Shannon Point Marine Center
Chemical Hygiene Plan

REVISED: SEPTEMBER 2021 (NON-HIGHLIGHTED SECTIONS ARE UNIVERSITY-WIDE REGULATIONS; HIGHLIGHTED SECTIONS ARE SPECIFIC TO SPMC OPERATIONS)

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1.0 Purpose

The purpose of this Chemical Hygiene Plan (CHP) is to describe laboratory work practices and procedures which are necessary to ensure that University laboratory employees are protected from health hazards associated with many hazardous chemicals used in laboratories. The CHP addresses this objective by including the requirements of the state safety and health regulation, Washington Administrative Code (WAC) 296-828 *Safety Standards for Hazardous Chemicals in Laboratories*, also known as the *Laboratory Safety Standard*. This is the primary regulation covering laboratories performing chemical manipulations. In chemical laboratories, this standard supersedes most of the chemical-safety requirements in other regulations.

2.0 Scope

The Chemical Hygiene Plan applies to all laboratory employees working on laboratory scale operations involving laboratory use of hazardous chemicals. (See Part 3 for definitions of these terms.) The Chemical Hygiene Plan also encompasses non-laboratory personnel required to enter a laboratory where potential exposure may occur. Laboratory personnel are expected to be familiar with their laboratory's chemical hygiene plan and follow standard operating procedures outlined in the plan.

Any laboratory which meets the definition of a chemical laboratory must complete a Chemical Hygiene Plan for the laboratory by adding laboratory-specific information to this manual. Laboratories which do not meet the definition of a chemical laboratory may refer to this manual for general safety information, but must comply with general industry regulations concerning chemical management.

According to WAC 296-828, a chemical laboratory must also utilize safety practices or safety equipment to reduce the risks of the hazardous chemicals. In addition, the chemical laboratory may not be a production type facility where one process is performed repeatedly to produce a product for others.

3.0 Definitions

- **Action Level:** A concentration of a specific substance calculated as an 8-hour time weighted average (TWA), which initiates certain required activities as designated in WAC 296-62.

- **Administrative Controls**: Operating procedures and policies that serve to reduce the risk of exposure to hazardous materials, such as minimum purchasing and storage, use of alternate materials, and controlled access to materials.

- **Carcinogen:** A carcinogen is any substance or agent that is capable of causing cancer – the abnormal or uncontrolled growth of new cells in any part of the body in humans or animals. Carcinogens are chronic toxins with long latency periods that can cause damage after repeated or long duration exposures and often do not have immediate apparent harmful effects. See also "Select Carcinogen".

- **Ceiling Limit:** The maximum concentration of a contaminant in breathing air which may not be exceeded for any length of time.

- **Chemical Hygiene Officer (CHO):** An employee qualified by training or experience to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. (See Part 4.1)

- **Chemical Laboratory:** A chemical laboratory is defined as an area (which can be a single room, a group of rooms, or a part of a room where chemical manipulations are done for research, educational, or clinical purposes. The manipulations must involve mixing different hazardous chemicals in a variety of formulations, done on a small scale (one person can easily handle the volume of the chemical in use).

- **Control(s):** Equipment, wearing apparel, or prescribed procedures which, when in good working order and properly used, will prevent laboratory employees from being exposed to hazardous materials.

- **Control Area:** Based on the International Fire Code (IFC), a control area is an area that may include a suite of laboratories, one or more floors in a building or an entire building where storage of hazardous materials limits apply. Buildings under newer codes have reduced hazardous material storage quantity limits above the second floor. To assure compliance with the IFC, contact EHS.

- **Department Safety Coordinator (DSC):** An employee who facilitates the flow of health and safety information and programs form EHS into the campus workplace. DSCs work as a liaison between departmental personnel and EHS staff and function as frontline staff in working to achieve safety and regulatory compliance within the department. DSCs are appointed by the department head.

- **Designated Area**: An area which may be used for storage and work with select carcinogens, reproductive toxins, or substances which have a high degree of acute toxicity. A designated area may be an entire laboratory, a section of a laboratory, or a device within a laboratory, such as a fume hood.

- **Engineering Control:** A device or apparatus designated to contain or reduce the risk of hazardous materials. Examples include ventilation, laboratory fume hoods, and shielding. Personal protective equipment such as gloves and face shields are not engineering controls.

- **Exposure:** Physical contact of a person with any material (solid, liquid, or gas) or any form of energy (temperature extreme, electricity, laser, ionizing or non-ionizing radiation, etc.).

- **Exposure Assessment:** The gathering of information by one or more of the following methods for the purpose of estimating the extent of exposure.

    - Interview,
    - Inspection,
    - Sampling and analysis of air, water, etc.,
    - Investigation of materials and/or procedures used,
    - Medical evaluation, and
    - Other forms of inquiry as deemed appropriate by the Chemical Hygiene Officer.

- **Hazardous Chemical / Hazardous Substance / Hazardous Energy**: A chemical, substance, or form of energy for which there is statistically significant evidence, based on at least one scientific study, that acute or chronic health effects may result from exposure to that chemical, substance or energy. This definition includes substances which present both physical and health hazards.

- **Health Hazard:** Health hazards 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.

- **Highly Toxic Chemical:** A chemical falling within any of the following categories:

  (a) A chemical that has a median lethal dose (LD_{50}) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

  (b) A chemical that has a median lethal dose (LD_{50}) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.

  (c) A chemical that has a median lethal concentration (LC_{50}) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

- **Laboratory Personnel:** An individual in a laboratory who may be exposed to hazardous chemicals in the course of their assignments.

- **Laboratory Scale:** Work with substances involving containers that can be easily and safely manipulated by one person.

- **Laboratory Supervisor:** An individual who is responsible for setting a standard of behavior and be a safety role model. Provide safety oversight of day-to-day laboratory operations. Incorporate safety discussions in lab group meetings for continuous improvement of best safety practices.

  In most research laboratories, the faculty member, principle investigator or research laboratory supervisor is designated as the laboratory supervisor.

  In non-research or teaching laboratories, the department head or chair should designate who the laboratory supervisor or responsible party may be.

  The responsible party must ensure that the lab has a chemical hygiene plan, chemical inventory is maintained, identify and assess hazards, document and enforce appropriate safety practices, ensure signage and labels are in place, provide and document training, ensure staff have access to safety information such as safety data sheets, and perform accident follow-up.

- **Lower Flammable Limit (LFL) / Lower Explosive Limit (LEL):** The minimum concentration (percent by volume) of flammable vapor in air below which the mixture cannot be ignited.

- **Permissible Exposure Level (PEL):** The maximum concentration of a contaminant in breathing air to which a laboratory worker may be legally exposed, as an 8-hour weighted average.

- **Physical Hazard:** A substance for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric (ignites spontaneously in air), unstable (reactive) or water-reactive. Substances, processes, and forms of energy are also considered to be physical hazards if

they involve a potential for skin or eye contact with a hot or cold material, surface, or source of energy sufficient to cause tissue damage or loss of eyesight.

- **Principal Investigator (PI):** An individual who is required to set a standard for behavior and be a safety role model. In research laboratories, the PI is considered the responsible party. The responsible party must ensure that the lab has a chemical hygiene plan, chemical inventory is maintained, identify and assess hazards, document and enforce appropriate safety practices, ensure signage and labels are in place, provide and document training, ensure staff have access to safety information such as safety data sheets, and perform accident follow-up. The PI has the authority to enforce correct procedures.

- **Reproductive Toxins:** Chemicals that affect the reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogeneses).

- **Required Respirator:** An appropriate respirator, which is worn to prevent the wearer from breathing a contaminant whose concentration in the air exceeds the PEL. A respirator is required when the air in a work place contains one or more contaminants exceeding a PEL or when sudden failure of an engineering control would create an exposure above the STEL. (Note: Other methods of exposure control take precedence over respirator use. A required respirator is to be used only in situations where other forms of exposure control are not possible. Regulations require that any employee who must work in a respirator be certified by a physician to be physically fit to work in that respirator. This certification must be obtained before the employee can be allowed to work while wearing a respirator, whether supplied by the employer or not.

- **Select Carcinogen:** Any substance that meets one of the following criteria:
    - It is regulated by regulations as a carcinogen, or
    - It is listed under the category “Known To Be Carcinogens” in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition), or
    - It is listed under Group 1 (Carcinogenic To Humans) by the International Agency for Research on Cancer Monographs (IARC) (latest edition), or
    - It is listed in either Group 2A or 2B by IARC or under the category “Reasonably Anticipated To Be Carcinogens” by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
    - 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/m^3,
    - After repeated skin application of less than 300 mg/kg of body weight per week, or
    - After oral dosages of less than 50 mg/kg of body weight per day.

- **Short Term Exposure Limit (STEL):** The maximum concentration of a contaminant in breathing air to which a laboratory employee may be legally exposed, as a time weighted average, for a maximum (for most contaminants) of 15 minutes.

- **Well Ventilated Area:** An area where the ambient conditions of use include sufficient ventilation to prevent a flammable or combustible vapor/air mixture from reaching the LFL/LEL and the concentration of air contaminants in the breathing zone of laboratory workers from exceeding a PEL.

4.0 Responsibilities

4.1 University Chemical Hygiene Officer

The Director of Environmental Health and Safety or designee will serve as the University Chemical Hygiene Officer (CHO). The CHO is responsible for the development and implementation of chemical hygiene policies and practices in the laboratory. He or she will:

- Monitor the procurement, use, and disposal of chemicals used in the laboratory,
- See that appropriate inspections are maintained,
- Help the Laboratory Supervisor develop precautions and adequate facilities to maintain the safety of laboratory personnel
- Know the current legal requirements concerning regulated substances,
- Maintain adequate records detailing efforts and results of employee exposure monitoring, including associated accident reports, medical consultations and examinations when applicable,
- Seek ways to improve the CHP, and
- Develop and oversee implementation of the CHP.

4.2 Dean, Department Chair and Director

The Dean, Department Chair and Director are responsible for the following:

- Ensure safety of occupants by being knowledgeable in department safety plans, the university's accident prevention program and taking reasonable approaches to minimizing hazards and risks.
- Enforce laboratory control methods by promoting creation, maintenance and implementation of standard operating procedures.
- Ensure that laboratory personnel are trained in safety procedures.
- Ensure that safety records are maintained.
- Ensure appropriate safety equipment is provided.
- Review accidents, ensure corrective actions are taken as necessary to prevent recurrence.
- Review and follow up on inspection findings to ensure corrective actions are completed.
- Ensure appropriate laboratory closures and moves are done responsibly. For more information, contact EHS.
- As needed, identify and assign laboratory supervisors or responsible parties to teaching or research laboratories.

