are inherently combustible and can easily ignite. Usually this is a small flame that is self-extinguishing due to the air assist or powering off the unit. However, it is possible for the flame to propagate and set fire to the machine and surroundings.

* Acrylic in all its different forms has been shown to be especially flammable when vector cutting with the laser engraver. Be aware that stacking materials especially organic materials such as wood and paper can lead to increased risk of fire.
* Keep the area around the machine clean and free of clutter, combustible materials, explosives, or volatile solvents such as acetone, alcohol, or gasoline.
* ALWAYS keep a properly maintained and inspected fire extinguisher (Class ABC) on hand and know its location.
* BE CAREFUL when vector cutting. Many materials have the potential to burst suddenly into flames, even materials that may be very familiar to the user. Always monitor the machine during operation.

KEEP THE LASER SYSTEM CLEAN

* Buildup of residue and debris is dangerous and can create a fire hazard. Keep the laser system clean and free of debris. Regularly remove the cutting grid to clean any small pieces that have gotten stuck or fallen through.

Records Management: All safety concerns shall be reported to the Laser Lab Authority. Training certifications will be maintained on the Laser operating computer in a pdf file. The original of the completed certifications will be held by the Workforce Education office. Any and all accidents will be reported to the Workforce Education office.

Quality control: Standard Operating Procedure will be reviewed annually and updates as needed.

Reference:

1. ANSI Standard Z136.1 -2007, *American National Standard for the safe Use of Lasers*, 2007.
2. Occupational Safety & Health Administration, OSHA, 29 CFR 1926.1 02(b)(2), *PPE Selection- Optical Radiation: Laser Protection*.
3. WAC 296-62-09005 Nonionizing radiation

Updated by: Scott Keating, Instructional Technician I — Date: 3/7/19

Approved by: David Peterson, Acting Laser Lab Authority — Date: 3/7/19

Approved by: Jake Fay, Dean of Instruction: Healthcare and Industrial Trades — Date: 3/8/19

Approved by: John Martens, Chemical Hygiene Administrator & V.P of Instruction — Date: 7 March 2019

(Revised 03/2019)

Standard Operating Procedure #10
Laboratory Fume Hoods – Performance Criteria and Certification Procedure

Purpose: To attain certification at Centralia College, a laboratory fume hood must pass both the quantitative and qualitative evaluation and have a functioning quantitative airflow indicator.

Summary: The fume hoods at Centralia College in both the Biology and Chemistry departments must be tested and certified at least annually or when changes have occurred.

Definitions:
Qualitative: Test data is collected by visual observation such as evaluation during the smoke test.
Quantitative: Test data is collected using a measuring device such as an anemometer or air flow monitoring device.
CHO: Chemical Hygiene Officer ensures compliance and safety procedures meet the regulatory guidelines established by local, state, and federal regulatory agencies.

Responsibilities:
Chemical Hygiene Officer: Ensures that testing is performed per scheduled. Generated work orders and ensures that work is completed. Maintains certification reports.
Lab Technician: Performs fume hood testing yearly or when changes are made. Follows all testing protocols outlined in this standard operating procedure. Generates certification reports. Reports any concerns to the chemical hygiene officer.

Procedure:

A) Qualitative Evaluation: "Smoke Test"
   1. Position the sash at the appropriate max sash height (15"-18").
   2. Generate "smoke" in direction perpendicular to exhaust flow from locations of containment.
   3. Generate "smoke" around the perimeter of the designated face, and any other location within the fume hood where turbulent airflow is thought to exist (i.e. around any large obstructions).
   4. If the smoke is contained within and exhausted from the fume hood, the unit has PASSED the qualitative evaluation.
   5. Record all collected data in the Laboratory Fume Hood Certification Report.

B) Quantitative Evaluation – Face Velocity Measurements
   1. Position the sash at the appropriate max sash height (15"-18").
   2. Set imaginary grid pattern w/grid intervals of 1 foot or less.
   3. Locate anemometer at center of every segment and measure/record velocity. Take a total of 12 data points per hood tested.
   4. Record all velocity readings on the Laboratory Fume Hood Certification Report.
   5. Calculate average face velocity and identify minimum velocity value. Record these on the Laboratory Fume Hood Certification Report. If average face velocity is greater than or equal to 80 FPM, with a minimum of 70 FPM at any point, the unit has PASSED the quantitative evaluation. Record all collected data on Laboratory Fume Hood Certification Report.
   6. Include the Width and Height of each fume hood on the report.
   7. Calculate the Area (sq. ft.) and record on report.
   8. Calculate Volume (CFM) and record on report.
   9. Record Serial# of hood on Laboratory Fume Hood Certification Report.

C) Air Flow Monitoring Device

1. Note if air velocity monitoring device is functioning properly. If not functioning properly, notify CHO to issue work order for FOM to evaluate if it is out of calibration, broken, ect., and to repair it.

