Academic Chemical Management and Safety Program

POLICY/SCOPE

Policy: This program sets forth the instructions, resources and requirements for work with and around chemicals in academic settings at Whitworth University. This program contains our chemical hygiene plan in compliance with Washington Administrative Code 296-828 as well as university chemical management procedures and requirements governing the training, labeling, safety data sheets, chemicals produced, medical evaluations and protection of employees from hazardous chemicals while in use in a laboratory setting. Although by regulation this program strictly applies to employees only, our chemical safety procedures are integral with our teaching endeavors and as such, much of this program will be used to teach our students chemical safety. It is expected that staff and faculty explicitly teach these principals, while demonstrating their own compliance. Sections that speak to specific WAC requirements are referenced herein.

Scope: This program applies to the use of chemicals and commercial chemical products in all academic departments where they are used in a laboratory setting. The Washington Administrative Code defines a laboratory setting as a workplace where relatively small amounts of hazardous substances are used on a nonproduction basis. For the purposes of this program the university further defines a laboratory setting as a physical location where chemicals are used in academic coursework or research. This program does not apply to other departments that may also use chemicals, but not in a laboratory setting. Those departments must follow the guidelines set forth in the university's Hazardous Communication Program.

RESPONSIBILITIES

CHO: The Chemical Hygiene Officer (Referred to herein as the CHO) oversees the adoption and implementation of this program by individual departments, in coordination with the Campus Safety Manager. The CHO can be contacted for more information by calling (509) 777-4339.
Department Chairs: Supervisors have the authority and responsibility to ensure that employees under their supervision adhere to the standards in this program and that their departments remain compliant with the procedures and requirements.
Lab Coordinator/Manager/Support Staff: As the individuals that manage chemical usage on a day-to-day basis they are responsible for the application of this program. They are a key point of communication between the CHO and the departments that they serve.
Employees/Lab Personnel: For the purposes of this plan, employees are those that work in a laboratory setting; also referred to as lab workers, lab personnel, lab staff, lab employees or science faculty. All staff and faculty that work in an academic lab, regardless of position or title are expected to abide by and implement all of the procedures in this program. Further, they must complete designated training and provide applicable training to student workers or others in their charge. They are responsible to report hazardous or unsafe conditions to their supervisor and ensure that those conditions are corrected.

ADMINISTRATIVE PROCEDURES

Availability of the Program (WAC 296-828-20005(2))

> This program shall be readily available to employees via the university's website and available to their representatives by request. To request a paper copy, contact the CHO by calling (509) 777-4339.

Program Review (WAC 296-828-20002(4))

This program shall be reviewed annually by the Provost, the Dean of the College of Arts and Sciences, the CHO and applicable department chairs to ensure continued compliance and applicability.

Exposure Evaluations/Monitoring (WAC 296-828-20010)

1. WAC 296-828 contains a list of chemicals the use of which requires written plans and precautions in addition to this plan. However, when these chemicals are used in a laboratory setting separate plans are not required provided the requirements in this plan are met. In addition, medical evaluations (as specified in their individual WAC) ARE required for individuals using these chemicals if their exposure routinely exceeds the Action Level (AL) or Permissible Exposure Limit (PEL). To determine whether medical surveillance applies, routine exposure monitoring is required for individuals who use the referenced chemicals. Personnel using these chemicals shall make the use known to the CHO in order to facilitate routine exposure monitoring.
2. Monitoring results will be provided to affected employees within five working days of the results being made known to the CHO. Notification will be in a written form and will contain sufficient information so that that employees can determine the extent to which the results apply to them and steps to take in response to the results.
3. List

Chemical	**CAS#**	**WAC**
Acrylonitrile	107-13-1	296-62-07336(7)(b)
Arsenic (inorganic)	7440-38-2	296-848-40005
Asbestos		296-65
Benzene *	71-43-2	296-849-13005
Butadiene	106-99-0 and 590-19-2	296-07460(6)(b) and -07460(7)
Cadmium *	7440-43-9 & 10108-64-2	296-62-074
Coke ovens		296-62-20009(6)
Cotton dust		296-62-14533(5)(c) and (7)
1, 2-Dibromo-3-chloropropane	96-12-8	296-07342(7)(b)
Ethylene oxide	75-21-8	296-855-40010
Formaldehyde *	50-00-0	296-856
Lead *	7439-92-1	296-62-07521
Methylene chloride *	75-09-2	296-62-0745-07477
Methylenedianiline	19471-12-6	296-62-07613(2)
Vinyl chloride	75-01-4	296-62-07329(6)(c)
Ionizing radiation		296-828 & 296-62-09004
4-Nitrobiphenyl	92-93-3	296-62-073 (as a carcinogen, does not have a specific plan)
Alpha-Naphthylamine	134-32-7	296-62-073 (as a carcinogen, does not have a specific plan)
4,4' Methylene bis (2 - chloroaniline)	101-14-4	296-62-07306
Methyl chloromethyl ether	107-30-2	296-62-073 (as a carcinogen, does not have a specific plan)
3,3'-Dichlorobenzidine (and its salts)	91-94-1	296-62-073 (as a carcinogen, does not have a specific plan)
Bis-Chloromethyl ether	3188-13-4	296-62-073 (as a carcinogen, does not have a specific plan)