4.3 Laboratory Supervisor / Principal Investigator

The terms "laboratory supervisor" and "principal investigator" may be synonymous, particularly in research laboratories. The Dean, Department head or Director will assign a laboratory supervisor to teaching laboratories. The Laboratory Supervisor is responsible for chemical hygiene in the laboratory. The Laboratory Supervisor shall ensure:

- Laboratory personnel know and follow the chemical hygiene rules,
- Protective equipment is available and in working order, (See 5.4 – Personal Protective Equipment),
- Laboratory personnel have been provided with appropriate training, (See Part 13 – Employee Training)
- Facilities and training for the use of any material being ordered are adequate, (See Part 6 – Chemical Procurement, Distribution, and Storage)

- Locations of any control areas within the laboratory are defined, and inventory of any toxic substances and potential or known carcinogens are properly maintained,
- Unwanted and/or hazardous chemicals and hazardous waste are disposed properly,
- The University Chemical Hygiene Officer is notified of all incidents that constitute a danger of environmental contamination or that cause laboratory workers to be exposed to hazardous materials where symptoms of exposure are evident and/or medical treatment is rendered,
    - Note: “danger of environmental contamination” refers to the spill or release of a hazardous chemical when the nature of the material or the circumstances of the spill are such that personnel in the immediate area cannot clean up the spill without further environmental contamination or increased exposure to the hazardous material.

4.4 Laboratory Personnel

Each laboratory personnel is responsible for planning and conducting all operations in accordance with the chemical hygiene procedures and developing good personal chemical hygiene habits. This includes:

- Understanding the function and proper use of personal protective equipment and using personal protective equipment when mandated or necessary,
- Notifying the Laboratory Supervisor of conditions or actions that could result in an accident or injury, or significant problems arising from the use of the Standard Operating Procedures, and
- Asking the Laboratory Supervisor for clarification of any of the above responsibilities which they do not fully understand.

4.5 Department Safety Coordinator (DSC)

The Department Safety Coordinator supports the department chair or director in implementing the CHP and acts as a liaison between the department and the EHS staff in addressing significant, complex or large scale safety challenges. The list below focuses on laboratory safety responsibilities and is not all-inclusive.

- Develop safety training plans for faculty and staff within the department,
- Coordinate departmental safety trainings and maintain safety training records for faculty and staff within the department to ensure compliance with safety training plans,
- Coordinate department chemical acquisition and hazardous waste disposal,
- Manage the department’s chemical inventory system and ensure availability of SDSs for all departmental chemicals,
- Serve as initial point of contact for laboratory safety questions and issues within the department,
- Maintain laboratory emergency response equipment including first aid kits and spill response materials,
- Serve as point of contact for compiling annual department wide hazard assessment for laboratory work,
- Maintain current CPR and First Aid certifications,
- Conduct general housekeeping inspections ensuring access to emergency equipment and follow up monitoring on areas of risk identified during EHS laboratory inspections.

4.6 Laboratory and Chemical Safety Committee (LCSC)

The LCSC is composed of faculty, staff, a student representative and reports to the Provost and Vice President of Business and Financial Affairs. The committee's purpose is to help guide laboratory safety decisions, including instructional, research and support functions at Western. The committee will also provide guidance on procurement and movement of hazardous chemicals for University-related business and on University property. Committee tasks include:

- Provide oversight for the implementation of the University's Chemical Hygiene Plan;
- Review injuries, illnesses, and incidents related to laboratory work or other use of hazardous chemicals;
- Review the University's laboratory employee medical monitoring program;
- Recommend remedial action to correct laboratory safety infractions;
- Review records and reports from individuals responsible for monitoring laboratory safety practices;
- Formulate and review the University's training program for safe work practices in the laboratories; and,
- Review hazardous material procurement policy and procedures.

4.7 Environmental Health and Safety (EHS)

The Environmental Health and Safety Department is responsible for the following:

- Develop and update the Chemical Hygiene Plan (CHP) template. EHS will make the CHP available through electronic methods and via paper if requested. EHS will also assist laboratories, as needed, with the development of laboratory-specific information required to complete their CHP.
- Liaise between the University and regulatory agencies enforcing environmental, health and safety regulations.
- Advise and act as a resource regarding laboratory safety issues.
- Perform laboratory inspections
- Maintain a system for safety data sheet (SDS) and chemical inventory management
- Develop general training courses in laboratory safety and provide general laboratory safety training classes, if needed

5.0 Standard Operating Procedures

5.1 General Safety Guidelines

- Never work alone at a potentially dangerous activity.
- When working with flammable materials, be certain there are no sources of ignition near enough to cause a fire or explosion in the event of a spill or vapor release.
- Use a shield for protection whenever an explosion or implosion is possible.
- The hazardous properties of each material used in a procedure must be determined before the first time it is used. Assume a mixture to be more toxic than any of its components.
- Use proper protective equipment whenever required. Refer to the Department Safety Information Book, Section 5, Personal Protective Equipment.

- Know the location and proper use of emergency equipment and be familiar with emergency procedures.
- Minimize all chemical exposures; avoid skin contact with chemicals. Immediately notify a Laboratory Supervisor if exposure to a hazardous substance occurs.
- Store chemicals in tightly closed containers with readable and accurate labels. (See 7.1 Labeling Hazardous Materials)
- Use of hazardous chemicals that may produce gases, fumes, or hazardous vapors must be conducted in a working fume hood. Never use highly toxic agents, carcinogens, or reproductive toxins outside of a working fume hood, unless previously discussed with the Laboratory Supervisor.
- Type and scale of work conducted in a laboratory must be appropriate to the physical facilities as well as the quality of the ventilation system.
- Be alert to unsafe conditions and report them to the Laboratory Supervisor or the Environmental Health and Safety office for correction.
- Visitors to the laboratory are to be escorted by authorized lab personnel and are the responsibility of that individual. All safety regulations must be observed.

5.2 Unattended Operations

An experiment is considered to be an unattended operation if there is no one immediately present who fully understands the operation and shutdown procedure to be used in the event of an emergency. Reactions that are not well understood should not be permitted to run unattended.

- Unattended operations should be prominently labeled with the laboratory employee's name, start date and time, intended stop date and time, and contact information for the laboratory worker and faculty advisor, if applicable. Leave the laboratory lights on and post warning signs of any associated hazards (e.g. flammable, reactive, explosive, etc.).
- Unattended operations that could result in a fire or explosion should be equipped with the necessary automatic shutdown controls.
- Use necessary shields or barriers to contain splashes, explosions or other releases.
- Establish provisions for containment of toxic substances in the event of a utility service failure, such as loss of cooling water.

5.3 Personal Hygiene

- Avoid skin contact with chemicals; wash promptly whenever a chemical contacts the skin.
- Avoid inhalation of chemicals; do not smell or taste chemicals.
- Never pipette by mouth or use mouth suction to start a siphon.
- Never bring food, chewing gum, beverages, cigarettes, or food containers into the laboratory. Never eat, drink, smoke, bite fingernails, apply cosmetics, or handle contact lenses while in the laboratory.
- Always wash hands with soap and water before leaving the laboratory and before eating, drinking, smoking, using the restroom, applying cosmetics, or handling contact lenses. Areas of exposed skin (such as the forearms) should be washed frequently if there is a potential for contact with chemicals.
- Never store food in a refrigerator that is used to store chemicals.
- Never use laboratory glassware or utensils for storage, handling, or consumption of food or beverages.
- Ice generated for laboratory use shall not be used for human consumption or food storage.

5.4 Personal Protective Equipment

- Laboratory workers must always wear appropriate eye protection whenever anyone is working with hazardous materials or performing hazardous process in the laboratory. Goggles must be worn when there is a potential for splashing or spilling of a hazardous liquid. Face shields should be worn when appropriate.
- When working with hazardous chemicals, wear gloves made of a material that is resistant to permeation by that chemical. Latex gloves are typically not permitted for chemical handling. If latex gloves are warranted, potential allergic reactions to latex should be considered prior to use. Disposable nitrile gloves are the minimum hand protection for chemical use. Refer to safety data sheets for proper glove type and make note of permeation data as some chemicals can pass through a protective film without going through pinholes, pores or other visible openings.
- Protect skin and feet with adequate clothing and footwear.
- Confine loose hair and clothing while working in the laboratory.

The Laboratory Supervisor (or designee) will be responsible for selecting and acquiring appropriate personal protective equipment, maintaining its availability, and establishing cleaning and disposal procedures. Standard personal protective equipment must be provided by the employer to employees free of cost. Student or other non-employee laboratory personnel may be required to purchase personal protective equipment.

Refer to Western Washington University's Safety Information Book, Section 5 (Personal Protective Equipment), Section 13 (Respiratory Protection Program), and Section 14 (Hearing Conservation Program).

Chemical protective clothing must be removed before leaving the work area. Gloves should be removed before touching other surfaces, such as doorknobs, drawer pulls, or faucet handles.

- Gloves and goggles are available in a marked drawer in the Marine Chemistry Lab (ME35).
- Lab coats are available in the hallway outside of the Marine Chemistry Lab (ME35).
- Fume hoods are located in the Water Quality Lab (ME03) and the Marine Chemistry Lab (ME35).

5.5 Clothing

- Laboratory coats or aprons shall be worn by laboratory personnel whenever handling liquids that are injurious to or absorbed through the skin.
- Laboratory coats must be cleaned regularly. If a spill occurs on the laboratory coat or personal clothing, it must be either decontaminated before reuse or disposed of as hazardous waste.
- Laboratory coats must not be laundered with personal laundry.

The commercial firm laundering any contaminated work clothing shall be notified of potentially contaminated substances. Grossly contaminated clothing shall be bagged and disposed of as hazardous waste.

5.6 Housekeeping

- Lab areas should be kept clean and uncluttered. Spills must be immediately cleaned and floors must be maintained dry at all times. Contaminated glassware should not be left out.

- Access to exits, emergency equipment, eyewashes, safety showers, fire extinguishers, emergency spill equipment, circuit breakers, and fire alarm pull boxes must never be blocked.
- All chemical containers must be labeled with (at least) the identity and hazards of its contents.
- Waste must be properly labeled and kept in proper containers. (See Section 14 – Waste Disposal Procedures)
- Chemicals should be stored in an earthquake-safe storage area and should be returned to their storage area after use.

5.7 Operations Requiring Prior Approval

The following laboratory operations require prior approval from the department head, department safety coordinator, or laboratory supervisor.