D) For fume hoods that PASS both the Quantitative and Qualitative Evaluation and have a functioning Air Flow Indicator:
   1. Document that unit has passed performance inspection on the certification report and affix a certification sticker. The unit is certified for use to prevent harmful exposures to hazardous substances.

E) For units that FAIL, immediately:
   1. Inform users, CHO, and FOM that the unit has FAILED performance inspection and CANNOT be used for containment of hazardous materials until the unit has been certified.
   2. Document that the unit has failed performance inspection on the Certification report.
   3. Affix signage to hood stating that it CANNOT be used for preventing harmful exposures to hazardous chemicals.
   4. If fume hood appears to have failed certification due to improper hood use/setup (i.e. due to equipment blocking baffles), indicate as such on the report and communicate to the CHO for correction prior to any retesting.
   5. If fume hood appears to have failed certification due to mechanical deficiencies, immediately requires CHO to initiate repairs via work order to reduce hood downtime.
   6. Repeat performance certifications after necessary corrections have been made.

Records Management: All fume hood certification reports will be maintained by the CHO and VP of Operations.

Quality control: Standard Operating Procedure will be reviewed annually and updates as needed.

Reference:

1. ANSI/AIHA Standard Z9.5-2012, *Laboratory Ventilation*.

2. Occupational Safety & Health Administration, OSHA, 29 CFR 1910.1450 *Occupational exposure to hazardous chemicals in laboratories*.

Written by: _____ _____
Renae Z'berg, Chemical Hygiene Officer — Date

Approved by: _____ _____
John Martens, Chemical Hygiene Administrator & V.P Instruction — Date

(Approved July 15, 2015 RAZ)

Standard Operating Procedure #11
Microwave Oven Safety

Purpose: To establish a safety procedure to ensure safe operation of microwave ovens in the science laboratories at Centralia College. This standard operating procedure outlines the safety precautions that that must be considered whenever using the laboratory microwaves.

Summary: Microwave heating presents several potential hazards not commonly encountered with other heating methods. Users of such equipment must be thoroughly knowledgeable of operation procedures and safety protocols before beginning experiments, especially when there is a possibility of fire, over pressurization, or arcing.

Responsibilities:
Chemical Hygiene Officer: ensures compliance and safe use of microwave ovens in the science department.
Lab Technician: ensures safety in the laboratory and proper use of microwave ovens. Also, responsible for inspection of equipment to ensure good working order.
Faculty: ensures safety in the laboratory and proper use of microwave ovens during laboratory instruction.
Chemical Hygiene Administrator: ensures compliance by employees in instructional areas.

Safety Precautions: According to best practices, domestic microwaves are not appropriate for laboratory work. Domestic microwaves ovens do not provide mechanism for monitoring temperature and pressure and contain no safeguards against explosion. Instead, use of an industrial grade instrument (equipped with safeguards to minimize explosion hazards) are suitable for laboratory experiments. (Prudent Practices in the Laboratory Updated Version, Section 6.1, pg. 141)

We have domestic microwave ovens in our science departments. These microwave ovens are not equipped with temperature or pressure control devices, ventilation, or any other improved safety feature beyond the ones typically present in a domestic microwave oven. The operating instructions and safety precautions supplied by the manufacturer must be thoroughly reviewed before operating the oven. Where domestic microwave ovens are being used in the laboratory settings, personnel must be aware that they may be changing the intended use as stipulated by the manufacturer. It is therefore important to risk assess the application involving the use of the domestic microwave, and where appropriate implement safety and control measures. After careful review of best practices, microwave guidelines, and current laboratory experiments being performed, we have developed some safety protocols that must be followed to ensure the safety and health of all microwave users in the science department.

- The microwave should only be used in a well-ventilated area or in a properly vented fume hood.
- Never use this microwave oven to heat food, especially if it has ever been used to heat chemicals.
- Do not operate the oven if it is damaged or does not operate properly. The oven door must be closed properly and there much have no damage to the door seals, sealing surfaces, hinges, and latches.
- Do not defeat the interlock switch that prevents a microwave oven from operating with the door open. Do not place any wires, cables, tubing, etc. between the door and the seal. Do not modify in any way the mechanical or electrical systems of a microwave oven.
- Do not heat or produce combustible or flammable materials in the oven. Fire and/or explosion may result. Do not heat up low-boiling solvents or reactants in the oven.
- Do not heat sealed containers inside the oven as they may explode.
- Do not use aluminum foil or any metal containers, utensils, or objects with a metallic trim inside the oven.
- If materials inside the oven ignite, KEEP OVEN DOOR CLOSED and disconnect the power cord.
- Do not leave unattended while in use. Never make adjustments or tamper with any component of the oven. Do not try to perform any repairs. Notify instructor or laboratory personnel if repairs or replacement is needed.
- Avoid standing right in front of the microwave during use, in case of explosion or fire. Stand nearby and do not leave unattended.
- Care must be taken when heating solidified agar/agarose. Large amounts (e.g. 250mL) of solidified agar should not be warmed in a microwave oven unless the agar is first chopped up with a sterile spatula or other suitable instrument. Failure to chop up the agar may result in explosive vaporization.
- Agar bottles must have their lids completely removed before heating. Use loose fitting sterile foam plugs or loose cotton plugs, rather than just relying on a loosely placed cap.
- Ensure adequate amount of headspace is available in the container above the substance being heated. Do not overfill containers (no more than two thirds full).