Beta-Naphthylamine benzidine	91-59-8/92-87-5	296-62-073 (as a carcinogen, does not have a specific plan)
4-Aminodiphenyl	92-67-1	296-62-073 (as a carcinogen, does not have a specific plan)
Ethyleneimine	9002-98-6	296-62-073 (as a carcinogen, does not have a specific plan)
Beta-Propiolactone	57-57-8	296-62-073 (as a carcinogen, does not have a specific plan)
2-Acetylaminofluorene	53-96-3	296-62-073 (as a carcinogen, does not have a specific plan)
4-Dimethylaminoazobenzene *	60-11-7	296-62-073 (as a carcinogen, does not have a specific plan)
N-Nitrosodimethylamine	62-75-9	296-62-073 (as a carcinogen, does not have a specific plan)
*=Some quantity on hand in Robinson as of June 2016		

Medical Evaluations (WAC 296-828-20030 & WAC 296-828-20005(3)(h))

1. For chemical exposures, the university will make medical evaluations available (at reasonable times and at no cost to the employee) in the following circumstances:
   - An employee develops signs or symptoms associated with the hazardous substance from laboratory exposure.
   - An emergency situation that could cause a hazardous exposure, such as a spill, leak or explosion occurs.
   - A medical provider recommends a follow-up evaluation.
   - Exposure monitoring reveals exposures routinely above the Action Level (AL) or the Permissible Exposure Limit (PEL).
2. All medical evaluations shall be conducted by a Licensed Health Care Provider (LHCP). The LHCP must be provided with the following:
   - The name of the hazardous chemical(s) the employee may have been exposed to
   - Any signs or symptoms of exposure the employee has
   - A description of the conditions under which the exposure occurred
   - The exposure monitoring results for the conditions, if available.
3. A written opinion from the LHCP must be obtained that includes the following:
   - Recommendations for medical follow-up
   - Any medical conditions found that would increase the employee's risk for impairment from exposure to a hazardous chemical.
   - A statement that the employee has been informed of exposure-related medical results and conditions that require further examination or treatment.
   - A written opinion that does not contain any medical information unrelated to the employee's occupational exposures. If the written opinion contains any medical information unrelated to occupation exposures, it is to be returned to the LHCP and a revised version without the additional medical information is to be obtained.

Protective Equipment Selection and Performance

1. Ventilation (WAC 296-828-20005(3)(e)) Fume hoods and other ventilation equipment are to be maintained so that they provide proper and adequate air flow.

1.1. Operational requirements: Bench top fume hoods shall have an air flow of between 80 and 100 feet per minute velocity at the face as measured by an anemometer. Snorkels shall have a face velocity of between 100 and 120 feet per minute as measured by an anemometer. Building ventilation shall provide air exchanges in a quantity and frequency that is sufficient to supply the necessary make-up air to meet the above mentioned hood ventilation requirements.

1.2. Inspection procedure/frequency: Building ventilation systems are maintained by Facility Services personnel on a preventative maintenance schedule that is in compliance with the system manufacturer's recommendations. This includes filter change out and other routine system maintenance. Fume hood/snorkel performance is tested annually by an outside firm that provides a written certification report. This report is kept on file with Facility Services.

2. Chemical Resistant Gloves

2.1. Selection guide: Manufacturers provide glove selection guides that should be consulted whenever working with a new chemical. Consult with the CHO for additional guidance and resources. Guides from select manufacturers provided below.

2.1.1. Ansell Pro 8th Edition

2.1.2. North Safety glove selection guide

2.2. Options regularly provided: The two most common types of gloves offered for use are nitrile and latex. Each have their own strengths and weakness and particular resistances to chemicals. Follow the hazard analysis process outline later in this program to ensure the selection of the proper glove.

3. Eye/face protection: The American National Standards Institute has published a standard for Occupational and Educational Personal Eye and Face Protection Devices (ANSI/ISEA Z87.1-2015). Each device that is manufactured to the specifications in this standard is marked/stamped accordingly (typically "Z87.1"). All eye/face protection used at Whitworth is required to have such a mark.