- Newly developed high hazard experiments or processes
- Procedures for which the laboratory worker has not been trained
- Operations or activities for which there are no written procedures,
- Completing a medical examination prior to respirator use when performing procedures involving certain hazardous substances
- Work with unknown substances,
- Work in designated areas.
- Chemical purchases, which should be made through MarketPlace and be approved by SPMC designated staff.
- Bringing chemicals to SPMC from another lab
  Anyone bringing chemicals to SPMC from off-site must fill out a Chemical Acquisition Form. Upon leaving SPMC, researchers must inform the DSC whether these chemicals will be turned over to the DSC to remain in the SPMC inventory, disposed of, or taken off site.
- Use of chemicals that are classified as highly toxic (see p. 5) or select carcinogens (see p. 39) requires approval of the SPMC Chemical Control Board. Anyone planning to use these chemicals should notify the DSC well in advance of the planned start of the use of the chemicals and fill out and submit to the Chemical Control Board a Hazardous Chemical Approval form to request approval.
- Use of the Marine Chemistry Facilities (which include the Marine Chemistry Lab (ME35), Instrument Lab (ME38), Chemical Storage Room (ME34), Balance Room (ME37) and Water Quality Lab (ME03)) by students outside of normal SPMC operating hours (M-F, 8:30a.m. – 4:30 p.m., excluding University holidays) requires specific approval from the student's supervisor or instructor.

5.8 Planning Chemical Laboratory Experiments

- Consider all possible reactions, including side-reactions, before beginning.
- Think through all reactants, intermediates, and products in terms of flammability, toxicity, route of entry, and reactivity hazards.

- Follow recognized safe practices concerning personal protective equipment, housekeeping, and handling of hazardous chemicals as outlined in this chemical hygiene plan.
- When conducting unknown reactions, always start with small quantities of material and carefully observe reaction characteristics before increasing quantities.
- Obtain safety information about reactants and by-products.
- If possible, determine the quantity and rate of evolution of heat and gases to be released during the reaction.
- Provide adequate cooling, ventilation, pressure relief, and gas purging. If possible, isolate the reaction vessel and make frequent inspections of equipment during the reaction. Do not leave a hazardous system unattended.
- Consider the recommended first aid treatment for each reactant, intermediate, and products.
- Develop a plan of action for situations such as power failure, cooling system failure, exposure of the system to water or air, unexpected increase in pressure, or broken reaction containers.

5.9 Utility and Safety Equipment Shutdowns or Failures

In the event that building utilities or safety equipment are not functioning due to a scheduled shutdown or unplanned failure, chemical laboratory experiments and other hazardous processes should be cancelled until systems are confirmed operational by EHS or FM.

5.10 Emergency Procedures

Refer to Western Washington University Safety Information Book, Section 2 (Emergency Chemical Procedures) for information on emergency procedures and the Departmental Emergency Plan.

5.11 Accidents and Accident Reporting

Accidents or injuries that occur in the laboratory and require medical treatment must be reported immediately and treated immediately. Personnel trained in first aid and CPR must be available during working hours to render assistance until medical help can be obtained.

All accidents, whether resulting in injury or damage, should be carefully analyzed with the results reported to all who might benefit. Accident reports will be kept on file with the Director of Environmental Health and Safety and will be made available to personnel upon request. Please refer to Western Washington University Safety Information Book, Section 4 (General Safety Information Accident Prevention Plan) for more information on accident reporting.

6.0 Chemical Procurement, Distribution, and Storage

6.1 Chemical Procurement and Distribution

- The Department Safety Coordinator reviews the purchase of all new hazardous chemicals. Prior to purchase of new hazardous chemicals, the following must be considered:
    - Proper storage, handling, and disposal procedures,
    - Facility requirements for safe handling of the material, and
    - Personnel training or proficiency necessary for safe handling of the material.
- Before a substance is received, information of proper handling, storage, and disposal should be known. All Safety Data Sheets (SDSs) received with shipments to a laboratory will be maintained in the department either electronically or via paper method. Please refer

to Western Washington University Safety Information Book ,Section 6 (Hazard Communication) for more information on SDS Management.

- SDSs at SPMC must be on file in the file cabinet outside the Marine Chemistry Lab (ME35) before a chemical can be used. Chemicals will remain under the control of the SPMC DSC until SDSs are on file.
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- No container will be accepted without an adequate identifying label. This label should include the substance name, an appropriate hazard warning, and specific target organ effects.

6.2 Chemical Inventory

- The chemical inventory is kept in the department. Refer to Western Washington University Safety Information Book, Section 6 (Hazard Communication) as it provides the inventory or its location.
- Physical inventories are conducted annually to identify leaking or damaged containers, containers with missing or illegible labels, and chemicals that are no longer needed.
- All chemicals at SPMC, whether purchased or transported from another location, must be logged into the chemical inventory and labeled according to the directions posted on the chemical inventory binder located in the Chemical Storage Room (ME34). The Marine Chemistry Technician will maintain an inventory of all chemicals at SPMC and will maintain specific inventories of chemicals in the Marine Chemistry (ME35) and Instrument Labs (ME38). Individual PIs/Laboratory Supervisors are responsible for maintaining inventories of chemicals in their lab areas.

6.3 Chemical Distribution

- When chemicals are hand-carried, they are placed in a secondary container to protect against breakage and spilling.
- Carts are available for chemical transport at SPMC. They are located near the elevators on the 1st, 2nd, and 3rd floors and should be returned to those locations after use.
- Large compressed gas cylinders are transported with a suitable handcart and strapped in place during transport.

6.4 Chemical Storage Practices

Establish and follow safe chemical storage and segregation procedures for your laboratory. Practices will include:

- Provide an appropriate storage place (following guidelines in Appendix 7B, Table 7-2) for each chemical and return the chemical to that location after use.
- Storage and working amounts of hazardous chemicals are kept to a minimum.
- Chemical storage in fume hoods is kept to a minimum.
- Chemicals are stored in containers with which they are compatible; containers are kept closed when reagents are not being used.
- All chemical containers must have a legible, firmly attached label. The containers are dated when received and when opened.
- Keep peroxide forming chemical containers tightly closed and away from light sources. Containers should also be opaque. Label container with the date received and date

opened. Test for peroxides regularly, preferably before each use. Record the test data on the label for the next user. If the concentration exceeds 10 ppm, contact your department safety coordinator, immediate supervisor or EHS at x3064. (See 7.1 Labeling Hazardous Materials and 16.3.1 Reactive Chemicals and Appendix 7B, Table 7-5)

- Compressed gas cylinders are individually secured at all times; cylinder caps must be in place on cylinders when not in use.
- Incompatible chemicals must be segregated. See Appendix 7C, Table 7-2 for a partial list of incompatible chemicals.
- Chemicals are stored on shelves or in cabinets that prevent the containers from falling in the event of an earthquake. Heavy items and corrosive materials are stored on shelves near the floor.
- Avoid storing chemicals on bench tops
- Avoid storing chemicals in laboratory hoods
- Containers of chemicals must be capped when not in use; make sure that caps on containers are secure; replace damaged caps.
- Chemicals should not be stored under the sink, near the sink or in the sink, to minimize the chance of accidents and improper discharges to the sanitary sewer. Any vapors of corrosive materials and bases will cause corrosion of the plumbing fixtures under the sink. Some chemicals, including many corrosives, are water reactive and, in the event of a water leak, there can be unanticipated and unfortunate consequences.
- Do not store chemicals in hallways, corridors or exit ways.
- Use secondary containment to prevent incompatible chemicals from mixing and reacting with each other if they must be stored adjacent to each other on a benchtop.
- Maintain the lowest possible quantities of highly toxic chemicals
- Chemicals with a high degree of toxicity (e.g. venoms, mycotoxins, and select agents) should be doubly contained and stored in a locked area accessible only by authorized personnel.
- If containers are placed on refrigerator/freezer door shelves, use secondary containers, additional barriers, Velcro or other protective measures to keep them from falling out when the door is opened.
- Use secondary containment or spill control, such as placing the container on an absorbent pad (generally required for containers on the floor).

6.5 Spill Response

Locations where chemicals are stored should have available a supply of equipment and materials for use in the event of a chemical spill. Spill response materials may include:

- Absorbent
- Personal protective equipment
- Scoops and/or pans for picking up granular solids
- Plastic bags to contain contaminated absorbent

For spills creating an airborne hazard or that require equipment beyond standard laboratory apparel, contact the Environmental Health and Safety office for assistance in containment and clean up.

7.0 Hazard Identification

- All chemical containers must have a legible, firmly attached label showing the contents of the container.
- Labels on incoming containers of hazardous chemicals must not be removed or defaced.
- Safety Data Sheets (SDSs) received with incoming shipments of hazardous chemicals are maintained and made readily accessible to laboratory personnel. SDSs are kept in the department. Refer to Western Washington University Safety Information Book, Section 6 (Hazard Communication) for information on SDS locations.
- A hazard review of new materials not previously used in the laboratory shall be completed before working with the new material. The Department Safety Coordinator or Laboratory Supervisor conducts this review. (See Part 6.1 – Chemical Procurement and Distribution)
- Chemical substances developed in the laboratory are assumed to be hazardous in the absence of other information.
- Laboratory areas that have special or unusual hazards should be identified with an appropriate warning sign.

7.1 Labeling Hazardous Materials

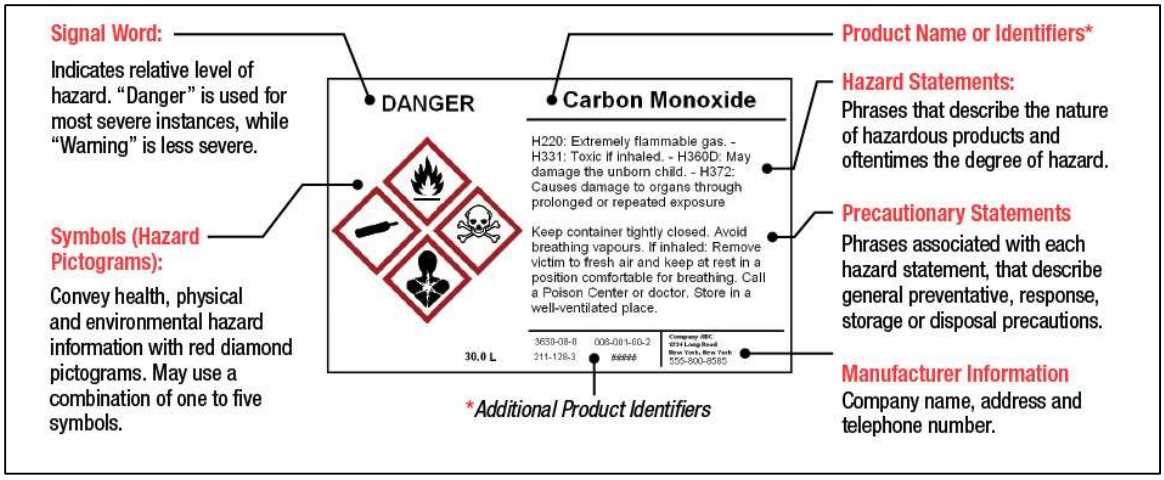
1. Original Container

The label on an original container must be legible and written in English. It must include the chemical/ product name as shown on the safety data sheet (SDS) and the manufacturer's name and address. Do not accept materials if the label is illegible or missing required information.