- When removing a bottle, flask, or similar container, point its opening away from you and nearby people, to prevent splattering of the material onto any person.
- When removing items from the oven, use proper gloves, eye protection, and other recommended PPE's.
- Be careful when removing vessels containing liquids, as these may be superheated and boil once moved.
- Once microwave reactions are complete, allow reactions to sit in microwave for at least 1 full minute before opening the fume hood and microwave door. Open microwave door slowly in order to allow any vapors to dissipate before entering the oven.
- The use of microwave heating as a reaction accelerator is to be treated with extreme caution. While techniques have been developed, these usually involve the use of dedicated laboratory-grade equipment rather than domestic ovens. Should a need be identified for this application of microwave heating, the faculty member must carry out a full risk assessment. The Chemical Hygiene Officer should be consulted for guidance.
- The use of flammable materials, hazardous substances, and radioactive materials is STRICTLY PROHIBITED.
- Do not perform any unauthorized repairs on the microwaves. When a microwave is suspected to be faulty it should be disconnected from the power supply, removed from service, and labeled with an appropriate tag while awaiting repair, surplus, or disposal.

Hazard Control Measures: To minimize the risk of these hazards, an appropriate combination of control measure should be implemented to ensure the risk is low. The following hazard control measures must be adopted:

- Place a sign or label microwave as, "For Laboratory Use Only".
- The microwave should only be used in a well ventilated area or a properly vented fume hood.
- Ensure the oven cavity is adequately ventilated. The microwave should be located where the vents are not obstructed.
- Conduct regular inspections to ensure the sealing surfaces are clean and do not show any sign of damage. The presence of arcing or burn marks may be indicative of microwave leakage.
- Ensure that the microwave ovens are electrically grounded and connected using a properly rated three-pin cord and plug directly into an outlet without overloading the circuit. The use of an extension cord or strip is prohibited.
- Report defective equipment or difficulties in operation to the laboratory technician or chemical hygiene officer.
- Inspect all glass vessels for cracks or flaws before using in the microwave oven.
- Use appropriate protective equipment when removing heated liquids from the oven.
- Periodically, assess the utilization of typical microwave oven processes to ensure that established procedures for the safe operation of microwave ovens in the science department are consistent with the microwave's intended use.

Quality control: Standard Operating Procedure will be reviewed annually and updates as needed.

Written by: _____ _____
Renae Z'berg, Chemical Hygiene Officer Date

Approved by: _____ _____
John Martens, Chemical Hygiene Administrator & V.P Instruction Date

(Approved October 19, 2016 RAZ)

Standard Operating Procedure #12
Rotary Evaporator (Rotovap) Safety

Purpose: This standard operating procedure outlines general safety precautions for the use of the rotary evaporator (Rotovap), in the Centralia College chemistry department.

Summary: Working with hazardous chemicals at high or low pressures requires planning and special precautions. Procedures should be implemented to protect against explosion or implosion through appropriate equipment selection and the use of proper PPE's.

Responsibilities:
Chemical Hygiene Officer: ensures compliance and safe use of the rotary evaporator in the chemistry department.
Lab Technician: ensures safety in the laboratory and proper use of the rotary evaporator. Also, responsible for inspection of equipment to ensure good working order.
Faculty: ensures safety in the laboratory and proper use of the rotary evaporator during laboratory instruction.
Chemical Hygiene Administrator: ensures compliance by employees in instructional areas.

Safety Precautions:
Vacuum work can result in an explosion, implosion and the possible hazard of flying glass, spattering chemicals, or fire. Implosion and flying glass can lead to cuts and lacerations. Any piece of glassware under vacuum has the potential to do harm following implosion. Operational instructions and safety precautions must be thoroughly reviewed before operating the Rotary Evaporator.

After careful review of best practices, rotary evaporation guidelines, and current laboratory experiments being performed, we have developed some safety protocols that must be followed to ensure the safety and health of all who use the Rotovap in the chemistry department.