3.1. Chemical resistant 'splash' goggles: Generally, simply referred to as goggles, this type of eye protection is designed to protect the wearer from incidental chemical splashes. They generally have a soft plastic flange that helps them seal snuggly to the wearers face preventing chemical droplets from finding their way into the eyes. Some varieties have vents that can be opened to help prevent them from fogging up while in use, however having these open can decrease their eye protection effectiveness. It is preferable to select models that have integral vents that maintain effective eye protection.

3.2. Impact resistant glasses: Often referred to as 'safety glasses' they are frequently confused with splash goggles. As the name implies, impact resistant safety glasses are designed to protect the wearer from the impact of flying particles or debris, not chemicals. These should be worn whenever there is an impact hazard, such as when working in a machine or wood shop. They are not appropriate protection for chemical use, neither are splash goggles appropriate for use in a machine shop.

3.3. Contact lenses: Contact lenses offer no protection from chemical exposure, in fact if present during an exposure they can heighten the severity of the injury. Contact lens wearers should be aware of this potential and make corrective lens selection accordingly.

3.4. Other:

3.4.1. Face shields can serve to protect from both chemical splash and mechanical impact and should be worn in conjunction with the appropriate eye protection. The purpose of a face shield is to protect the entire face from the hazard.

3.4.2. Specialized eye protection is required for use of certain equipment such as lasers. The selection of this eye wear is specific to the energy source of the equipment. Refer to the instructions for each piece of equipment for more information.

4. Emergency eyewashes and safety showers:

4.1. Placement: An emergency eyewash and safety shower must be available within 50 feet wherever there is a potential for substantial portions of the body to come into contact with corrosives, strong irritants, or toxic chemicals. These may be free standing units or eyewash units installed in lab sinks.

4.2. Inspection: Eyewashes must be activated weekly and inspected annually to ensure that they function correctly and to prevent microorganism growth in stagnant water. Safety showers must be activated and inspected annually. (See WAC 296-62-130, part L, pg. 35 "Emergency washing facilities.") Whitworth's practice is to activate both showers and eyewashes weekly. Sealed portable eyewash bottles may be used to provide an initial flush of the eyes. They should be immediately followed by the use of a plumbed eyewash for at least 15 minutes, as the bottle does not contain enough liquid to flush the eyes for as long as necessary, and can only be used on one eye at a time. All portable eyewash bottles must be inspected monthly and replaced by the manufacturer's expiration date. Maintain access to emergency eyewashes and safety showers at all times – Do not store anything around them that could impede access.

4.3. Locations:

Johnston:

Eyewash: rooms 114, 134, 319, 325, 330

Shower: rooms 132, 325

Portable eyewash bottles: rooms 124, 321, 323, 327

Robinson:

Eyewash/shower units: rooms 125, 132, 137, 145, 225, 226, 236, 237, 241, 243, 321, 324, 325, 329, 330, 335, 336, 337, 341, 347

Lied Art Building:

Eyewash: rooms 103, 105, 107, 203, 205, 207

Housekeeping

It has long been known that a clean workspace contributes to a safe workspace. General facility housekeeping, such as floor cleaning, will be accomplished by custodial personnel. Lab specific cleaning, such as bench and equipment cleaning will be performed by lab personnel. Department specific policies and procedures will ensure that lab spaces are cleaned and maintained properly.

Lab Inspections

All teaching and research labs/studios are subject to inspection at any time by appropriate representatives of the University (e.g., CHO, insurance representatives or consultants) and regulatory compliance inspectors (e.g., Department of Ecology, Spokane County Fire District 9 Fire Marshal).

Chemical Emergencies

Spills can occur wherever chemicals are used. It is important to know how to properly respond when a chemical incident does occur. Proper response can potentially minimize personal injury and mitigate environmental impact.

1. As required by the university's Hazardous Waste Management Program, emergency telephone numbers and procedures (see below) are posted in each laboratory and waste accumulation area. The contents of this plan are included in safety orientation training so that everyone understands proper chemical spill clean-up procedures.

2. As soon as practical, but no more than 2 weeks after employment, new lab personnel (faculty, staff and student employees) will be trained by the CHO on the following topics and the standard procedures and guidelines in this program. Annual refresher training is required for student employees. See also section III(i) of this program for additional training information.

- Location and operation of fire extinguisher
- The locations, uses and limitations of lab spill kits
- The location of first aid supplies and how to properly respond to an injury

- Chemical exposure emergency procedures, including locations of eyewashes and safety showers.