Beginning June 1, 2015, labels on chemicals and products shipped from the manufacturer must be consistent with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) as required by Washington Administrative Code (WAC) 296-901. There are six required WAC elements as of June 1, 2015:

1. Product name
2. Manufacturer's name and contact information
3. Signal word (e.g., danger, warning or no signal word)
4. Hazard statement(s) (e.g., toxic if inhaled, combustible liquid)
5. Pictogram(s)
6. Precautionary Statements (e.g., keep container tightly closed)

Figure 7-1, Example of Original Label



Avoid damaging the original container's label, if possible. If a container label becomes illegible, replace the label. The replacement label must include the six required WAC elements to be in compliance with GHS rules, Contact EHS at 360-650-3064 or ehs@wwu.edu for assistance.

2. Labeling Stock/ Working Solutions

Containers of preparations, sample aliquots, and other working solutions are not required to be labeled if the container will be emptied before the end of the work shift and used by only one person. If a preparation or working solution is kept for a longer period than day of use or be used by others, the container must be labeled with the following information:

- Identity of the contents (spell out chemical names)
- Signal word, if known or suspected (e.g., danger, warning)
- Hazards, if known or suspected (e.g., flammable, corrosive, irritant)

It is also "best practice" to label the working solution with the initials of the person preparing the solution and the date of preparation. Information about the signal word, the hazards, and the precautionary statements from the label, can be obtained from the SDS, but dilutions and reactions may change the hazards and their severity. See Table 7-1 below for examples of physical and health hazards.

Table 7-1.

List of Physical and Health Hazards of Chemicals
Physical Hazards
Combustible Liquid
Compressed Gas
Explosive
Flammable
Organic Peroxide
Oxidizer
Pyrophoric
Unstable (reactive)
Water-reactive
Health Hazards
Carcinogenic
Acutely Toxic

Chronically Toxic
Reproductive Toxin
Irritant
Corrosive (acid/ base)
Hepatotoxins (liver)
Nephrotoxins (kidney)
Neurotoxins (central nervous system)
Agents which damage the lungs, skin, eyes, mucous membranes
Agents which act on the hematopoietic system

a. Labeling Specialized Containers

Containers that are too small for labels, installed into a process, or would become unusable for their intended purpose if labeled, must still have their contents identified in some way. Use any labeling method that enables personnel and visitors from other agencies, such as the fire department, to identify the chemicals and their hazards. Examples include a sign identifying the materials and their hazards, color or numeric codes cross-referenced on a chart, or room diagrams identifying locations of the chemicals and hazards.

b. Additional Label Required for Peroxide-Forming Chemicals

Label chemicals that form peroxides with the date the container was first opened. This will assist in conducting tests for peroxides at an appropriate frequency as noted in the University and each department's Chemical Hygiene Plan.

c. Labeling Waste Containers

Waste containers must be labeled following guidelines in Section 10 Hazardous Waste Program of the Safety Information Book. If re-using a container to hold waste, the container must be compatible and appropriate for the waste. Completely deface all old labels on containers used for wastes.

For radioactive and biological waste, please contact your department safety coordinator or EHS at x3064.

8.0 Environmental Monitoring

Employee exposure to regulated substances shall not routinely exceed the action level or, in the absence of an action level, the PEL. When there is reason to believe that employee exposure levels of regulated substances are routinely exceeding the action levels, employee exposure to these substances will be monitored.

In the event that the action level is exceeded, Western Washington University will immediately comply with the exposure monitoring requirements of the standard for that substance (WAC 296-62). In addition, environmental monitoring of airborne concentrations of hazardous chemicals should be conducted in the following conditions:

- When requested by a laboratory employee or a concerned party as a result of a documented health concern or suspicion that a PEL is being exceeded,

- When a highly toxic substance is being regularly and continuously used outside of a chemical fume hood (three or more times a week)

The Environmental Health and Safety office will ensure that employee exposure is monitored. Exposure testing procedures and monitoring results are provided to the Department Head, Laboratory Supervisor, and personnel within 15 working days after receipt of the results. An accurate record of all measurements taken to monitor employee exposures will be kept, transferred, and made available for each employee in accordance with Provide access to employee medical records, exposure records and analyses requirement (WAC 296-802-40005).

9.0 Maintenance and Inspections

9.1 Maintenance

All local exhaust ventilation hoods and other engineering controls shall be functioning properly. Improperly functioning equipment, out of service equipment, and equipment under repair shall be tagged "OUT OF SERVICE" and locked out if possible. The equipment shall not be restarted without the approval of the Chemical Hygiene Officer or designee, Laboratory Supervisor, and Facilities Maintenance personnel.

9.2 Perform Safety and Health Audits and Assist External Inspections

It is recommended that laboratory staff perform periodic audits of the laboratory. An audit checklist is available in Section 4 of the Safety Information Book, *General Safety – Accident Prevention (pages A4-21 to A4-23)* and can be modified with additional laboratory-specific components.

Safety and health audits should be performed at least annually. Turnover of personnel, new laboratory equipment and procedures may warrant more frequent inspections. It is recommended that all audits are documented and performed by different individuals for educational purposes and opportunities for diverse viewpoints. If deficiencies are identified, they must be addressed. Documentation should be retained for six years after calendar year then destroyed.

When notified of third-party inspections (e.g. EHS lab inspection), the responsible party should be responsive in scheduling and providing laboratory-specific information as requested. Survey findings should be addressed and corrected in a timely manner. All laboratory staff should support the inspection process.

Facilities Management will conduct inspections of chemical fume hoods, safety showers, eyewashes, and fire extinguishers as prescribed in the preventative maintenance schedule.

Facilities Management inspects the following items at appropriate intervals:

- Emergency lighting and/or illuminated exit signs,
- Fire alarms,
- Smoke and heat detectors and sprinklers,
- Fire doors, and
- Fire suppression systems.

10.0 Medical Program

Medical attention, including medical consultation and follow-up, is provided to employees under the following circumstances:

- Where exposure monitoring is over the action level for a regulated substance that has medical surveillance requirements.
- Whenever a laboratory employee develops signs or symptoms that may be associated with a hazardous chemical to which the employee may have been exposed in the laboratory.
- Whenever a spill, leak, or explosion results in the likelihood of a hazardous exposure.

All medical examinations will be provided by or under the direct supervision of a licensed physician, at no cost to the employee, without loss of pay, and at a reasonable time and place. All questions

regarding medical consultations and examinations should be directed to the Chemical Hygiene Officer.

When medical consultations or examinations are provided, the examining physician will be provided with the following information:

- The identity of the hazardous chemical(s) or material(s) to which the employee(s) may have been exposed,
- The SDSs for the hazardous chemical(s) or material(s) if available,
- A description of the conditions under which the exposure occurred, including quantitative exposure data if available, and
- A description of the signs and symptoms of exposure that the employee is experiencing, if any.

For examinations or consultations provided to employees, the Chemical Hygiene Officer shall obtain a written opinion from the examining physician. It shall include:

- Recommendations for further medical follow-up,
- Results of the examination and associated tests,
- Any medical condition revealed that places the employee at an increased risk of exposure to a hazardous substance found in the workplace, and
- A statement that the employee has been informed of the results of the examination or consultation.

The written opinion will not reveal specific diagnoses unrelated to occupational exposure, except as noted above.

The Environmental Health and Safety office keeps an accurate record of any medical consultations or medical examinations. Records for each employee are transferred and made available as specified under WAC 296-802-4005, Provide access to employee medical records, exposure records, and analyses.

11.0 Emergency Equipment

11.1 General

The Dean, Department Chair, Department Head, or Director will ensure that adequate emergency equipment is available in the laboratory and inspected periodically to ensure that it is functioning properly. Signs may be posted to show the location of safety showers, eyewashes, exits, first aid kits, fire extinguishers, etc. Each laboratory employee must be familiar with the location, application, and/or correct way to operate the following emergency equipment:

- Fire extinguishers,
- Fire alarms,
- Fire doors,
- Smoke detectors,
- Fire sprinklers
- Safety showers,
- Eyewashes,
- First aid kits.

11.2 Fire Extinguishers

- Fire extinguishers are provided along normal paths of travel per fire code.
- Fire extinguishers are labeled to show the type of fire for which they are intended.

- Access must be maintained and the location clearly marked in an appropriate manner.
- The fire extinguisher type and size must be selected for the appropriate hazards.
- Documented inspections are conducted at least annually by Facilities Management to ensure:
    - The extinguisher is in its designated location,
    - Access is maintained,
    - The pin is in place and attached with unbroken wire,
    - The indicator, if present, is in full range, and
    - No physical damage is evident.

11.3 Fire Alarms

- Fire alarms are provided along normal paths of travel and exit routes.
- Access must be maintained and the location should be clearly marked in an appropriate manner.
- Documented inspections involving activation of fire alarms are conducted at appropriate intervals to insure proper operation.

11.4 Fire Doors

- Fire doors are provided per building codes, fire codes, and fire insurer's requirements.
- Fire doors are not blocked open and must be able to close properly.
- Inspections are conducted at appropriate intervals to ensure proper working order.

11.5 Smoke or Heat Detectors

- Smoke or heat detectors are selected and installed for the appropriate hazards per building code, fire codes, and fire insurer's requirements.
- Inspections are conducted at appropriate intervals to ensure proper working order.

11.6 Safety Showers

- Safety showers are within the work area for immediate emergency use.
- Safety shower water is potable and provides at least fifteen minutes of flushing.
- Access is maintained at all times.
- Inspections are conducted by Facilities Management to ensure adequate flow.

11.7 Eyewashes

- Eyewashes are within the work area for immediate emergency use.
- Eyewashes are plumbed, whenever possible. Water is potable and provides at least fifteen minutes of flushing.
- Access is maintained at all times.
- Inspections are conducted by Facilities Management to ensure adequate flow.

11.8 First Aid Kits

- First aid kits are available for treatment of minor injuries or for short-term emergency treatment before medical assistance is available.
- Inspections are conducted by the Department Safety Coordinator or designee to ensure first aid kits are adequately stocked and maintained.

11.9 Emergency Lighting

- Emergency lighting provides adequate illumination for evacuation during an emergency situation or power failure.
- Inspections are conducted at appropriate intervals to ensure proper working order.

11.10 Fire Suppression Systems

- The fire suppression system is selected based on the hazards.
- Documented inspections involving activation of the system are conducted at appropriate intervals to ensure proper working order.

11.11 Emergency Blankets

- Blankets may be provided in the vicinity of safety showers to prevent shock and provide privacy.
- If present, inspections are conducted annually by the department safety coordinator or a designee to ensure blankets are not contaminated or damaged.