- Do not hold onto the sample during revolutions: failure of the flask could result in serious lacerations to the hands.
- Never have the water bath temperature exceed the boiling point of the solvent at the pressure that is being produced by the vacuum.
- Do not use tap water in the water bath as it will promote biological growth and scale buildup.
- Ground glass joint may become stuck or frozen if not greased properly. Do not attempt to remove a stuck piece of glassware. Notify your instructor immediately.
- Do not inhale any vapors produced during rotary evaporation.
- Do not touch hot surfaces or liquids without suitable personal protective equipment.
- Always visually inspect glass components for damage every time they are to be used.
- Do not use any glassware that may be damaged. Only use specialized glassware intended for high vacuum application. Use only heavy walled vacuum flasks and shatter-proof solvent collection bulb.
- Always place the flasks in a suitable holder (cork ring) when they are not mounted on the Rotovap.
- Do not handle dry ice with your bare hands. Ensure you are using proper gloves to protect you from potential frost bite.
- Do not attempt to clean up broken glass. Notify your instructor or lab technician immediately.
- Always wear personal protective equipment (goggles, gloves, lab coats) when operating the Rotovap.
- Always work in a well ventilated area to control vapor emissions in to the lab space and minimize potential employee exposure to solvent vapors.

Hazard Control Measures: To minimize the risk of these hazards, an appropriate combination of control measure should be implemented to ensure the risk is low. The following hazard control measures must be adopted:

- The solvent collection flask should always be emptied at the end of every lab to prevent accidentally mixing of incompatible chemicals.
- Use a bump trap to prevent the solution from accidentally splashing into the condenser. Never operate the Rotovap without the bump trap.
- Personal protective equipment, such as chemical googles, gloves, and laboratory coats must be worn.
- Care should be taken to select glass apparatus that can safely withstand designated pressure extremes. Use only heavy walled vacuum flasks and shatter-resistant solvent collection bulb to reduce the risk of implosion.
- Glassware used should be visually checked for cracks, scratches, or blemishes before each use.
- Secure glassware using metal or Keck clips only. This will prevent spills in case of loss of vacuum.
- The rotation speed and application of vacuum should be applied gradually when using the Rotovap.

- Only use Isopropyl alcohol and dry ice in the condenser per manufacturer instructions.
- Slowly allow air back into the apparatus after evaporation of the solvent is complete by turning the pressure release valve.
- Clean the apparatus after use. Do not mix halogenated and non-halogenated solvents in the collection bulb.
- Make sure the round bottom (RB) flask is at least twice the volume of your sample.
- Dry ice is used to condense the solvent. Only operate the Rotovap with a filled condenser of dry ice and isopropyl alcohol. The temperature of dry ice is -78.5 °C. Use proper gloves when handling the dry ice to prevent frost bite.
- Be careful when adjusting the height and tilt of the Rotovap to prevent damage to the glassware and unit. Perform this slowly and with smooth action.
- The bath is electrically heated. It should neither be overly full nor allowed to run dry. Make sure you do not leave on for extended periods when the Rotovap is not in use.
- Distilled water should be used in the heating bath to minimize scale build up and reduced efficiency. Regularly exchange the water in the heating bath to prevent biological growth. If the Rotovap is not being used for a length of time, remove all the water out of the bath.
- Use a very small amount of vacuum grease on the ground glass joints to avoid the glassware getting stuck.
- Consult the safety data sheet for all chemicals being used to ensure compatibility and proper handling.
- If a device is damaged, sharp edges, or has exposed electrical wires, switch off the device immediately, unplug the power cord and inform the laboratory technician.

In the event of the following:

- In case of fire or explosion, evacuate individuals from the area and call the emergency response (9-911). If you are unable to call 911, evacuate, and pull the fire alarm on your way out. Notify instructor and/or laboratory technician immediately. Follow appropriate procedures for evacuation and fire as provided in the safety briefing.
- In case of chemical spill, alert others in the immediate vicinity and notify your instructor. Determine the severity of the spill and proceed as appropriate. Small spills may be cleaned up by laboratory personnel. For large spills, evacuate the immediate area and notify emergency responders (9-911) who have the appropriate personal protective equipment to assist in clean-up. If possible to do so safely (without risk of over exposure), take action to stop the release of chemicals to the environment. Ensure that extraneous personnel remain at a safe distance until the spill is completely cleaned up.
- In case of broken glass, alert others in the immediate vicinity and notify your instructor immediately. Do not attempt to clean up broken glass.

Operational Instructions:
Operational Instructions can be found in the binder next to the Rotovap or by request from the chemistry lab technician.

Quality control: Standard Operating Procedure will be reviewed annually and updates as needed.

Written by: _____ _____
Renae Z'berg, Chemical Hygiene Officer Date

Approved by: _____ _____
John Martens, Chemical Hygiene Administrator & V.P Instruction Date

(Approved October 19, 2016 RAZ)