12.0 Record Keeping

- The Environmental Health and Safety office retains accident and incident records, medical records and industrial hygiene monitoring records.
- Departments maintain Safety Data Sheets
- Departments maintain chemical inventories and department-related inspections of equipment and training.

13.0 Employee Training

13.1 Training

- Refer to the Safety Information Book, Section 3, Responsibilities, for information on training responsibilities. Generally, the Department Safety Coordinator or Laboratory Supervisor trains all laboratory employees on the hazards of the chemicals present in their work area. The purpose of this training is to assure that all laboratory employees are adequately informed about the risks associated with working in the laboratory and what to do in the event of an accident.
- Training is provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present. Additional training is provided prior to assignments involving new exposure situations. Refresher information and training is provided annually. The department maintains employee training records and sends a copy to the Environmental Health and Safety office. (See Appendix A for sample.)
    - General lab safety, personal protective equipment and hazardous waste training, among other required elements can be accessed by contacting EHS at x3064 for enrollment in an on-line course. This training may become basic departmental lab training, or may be used to supplement departmental training.
- Employees may not use any personal protective clothing until they have received instruction on the proper selection, use, and limitations of the equipment. Refer to the Safety Information Book, Section 5, Personal Protective Equipment.
- Training should include:
    - Methods used to detect the release or presence of hazardous chemicals,
    - Physical and health hazards associated with chemicals in the work area,
    - Personal protective equipment,
    - Respirator protection, medical evaluation and fit-testing program, if respirators are used,

- General rules for laboratory safety and good personal hygiene,
- Laboratory operations and activities requiring approval,
- Handling of hazardous chemicals and hazardous waste disposal,
- Emergency response and evacuation procedures,
- Interpretation of SDSs,
- Engineering controls, and
- First aid.

- In addition to the training required by Environmental Health and Safety, all users of the SPMC Marine Chemistry Facilities, including course instructors and tour guides, must complete the SPMC Laboratory Safety Course, including satisfactory completion of the Safety Test, the Safety Training Verification Form, and a safety walk-through conducted by the Marine Chemistry Technician. In the event that the Marine Chemistry Technician is unavailable, an alternate person may be designated to conduct the safety walk-through.
- All generators of hazardous waste in the Marine Chemistry Facilities must complete the WWU Environmental Health and Safety Hazardous Waste Course (http://www.wwu.edu/ehs/training/hazardouswaste.shtml) on an annual basis. The Marine Chemistry Technician should be notified of the completion date of the course.
- Unless highly toxic chemicals or select carcinogens will be used, exceptions to the Safety Training requirement will be granted for a) non-resident students conducting work in the Marine Chemistry Facilities as part of a WWU course while they are under the direct supervision of an instructor who has completed the SPMC Marine Laboratory Safety Course, or b) short-term (1-2 days) visiting investigators who are working under the direct supervision of an SPMC faculty or staff member who has completed the SPMC Laboratory Safety Course. In these cases, the faculty or staff member supervising the students or visiting investigators are responsible for providing a safety orientation and ensuring that all SPMC safety regulations, including the use of appropriate personal protective equipment, are followed.

13.2 Reference Materials

Reference materials on the hazards, safe handling, storage, and disposal of hazardous chemicals can be found in many location(s). Contact the Environmental Health and Safety office or refer to their website at http://www.wwu.edu/ehs/ for links.

14.0 Waste Disposal Procedures

Chemical waste disposal procedures can be found in Western Washington University Safety Information Book, Section 10 (Hazardous Waste Program).

15.0 Ventilation

15.1 General Guidelines

- General laboratory ventilation shall provide airflow into the laboratory from non-laboratory areas and out to the exterior of the building.
- All operations that might result in the release of unpleasant and/or potentially hazardous fumes, vapors, gases or dust must be conducted with local exhaust ventilation.
- Storage in a fume hood is kept to a minimum, should not include flammable chemicals, and should not restrict ventilation or airflow.

15.2 Inspections

Laboratory employees should check fume hoods to ensure proper working order before each use. This should include a visual inspection of the hood area for storage or other visible blockages.

Further information on chemical fume hoods can be found in Western Washington University Safety Information Book, Section 8 (University Chemical Fume Hood Program).

16.0 Chemical Handling Procedures

Refer to Appendix 7B, Table 7-2 for information on proper storage for flammables, corrosives, and reactive chemicals.

16.1 Flammable Liquids and Solids

16.1.1 Hazards

- Flammable vapors can form ignitable mixtures in air. Vapors can travel great distances and be ignited by remote ignition sources, flashing back violently to the source.
- Many flammable liquids are toxic by inhalation and/or skin contact.
- Flammable liquids or their vapors can cause eye injury, ranging from irritation to severe damage.

16.1.3 Controls

- Perform work with flammable liquids in a properly functioning chemical fume hood whenever possible.
- Clean up spills of flammable materials immediately.

16.2 Corrosive Chemicals

16.2.1 Hazards

- Contact with the skin, eyes, respiratory system, or digestive tract can cause severe irritation and burns.

16.2.2 Controls

- Use appropriate personal protective equipment when handling corrosives. Safety goggles are required for liquid corrosives.
- In case of contact, flush the affected area with large amounts of water for at least 15 minutes, remove contaminated clothing, and seek medical attention.
- Always add acid to water when diluting.
- No acid baths are allowed in the Instrument Lab (ME38). Acid bath use in the Marine Chemistry Lab (ME35) is limited to the area near the western sink. Acid baths should be properly labeled. They should be neutralized and disposed of when they are no longer in use.

16.3 Reactive Chemicals

16.3.1 Hazards

Reactive chemicals are those which:

- Are oxidizers (can initiate or support combustions),
- Are organic peroxides (can form shock-sensitive explosives upon prolonged storage),
- Are explosive,

- Can react with other materials (including water) to release hazardous gases or can react violently or with the generation of large amounts of heat, or
- Can polymerize violently with the release of large amounts of heat.

16.3.2 Controls

- Use appropriate personal protective equipment when handling reactive chemicals.
- Read and understand handling instructions provided by the precautionary label or SDS.
- Perform work with reactive chemicals in a properly functioning chemical fume hood whenever possible.
- Perform potentially violent reactions behind a barrier or shield, or at a sufficient distance from any laboratory personnel.
- Explosive or peroxide-forming chemicals must be stored in the explosion-proof refrigerator in the Chemical Storage Room.

16.4 Compressed Gases

16.4.1 Hazards

- Compressed gases contain large amounts of energy that can cause serious injury and physical damage. Compressed gases may also be flammable, toxic, or corrosive.

16.4.2 Storage

- The cylinder must be in good condition with an operable valve. Cylinders not in use should be capped.
- Compressed gases must be stored in the upright position firmly secured with straps, chains or stands designed for this purpose. There are three exceptions:
    - Containers designed for use in the horizontal position
    - Compressed gas containers with a water volume less than 5 liters are allowed to be stored in the horizontal position
    - Compressed gas containers containing liquefied gases.
- Compressed gas cylinders should be stored in an organized, ventilated, well-lit place away from incompatible materials.
- Do not remove or damage manufacturer applied labels, decals, or cylinder content information. If the label is no longer legible, contact the vendor for pickup or contact EHS for more information.
- Storage outside should be above grade, dry and protected from weather extremes. Avoid direct contact with soil or non-paved surfaces.

16.4.3 Controls

- Transport compressed gas cylinders with caps in place, secured to suitable containers.
- Each cylinder must be matched with the appropriate fitting and regulator. Using regulator-adaptors is prohibited.
- Use only commercially manufactured regulators suitable for type of gas and cylinder you are using.
- Regulators must be fitted with check valves to prevent inadvertent mixing of gases and suck-back into the cylinder.
- Cylinder valves should always be opened slowly; do not stand in front of regulators when “cracking open” cylinder valves.

- Avoid completely emptying cylinders. Leave residual pressure in the cylinder and mark it as “empty”.

16.4.4 Transportation and Elevators

- Always cap a cylinder before you move it. Cylinders must always be transported using a hand truck or cart designed for that purpose. Safety glasses and closed toe shoes should be worn when handling cylinders.

  When moving compressed gas cylinders:

  1. Have the metal outlet cap/plug installed,
  2. Have the valve cap installed if the cylinder has one, and
  3. Secure cylinders in a cart or container designed to prevent the cylinder from falling over while being moved.
  4. Use service or freight elevators.

- Additional requirements for compressed gasses and cryogens:

  1. Transport compressed gasses and cryogens (for example, liquid nitrogen) using one of the following methods:

     a. Exclude people from the elevator by posting a sign on the cart carrying the cylinder. The sign should read ***Do Not Enter. Compressed Gas Transport***. Ideally, someone sends the elevator up and another person waits on the receiving floor to take the cryogens out of the elevator. If this is not possible then another plan should be devised to ensure that the cryogen is taken out of the elevator once it reaches the needed floor.

16.5 Carcinogens, Mutagens, Teratogens, and Reproductive Toxins

16.5.1 Hazards

Exposure can induce carcinogenesis, mutagenesis (chromosomal damage), teratogenesis (fetal damage), and infertility. Exposure may affect future generations.

16.5.2 Controls

- Work with these chemicals only in designated areas. (See Part 17.1 – Use of Designated Areas)
- Wear appropriate personal protective equipment. Avoid skin contact and always wash hands and arms immediately after working with these chemicals.
- Work only with adequate engineering controls such as glove bags, glove boxes, and fume hoods.
- Laboratory employees should be familiar with emergency procedures for accidents or spills involving these chemicals. The department safety coordinator or designee should be notified of all incidents of exposure or spills.
- The Laboratory Supervisor should keep records of the amounts of these materials used and the names of workers involved.
- At SPMC, the use of formaldehyde and formalin is limited to the 4 ft fume hood in the Water Quality Lab (MC03). Whenever possible, alternatives to formalin and

formaldehyde (such as Formalternate) should be used for storing specimens. Materials preserved with formalin can be stored in MC 03, MC 205, and MC 222.

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16.5.3 Examples of Carcinogens, Mutagens, Teratogens, and Reproductive Toxins

Examples of these chemicals are listed in Appendix 7B, Tables 7-3 and 7-7, 8, and 9. Additional information can be found on the International Agency for Research on Cancer (IARC) and National Toxicology Program websites.

16.6 Toxic Metals

16.6.1 Hazards

These chemicals are toxic by inhalation, ingestion, and possibly by skin absorption.

16.6.2 Controls

- Wear appropriate personal protective equipment when handling toxic metals.
- Work in a fume hood whenever possible.
- Spills should be immediately cleaned up and the work area properly decontaminated.

16.6.3 Examples of Toxic Metals

Examples of toxic metals are listed in Appendix 7B, Table 7-10.

16.7 Radionuclides

The Radiation Safety Officer and State of Washington have strict policies and procedures for the procurement, handling, use, and disposal of radioactive materials. These procedures must be followed by anyone using radionuclides. Contact the Environmental Health & Safety Department for further information.

- Radioisotopes are under the direct supervision of the SPMC radiation safety officer (RSO). Faculty and students proposing to use radioisotopes must so indicate on their application for space form.
- Written authorization from the RSO will be required before such use is approved. Such authorization will require evidence of prior experience in radioisotopes use and training by Western Washington University's Radiation Safety Officer.
- For the safety of all staff at SPMC and to facilitate control of radioisotopes use, all teaching and research involving radioisotopes in the laboratory building will be conducted in the Radioisotopes Laboratory (MC 204). The door to room MC 204 will remain locked when not in use. Glassware will be clearly marked and retained in the Radiation Laboratory.
- After all radioisotope use, wipe tests must be performed and sent to WWU's RSO. If the wipe tests do not come out "clean" (disintegrations per minute (dpm) less than two times the background dpm), detergent must be used to clean up radioactive areas and then re-wiped; all wipe tests sent to campus should be completely "clean." If there is no radioisotope use in Room MC 204, quarterly wipe tests must be performed and sent to WWU's RSO.
- All radioisotopes used at SPMC are subject to the regulations of WWU's license and must be purchased through WWU with the approval of the RSO. Because the University license places restrictions on the maximum quantities of specific isotopes that can be maintained on site, provisions for purchase of isotopes should be made well in advance of their planned use.
- It is the responsibility of the RSO to maintain chemical inventory stock in the Radioisotopes lab. The inventory of stock chemicals in the radioisotopes lab

should be given to the CHO annually. It is the responsibility of the CHO to assist the RSO in chemical and waste inventories of the Radioisotopes Lab.

- Waste disposal of chemicals is the responsibility of the researcher.
  - Liquids from Radioactive waste should be placed into waste jugs and used vials and filters should be emptied and rinsed into the waste jugs as well.
  - Filters should be taken out and placed with the solid waste
  - Used vials can be thrown in the trash.
  - Radioactivity of the waste jug must be measured and recorded and the waste poured down the sink after informing Maintenance ahead of time and the "Aqueous Material Disposal to Drain" form is filled out.

17.0 Substances of Moderate to High Chronic Toxicity or High Acute Toxicity (Including Select Carcinogens)

17.1 Use of Designated Areas

A "designated area" must be established and clearly marked for storage and work with "Select Carcinogens", reproductive toxins, and substances that have a high degree of acute toxicity. This area may be an entire laboratory, a section of a laboratory, or a device within a laboratory, such as a fume hood or balance. See Appendix 7C for a table of designated areas within the department.

17.2 Controls

- The Department Safety Coordinator reviews the use and disposal of these substances.
- Use properly functioning control equipment (fume hood, glove box, etc.) for procedures that may result in the generation of aerosols or vapors containing the substance. Released vapors should be trapped to prevent their discharge with the hood exhaust.
- Protect vacuum pumps from contamination by traps or other devices. Decontaminate vacuums pumps and other contaminated equipment before removing them from the designated area.
- Weigh materials only in closed containers unless balances are included in designated areas. Open containers to add or remove chemical in ventilated areas.
- Wear appropriate personal protective equipment. Avoid skin contact and always wash hands, arms, face, and neck immediately after working with these chemicals.
- The Laboratory Supervisor maintains records of the amounts of these materials on hand, amounts and dates used, and names of laboratory employees involved.
- Laboratory employees should be familiar with emergency procedures for accidents or spills involving these chemicals. The Department Safety Coordinator should be notified of all incidents of exposure or spills. If a major spill occurs outside of the fume hood or glove box, emergency responders should wear appropriate personal protective equipment and all other workers should evacuate the area.
- Do not work alone when using compounds of high or unknown toxicity.
- Contaminated clothing should be chemically decontaminated or destroyed.
- Determine the appropriateness of medical surveillance for employees if they are working with toxicologically significant quantities of these substances on a regular basis.
- Highly toxic chemicals and chemicals designated with an NFPA health hazard 4 rating on at least one published SDS will be stored in a locked cabinet or refrigerator in ME 34. They will remain under the control of the Marine Chemistry Technician.

14.0 LABORATORY CHEMICALS ON BOATS

- Chemical users must inform the boat skippers of their plans for chemical use and the hazards associated with each chemical. SPMC may refuse transportation on SPMC vessels if the Skipper feels that the chemical use presents an unacceptable risk to anyone onboard.
- MSDS should accompany all chemicals brought on board.
- Whenever possible, dilutions of chemicals used on SPMC boats should be made in the laboratory prior to transporting them to SPMC boats. Non-breakable containers should be used to contain chemicals whenever possible.
- All chemical use should take place outside on the deck. If the situation warrants moving into the cabin, all windows should be open and turned on the cabin fan.

Chemicals should be stored as low as possible on the deck to prevent container breakage.

Appendix 7A – Sample Employee Training Record

LABORATORY EMPLOYEE TRAINING RECORD

Employee Name:

Department:

Supervisor:

Date:

Training Requirement:Hazardous Chemicals in Laboratories
WAC 296-828-20015 (29 CFR 1910.1450), Chemical Hygiene Plan

The following information was covered in the training session:

- ☐ Laboratory Standard
- ☐ General laboratory safety rules
- ☐ Laboratory operations or activities requiring approval
- ☐ Procedures for handling and labeling chemicals and working alone
- ☐ Identity of Chemical Hygiene Personnel
- ☐ Emergency procedures
- ☐ Fire extinguishers
- ☐ Specific exposure control measures
- ☐ Methods and observations to detect the presence or release of a hazardous chemical
- ☐ Physical and health hazards of chemicals in the work area
- ☐ Measures of protection from the hazards posed by chemicals in the lab
- ☐ Safety Data Sheets (SDS)
- ☐ Proper waste disposal methods
- ☐ Other: _____

Employee's Signature: _____ Date:_____

Trainer's Signature: _____ Date: _____

Appendix 7B – Chemical Information
Table 7-2 – Chemical Storage Recommendations

Flammables	Store in approved safety cans or cabinets. Do not store incompatible materials in the same cabinet. Keep away from any source of ignition: heat, sparks, or open flames. Flammable solids must be segregated from flammable liquids
Acids	Do not store with flammable solvents or combustibles. Ideally, store in a cabinet designed for acids; do not store acids on metal shelving. Segregate inorganic from organic acids. Isolate nitric acid and perchloric acid from everything; including other perchlorics.
Bases	Store in corrosives cabinet or on protected shelving away from acids. Segregate inorganic from organic bases.
Light-Sensitive Chemicals	Store in amber bottles in a cool, dry, dark place.
Nitrated compounds	Nitrated compounds can be considered explosive; special care and handling may be required
Oxidizers	Store in a cool, dry place away from flammables and reducing agents. Oxidizers must not be stored on wooden shelves or in cardboard boxes.
Peroxidizable Chemicals	Store in airtight containers in a dark, cool place. Most peroxidizable compounds are flammable and should be stored in a flammable liquid storage cabinet or room. Label containers with receiving and opening dates. Test for the presence of peroxides at least every six months. Discard before exceeding expiration date. Inspect peroxide forming chemicals often for evidence of contamination, degradation, or any change from normal physical or chemical characteristics. If you suspect a material may have become explosive, contact EHS immediately and post “warning sign” so others do not handle or disturb the material.
Pyrophoric Substances	Store in a cool, dry place, making provisions for an airtight seal. Materials (e.g., tert-butyl lithium) will react with the air to ignite when exposed
Toxic Chemicals	Store according to the nature of the chemical, using appropriate security where necessary. Generally, store in a ventilated, dry, cool area in a chemically- resistant secondary container
Water-Reactive Chemicals	Store in a cool, dry location away from any water source, including sprinkler systems. Have a Class D fire extinguisher available in case of fire
Compressed Gas Containers	Store in a cool, dry place, preferably outside of the building and secured with a chain. Separate flammables and oxidizers by 20 feet or a 1-hour rated firewall.

Appendix 7B – Chemical Information
Table 7-3. Classes of Carcinogenic Compounds
(* Denotes Select Carcinogen)
Refer to Safety Data Sheet if chemical is not found on this list

Alkylating Agents: a-Halo Ethers	*bis(Chloromethyl)Ether *Methyl Chloromethyl Ether
Alkylating Agents: Sulfonates	*1,4-Butanediol Dimethanesulfonate Diethyl Sulfate Dimethyl Sulfate Ethyl Methanesulfonate Methyl Methanesulfonate Methyl Trifluoromethanesulfonate 1,3-Propanesultone
Alkylating Agents: Epoxides	*Ethylene Oxide Diepoxybutane Epichlorohydrin Propylene Oxide Styrene Oxide
Alkylating Agents: Aziridines	*Ethylenimine 2-Methylaziridine
Alkylating Agents: Diazo, Azo, and Azoxy Compounds	4-Dimethylaminoazobenzene
Alkylating Agents: Electrophilic Alkenes and Alkynes	*Acrylnotrile Acrolein Ethyl Acrylate
Acylating Agents	*b-Propiolactone b-Butyrolactone Dimethylcarbamoyl Chloride
Organohalogen Compounds	*1,2-Dibromo-3-chloropropane *Mustard Gas (bis(2-chloroethyl)sulfide) *Vinyl Chloride Carbon Tetrachloride Chloroform 3-Chloro-2-methylpropene 1,2-Dibromoethane 1,4-Dichlorobenzene 1,2-Dichloroethane 2,2-Dichloroethane 1,3-Dichloropropene Hexachlorobenzene Methyl Iodide Tetrachloroethylene 2,4,6-Trichlorophenol

Appendix 7B – Chemical Information
Table 7-3. Classes of Carcinogenic Compounds Continued
Refer to Safety Data Sheet if chemical is not found on this list

Hydrazines	Hydrazine and hydrazine salts 1,2-Diethylhydrazine 1,1-Dimethylhydrazine 1,2-Dimethylhydrazine
N-Nitroso Compounds	*N-Nitrosodimethylamine N-Nitroso-N-alkylureas
Aromatic Amines	*4-Aminobiphenyl *Benzidine (p,p'-diaminobiphenyl) *α-Naphthylamine *β-Naphthylamine Aniline o-Anisidine (2-Methoxyaniline) 2,4-Diaminotoluene o-Toludine
Aromatic Hydrocarbons	*Benzene Benz[a]anthracene Benzo[a]pyrene
Natural Products (Including Anti-Tumor Drugs)	Adriamycin Aflatoxins Bleomycin Cisplatin Progesterone Reserpine Safrole
Miscellaneous Organic Compounds	*Formaldehyde (gas) Acetaldehyde 1,4-Dioxane Ethyl Carbamate (Urethane) Hexamethylphosphoramide 2-Nitropropane Styrene Thiourea Thioacetamide
Miscellaneous Inorganic Compounds	*Arsenic and certain As compounds *Chromium and certain Cr compounds *Thorium Dioxide Beryllium and certain Be compounds Cadmium and certain Cd compounds Lead and certain Pb compounds Nickel and certain Ni compounds Selenium Sulfide

Appendix 7B – Chemical Information
Table 7-4 – Partial List of Incompatible Chemicals
Refer to Safety Data Sheet if chemical is not found on this list

Chemical	Is Incompatible With
Acetic Acid	Chromic Acid, Nitric Acid, hydroxyl compounds, Ethylene Glycol, Perchloric Acid, peroxides, permanganates
Acetylene	Chlorine, Bromine, Copper, Fluorine, Silver, Mercury
Acetone	Concentrated Nitric and Sulfuric Acid mixtures
Alkali and Alkaline Earth Metals	Water, Carbon Tetrachloride or other chlorinated metals, hydrocarbons, Carbon Dioxide, halogens
Ammonia (anhydrous)	Mercury (e.g. in manometers), Chlorine, Calcium Hypochlorite, Iodine, Bromine, Hydrofluoric Acid (anhydrous)
Ammonium Nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrates, Sulfur, finely divided organic or combustible materials
Aniline	Nitric Acid, Hydrogen Peroxide
Arsenical materials	Any reducing agent
Azides	Acids
Bromine	See Chlorine
Calcium Oxide	Water
Carbon (activated)	Calcium Hypochlorite, all oxidizing agents
Carbon Tetrachloride	Sodium
Chlorates	Ammonium salts, acids, powdered metals, Sulfur, finely divided organic or combustible materials
Chromic Acid and Chromium Trioxide	Acetic Acid, Naphthalene, Camphor, Glycerol, alcohols, flammable liquids
Chlorine	Ammonia, Acetylene, Butadiene, Butane, Methane, Propane (or other petroleum gases), Hydrogen, Sodium Carbide, Benzene, finely divided metals, Turpentine
Chlorine Dioxide	Ammonia, Methane, Phosphine, Hydrogen Sulfide
Copper	Acetylene, Hydrogen Peroxide
Cumene Hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable Liquids	Ammonium Nitrate, Chromic Acid, Hydrogen Peroxide, Nitric Acid, Sodium Peroxide, halogens
Fluorine	Isolate from everything
Hydrocarbons	Fluorine, Chlorine, Bromine, Chromic Acid, Sodium Peroxide
Hydrocyanic Acid	Nitric Acid, alkalis
Hydrofluoric Acid (anhydrous)	Ammonia (aqueous or anhydrous)

Appendix 7B – Chemical Information
Table 7-4 – Partial List of Incompatible Chemicals Continued
Refer to Safety Data Sheet if chemical is not found on this list

Hydrogen Peroxide	Copper, Chromium, Iron, most metals or their salts, alcohols, Acetone, organic materials, Aniline, Nitromethane, combustible materials
Hydrogen Sulfide	Fuming Nitric Acid, oxidizing gases
Hypochlorites	Acids, Activated Carbon
Iodine	Acetylene, Ammonia (aqueous or anhydrous), Hydrogen
Mercury	Acetylene, Fulminic Acid, Ammonia
Nitrates	Sulfuric Acid
Nitric Acid (concentrated)	Acetic Acid, Aniline, Chromic Acid, Hydrocyanic Acid, Hydrogen Sulfide, flammable liquids, flammable gases, Copper, Brass, any heavy metals
Nitrates	Sulfuric Acid
Nitroparaffins	Inorganic bases, amines
Oxalic Acid	Silver, Mercury
Oxygen	Oils, grease, Hydrogen, flammable liquids, solids, or gases
Perchloric Acid	Acetic Anhydride, Bismuth and its alloys, alcohols, paper, wood, grease, oils
Peroxides, Organic	Acids (organic or mineral), avoid friction, store cold
Phosphorous (white)	Air, Oxygen, alkalis, reducing agents
Phosphorous Pentoxide	Water
Potassium	Carbon Tetrachloride, Carbon Dioxide, water
Potassium Chlorate	Sulfuric and other acids
Potassium Perchlorate (also see chlorates)	Sulfuric and other acids
Potassium Permanganate	Glycerol, Ethylene Glycol, Benzaldehyde, Sulfuric Acid
Selenides	Reducing agents
Silver	Acetylene, Oxalic Acid, Tartaric Acid, ammonium compounds, Fulminic Acid
Sodium	Carbon Tetrachloride, Carbon Dioxide, water
Sodium Nitrate	Ammonium Nitrate and other ammonium salts
Sodium Peroxide	Ethyl or Methyl Alcohol, Glacial Acetic Acid, Acetic Anhydride, Benzaldehyde, Carbon Disulfide, Glycerin, Ethylene Glycol, Ethyl Acetate, Methyl Acetate, Furfural
Sulfides	Acids
Sulfuric Acid	Potassium Chlorate, Potassium Perchlorate, Potassium Permanganate, similar compounds of light metals such as sodium or lithium
Tellurides	Reducing Agents

Appendix 7B – Chemical Information
Table 7-5 – Partial List of Reactive Chemicals

Water-Reactive Chemicals

- Alkali metals (Na, Li, K)
- Alkali metal hydrides (LiH, CaH_2, $LiAlH_4$, $NaBH_2$)
- Alkali metal amides ($NaNH_2$)
- Metal alkyls (RLi, RNa, R_3Al, R_2Zn)
- Grignard Reagents (RMgX)
- Halides of nonmetals (BCl_3, BF_3, PCl_3, $SiCl_4$, S_2Cl_2)
- Inorganic acid halides ($POCl_3$, $SOCl_2$, SO_2Cl_2)
- Anhydrous metal halides ($AlCl_3$, $TiCl_4$, $ZrCl_4$, $SnCl_4$)
- Phosphorous Pentoxide
- Calcium Carbide
- Organic acid halides and anhydrides of low molecular weight, such as acetyl chloride acetic acid anhydride

Pyrophoric Chemicals

- Grignard Reagents (RMgX)
- Metal alkyls and aryls (RLi, RNa, R_3Al, R_2Zn)
- Metal carbonyls
- Alkali metals (Na, Li, K)
- Metal powders (Al, Co, Fe, Mg, Mn, Pd, Pt, Ti, Sn)
- Metal Hydrides (NaH, $LiAlH_4$)
- Nonmetal hydrides (B_2H_6 and other boranes, PH_3, AsH_3)
- Nonmetal alkyls (R_3B, R_3P, R_3As)
- Phosphorous (white)

Peroxide Forming Chemicals
List A: Discard within 3 months

- Diisopropyl Ether (Isopropyl Ether)
- Divinylacetylene (DVA)
- Potassium metal
- Potassium Amide
- Sodium Amide (Sodamide)
- Vinylidene Chloride (1,1-Dichloroethylene)

Peroxide Forming Chemicals
List B: Do not distill or evaporate without testing for the presence of peroxides. Discard or test for peroxides after 6 months.

- Acetaldehyde Diethyl Acetal (Acetal)
- Cumene (Isopropyl Benzene)
- Cyclohexene
- Cyclopentene
- Decalin (Decahydronaphthalene)
- Diacetylene (Butadiene)
- Diethyl Ether (Ether)
- Diethylene Glycol Dimethyl Ether (Diglyme)
- Dioxane
- Ethylene Glycol Dimethyl Ether (Glyme)
- Ethylene Glycol Ether Acetates
- Ethylene Glycol Monoethers (Cellosolves)
- Furan
- Methylacetylene
- Methylcyclopentane
- Tetrahydrofuran (THF)
- Tetralin (Tetrahydronaphthalene)
- Vinyl Ethers

Peroxide Forming Chemicals
List C: Normal Liquids. Discard or test for peroxides after 6 months.

- Chloroprene (2-Chloro-1,3-butadiene)
- Styrene
- Vinyl Acetate
- Vinylpyridine

Normal Gases. Discard after 12 months.

- Butadiene
- Tetrafluroethylene (TEE)
- Vinylacetylene (MVA)
- Vinyl Chloride

Appendix 7B – Chemical Information
Table 7-6 – Compressed and Liquefied Gases

Gas	Threshold Limit Values (ppm)	Flammability Limits in Air (% by vol)	Major Hazards
Acetylene (dissolved)	Not established*	2.5-81.0	Flammable, asphyxiant
Ammonia (liquid)	25	15-28	Toxic
Argon	Not established (non-toxic)	None	Asphyxiant
Boron Trifluoride	1	None	Toxic, causes burns
1,3-Butadiene (liquid)	10	2-11.5	Flammable, skin irritant, suspect carcinogen
Butane (liquid)	Not established*	1.9-8.5	Flammable
Carbon Dioxide (liquid)	5000	None	Flammable, toxic
Carbon Monoxide	50	12.5-74.0	Toxic, severe
Chlorine (liquid)	0.5	None	Irritant, causes burns, corrosive
Ethane (liquid)	Not established*	3.0-12.5	Flammable, asphyxiant
Ethylene	Not established*	3.1-32.0	Flammable, asphyxiant
Ethylene Oxide (liquid pure)	1	3.0-100.0	Flammable, toxic, can cause burns when trapped by clothes or shoes, suspect carcinogen
Helium	Not established	None	Asphyxiant
Hydrogen	Not established	4.0-75.0	Flammable, asphyxiant
Hydrogen Bromide (liquid)	3	None	Toxic, causes burns, corrosive
Hydrogen Chloride (liquid)	5	None	Toxic, causes burns, corrosive
Hydrogen Fluoride (liquid)	3	None	Toxic, causes severe slow healing burns, corrosive
Hydrogen Sulfide (liquid)	10	4.3-45.0	Toxic, flammable, irritant
Methane	Not established	5.3-14.0	Flammable, asphyxiant
Methyl Bromide (liquid)	5	13.5-14.5	Toxic, causes burns
Methyl Chloride (liquid)	50	10.7-17.4	Toxic, flammable
Methyl Mercaptan (liquid)	0.5	Unknown	Toxic, flammable
Nitrogen	Not established (non-toxic)	None	Asphyxiant
Nitrogen Dioxide (liquid)	3	None	Toxic, corrosive
Oxygen	Non-toxic	None	Highly reactive
Phosgene (liquid)	0.1	None	Toxic
Propane (liquid)	Not established*	2.2-9.5	Flammable, asphyxiant
Sulfur Dioxide (liquid)	2	None	Toxic, causes burns
Vinyl Chloride	5	4.0-22.0	Flammable, causes burns, human carcinogen

* non-toxic, produces anesthetic effects

- 2-Acetylaminofluorene
- Acrylonitrile
- Aflatoxins
- 4-Aminobiphenyl
- Analgesic mixtures containing phenacetin
- Arsenic and certain arsenic compounds
- Asbestos
- Azathioprine
- Benzene
- Benzidine
- Bis(chloromethyl) ether and technical grade chloromethyl methyl ether
- 1,4-Butanediol Dimethylsulfonate (Myleran)
- 1-(2-Chloroethyl)-3-(4-Methylnitrobiphenylcyclohexyl4-)-1-Nitrosourea (ME CCNU)
- Chlorambucil
- Chloromethyl methyl ether
- Chromium and certain chromium compounds
- Conjugated estrogens
- Cyclophosphamide
- 1,2-Dibromo-3-chloropropane
- 3,3'-Dichlorobenzidine and it's salts
- Diethylstilbestrol
- 4-Dimethylaminoazobenzene
- Erionite
- Ethylene Oxide
- Ethyleneimine
- Formaldehyde
- Melphalan
- Methoxsalen with ultraviolet A therapy
- 4,4'-Methylene-bis(2-chloroaniline)
- Bis(2-Chloroethyl)sulfide (mustard gas)
- N,N'-bis(2-Chloroethyl)-2-naphthylamine (chlornaphazine)
- α-Naphthylamine
- β-Naphthylamine
- N-Nitrosodimethylamine
- β-Propiolactone
- Thorium dioxide
- Tresulphan
- Vinyl Chloride

Appendix 7B – Chemical Information
Table 7-8 – Regulated Carcinogens (Substances Reasonably Anticipated to Cause Cancer in Humans)

- Acetaldehyde
- 2-Acetylaminofluorene
- Acrylamide
- Acrylonitrile
- Adriamycin
- 2-Aminoanthraquinono
- o-Aminoazotoluene
- 1-Amino-2-methylanthraquinone
- Amitrole
- o-Anisidine hydrochloride
- Benzotrichloride
- Beryllium and certain beryllium compounds
- Bischloroethyl nitroso-urea
- Bromodichloromethane
- 1,3-Butadiene
- Butylated hydroxyanisole
- Cadmium and certain cadmium compounds
- Carbon tetrachloride
- Chlorendic acid
- Chlorinated paraffins (C_{12} , 60% chlorine)
- Chloroform
- 1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU)
- 3-Chloro-2-methylpropene
- 4-Chloro-o-phenylenediamine
- C.I. Basic Red 9 Monohydrochloride
- Cisplatin
- p-cresidine
- Cupferron
- Dacarbazine
- DDT
- 2,4-Diaminoanisole Sulfate
- 2,4-Diaminotoluene
- 1,2-Dibromo-3-chloropropane
- 1,2-Dibromoethane (EDB)
- 1,4-Dichlorobenzene
- 3,3'-Dichlorobenzidine
- 3,3'-Dichlorobenzidine-dihydrochloride
- 1,2-Dichloroethane
- Dichloromethane (methylene chloride)
- 1,3-Dichloropropene (technical grade)
- Diepoxybutane
- Di(2-ethylhexyl)phthalate
- Diethyl Sulfate
- Diglycidyl Resorcinol Ether
- 3,3'-Dimethoxybenzidine and 3,3'-Dimethoxybenzidine Hydrochloride
- 4-Dimethylaminoazobenzene
- Dimethylcarbamall Chloride
- 3,3’-Dimethylbenzidine
- 1,1’-Dimethylhydrazine
- Dimethyl Sulfate
- Dimethylvinyl Chloride
- 1,4-Dioxane
- Direct Black 38
- Direct Black 6
- Epichlorohydrin
- Estrogens (not conjugated): Estradiol-17
- Estrogens (not conjugated): Estrone
- Estrogens (not conjugated): Ethinylestradiol
- Estrogens (not conjugated): Mestranol
- Ethyl Acrylate
- Ethylene Oxide
- Ethylene Thiourea
- Ethyl Methanesulfonate
- Formaldehyde (gas)
- Hexachlorobenzene
- Hexamethylphosphoramide
- Hydrazine and Hydrazine Sulfate
- Hydrazobenzene
- Iron Dextran Complex
- Kepone® (Chlordecone)
- Lead Acetate and Lead Phosphate
- Lindane and other hexachlorocyclo-hexane isomers
- 2-Methylaziridine (Propyleneimine)
- 4,4'-Methylenebis(2-Chloroaniline)
- 4-4'-Methylenebis(N,N-dimethyl)benzenamine
- 4,4'-Methylenedianiline and its dihydrochloride
- Methyl Methanesulfonate
- N-Methyl-N’-nitro-N-nitrosoguanidine
- Metronidazole
- Michler’s Ketone
- Mirex
- Nickel and certain nickel compounds
- Nitrilotriacetic Acid
- Nitrofen
- Nitrogen Mustard Hydrochloride
- 2-Nitropropane
- N-Nitrosodi-N-butylamine
- N-Nitrosodiethanolamine
- N-Nitrosodiethylamine

- N-Nitrosodimethylamine
- N-Nitrosodi-N-propylamine
- N-Nitroso-N-ethylurea
- 4-(N-Nitrosomethylamine)-1-(3-pyridyl)-1-Butanone
- N-Nitroso-N-methylurea
- N-Nitrosomethylvinylamine
- N-Nitrosomorphonline
- N-Nitrosonornicotine
- N-Nitrosopiperidine
- N-Nitrosopyrrolidine
- N-Nitrososarcosine
- Norethisterone
- Ochratoxin A
- 4,4'-Oxydianiline
- Oxymetholone
- Phenacetin
- Phenazopyridine Hydrochloride
- Phenoxybenzamine Hydrochloride
- Phenytoin
- Polybrominated Biphenyls
- Polychlorinated Biphenyls
- Procarbazine Hydrochloride
- Progesterone
- 1,3-Propane Sultone
- β-Propiolactone
- Propylene Oxide
- Propylthiouracil
- Reserpine
- Saccharin
- Safrole
- Selenium Sulfide
- Silica, Crystalline (respirable), Quartz, Cristobalite, Tridymite
- Streptozotocin
- Sulfallate
- 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
- Tetrachloroethylene (Perchloroethylene)
- Thioacetamide
- Thiourea
- Toluene Diisocyanate
- o-Toluidine and o-Toluidine Hydrochloride
- Toxaphene
- 2,4,6-Trichlorophenol
- Tris(1-Aziridinyl)Phosphine Sulfide
- Tris(2,3-Dibromopropyl) Phosphate
- Urethane
- Polycyclic Aromatic Hydrocarbons,
- Benz[A]Anthracene
- Benzo[B]Fluoranthene
- Benzo[J]Fluoranthene
- Benzo[K]Fluoranthene
- Benzo[A]Pyrene
- Dibenz[A, H]Acridine
- Dibenz[A, J]Acridine
- Dibenz[A,H]Anthracene
- 7H-Dibenzo[C,G]Carbazole
- Dibenzo[A,E] [A,H] [A,I] [A,L] Pyrene
- Ideno[1,2,3-CD]Pyrene5-Methylchrysene
- 5-Methylchrysene

Table 7-9 –Partial List of Reproductive Toxins (Teratogens)

- Acrylic Acid
- Aniline
- Benzene
- Cadmium
- Carbon Disulfide
- N,N-Dimethylacetamide
- Dimethylformamide (DMF)
- Dimethyl Sulfoxide (DMSO)
- Diphenylamine
- Estradiol
- Formaldehyde
- Formamide
- Hexachlorobenzene
- Iodoacetic Acid
- Lead compounds
- Mercury compounds
- Nitrobenzene
- Nitrous Oxide
- Phenol
- Polychlorinated and Polybrominated Biphenyls
- Toluene
- Vinyl Chloride
- Xylene

Appendix 7B – Chemical Information
Table 7-10 – Toxic Metals and Toxic Metal Compounds

- Antimony and antimony compounds
- Arsenic and arsenic compounds, arsine
- Barium, soluble barium compounds, barium sulfate
- Beryllium compounds
- Boron, borates, boron halides
- Cadmium salts
- Chromium compounds
- Germanium tetrahydride
- Indium compounds
- Iron salts, soluble
- Lead salts and organo compounds
- Manganese compounds
- Mercury and mercury compounds, organo compounds
- Molybdenum compounds
- Nickel compounds
- Osmium compounds, tetroxide
- Rhodium compounds
- Selenium compounds
- Silver compounds, soluble
- Tellurium compounds
- Thallium compounds, soluble
- Tin compounds, inorganic and organic
- Tungsten compounds, soluble
- Uranium compounds
- Yttrium metal and compounds
- Zinc, chromates, oxide dust
- Zirconium compounds

Appendix 7C - Laboratory Specific Information
Table 7C-1 – Locations of Designated Areas

Department_____SPMC_____
Department Head/ Chair _____Brian Bingham_____
Department Safety Coordinator_____
Building _____Shannon Point Marine Center_____

Room Number	Laboratory Supervisor	Class of Chemical or Name	Designated Location(s) in Room (Hood Number)
MC 204	Dr. Suzanne Strom	Radioisotopes/C14	Shelves FC9 and FC10
ME 34	Dr. Kathy Van Alstyne	Select Carcinogens, Reproductive Toxins	
MC 03	Dr. Kathy Van Alstyne	Reproductive Toxins, Select Carcinogens (Formaldehyde)	4’ Fume Hood
MC03	Dr. Brooke Love	Highly Toxic Chemicals (Mercuric Chloride)	Area designated by red/yellow tape; 4’ Fume Hood
ME 35	Dr. Kathy Van Alstyne	Reproductive Toxins, Select Carcinogens, Highly Toxic Chemicals	

Maintain this table in the Department Safety Information Book, Section 7, Chemical Hygiene Plan.

Provide a copy to the Environmental Health and Safety Office, MS 9070

Appendix 7C - Laboratory Specific Information
Table 7C-2 –Chemical Hygiene Personnel

Department Laboratory Supervisors (Principal Investigators)

Name:	Title:
Location:	Extension:
Home Phone:	Cell Phone:

University Chemical Hygiene Officer

Name: Sue Sullivan	Title: Director, Environmental Health and Safety	
Location: Environmental Studies Rm 70	Extension: 6512	Home Phone: (360) 756-2263
	Cell Phone: (360) 303-9662	Pager: 650-3064

Department Head or Chair

Name:	Title:
Location:	Extension:
Home Phone:	Cell Phone:

Department Safety Coordinator (if applicable)

Name:	Title:
Location:	Extension:
Home Phone:	Cell Phone:

WWU Medical Director - Contact Director of Environmental Health and Safety

Receipt of Chemicals

Chemicals are received and inspected by the department safety coordinator or a designee before inventory and distribution. OR

Describe Receipt of Chemicals:

Post a copy of this table in the laboratory and make readily accessible to laboratory personnel.

Provide a copy to the Environmental Health and Safety Office, MS 9070