3. Serious spills (large quantity or severe hazard): Spills of a large quantity (> 1 liter) of highly volatile liquids not only are a fire hazard but may affect your health due to overexposure. Laboratory personnel should not clean up spills that present an immediate life threatening hazard (e.g., fire, explosion, chemical exposure due to high volatility or high toxicity (LD_{50} of 50 mg or less), easily aerosolized dust, have an overwhelming stench, or are a biohazard, etc.) unless they have appropriate additional training and equipment. Don't risk your health, call 9-911 and ask for the hazardous materials team. All serious spills are to be reported immediately to the CHO.
    - Alert those in the area and evacuate. Close the doors behind you.
    - Call the Chemical Hygiene Officer (777-4339) or the Fire Department Hazardous materials team (9-911) for instructions.
    - Keep others away from the area
    - Notify campus Security (777-4444)
4. Incidental spills (small spills that lab staff are comfortable handling). Lab personnel can clean up small, incidental spills of hazardous chemicals if they feel comfortable doing so, and if they have the proper equipment and training. Prior to responding to any spill, lab workers should be thoroughly familiar with the hazards involved. This information should be included in the lab procedures or as a safety SOP. Lab workers should only handle *small, incidental* spills and should never handle a spill without understanding the risks to themselves and others.
    - Alert those in the area to stay clear
    - Using protective equipment, use appropriate spill kit to contain the spilled material.
    - Dispose of materials as chemical waste according to Whitworth's Hazardous Waste Management Program.
5. All laboratory and research labs are supplied with a spill kit provided by the applicable department. Employees who choose to clean up a spill must wear the proper personal protective equipment and wastes must be disposed of according to the guidelines in Whitworth's Hazardous Waste Management Program. Labs are equipped with some or all of the following kits:
    - A container of sodium bicarbonate for neutralization of acid/base type spills
    - A mercury spill kit (see below for more information)
    - A solvent spill kit
    - A bucket of sand to be used for spill containment or as a class D fire extinguishing material.
6. Mercury Clean-up - Small spills (such as from a broken thermometer) can be effectively cleaned up by using the mercury spill kits in accordance with the instructions. However, vacuum gauges and some other equipment contain a large amount of liquid mercury – too much to be effectively cleaned up with the small spill kits that are available. In the event of a large mercury spill, turn on all available ventilation systems, contain the mercury as much as possible with sand or other inert material, and evacuate the area. Call 9-911 and ask for a hazardous materials team to respond. Larger spill kits are provided in areas where larger quantities of mercury are used. The cleanup of a mercury spill is hazardous, time consuming and costly; the use of mercury equipment should be avoided whenever possible.

Training (WAC 296-828-20015 & WAC 296-828-20005(3)(g))

1. Frequency: Training must be done at the time of initial assignment and prior to situations involving a new exposure to hazardous chemicals. Refresher training is to be provided as necessary when workers are going to be using new chemicals that they are not familiar with.
2. Topics that are addressed:
    - Methods and observations for detecting the presence or release of hazardous substances which may include monitoring conducted by the university, continuous monitoring devices and/or the visual appearance or odor of hazardous chemicals when released.
    - The physical and health hazards of chemicals in the work area

- The procedures and measures to be used to protect themselves from hazardous substances including: appropriate work practices, emergency procedures, personal protective equipment.
- The contents of WAC 296-828 and where to find a copy.
- The permissible exposure limits found in WAC 296-841, Respiratory Hazards.
- Any recommended exposure levels for compounds without an exposure limit in the WISHA/DOSH rules (WACs). For example, those found in NIOSH or ACGIH publications.
- Signs and symptoms associated with exposure to hazardous chemicals.
- The contents of this program and where to find a copy.
- Where to find and how to access Safety Data Sheets.
- Reference materials available that address material hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory.

Resources

There are a variety of resources available to help chemical users recognize, evaluate and control chemical hazards. This section outlines several of the most commonly used sources and basic chemical handling procedures. It is expected that individuals using chemicals will make a thorough search of available literature in order to make a comprehensive hazard analysis and control plan prior to working with chemicals they are unfamiliar with.

1. Safety Data Sheets (SDS): Safety Data Sheets contain information on chemical identification, composition, physical properties along with health, physical, and environmental hazards. They also discuss engineering controls for handling the material and personal protective equipment that should be used. Most SDSs also provide stability and reactivity information, toxicology, ecological information, disposal considerations, transport and regulatory information.

1.1. Document Maintenance: Chemical manufacturers and distributors must provide SDSs, and chemical users must have them available in the workplace during all working hours. Paper copies are also required, because computer systems might not be always working or workers might not have access to a computer. Each academic department must ensure that paper copies of SDS for all of the chemicals in their inventory are available to students, staff and faculty. These should be kept in the department office, computer lab or other common area closest to the chemical use for each department. The CHO will assist with this recordkeeping process. For more information, see the Chemical Procurement section of this program and department specific SOPs.

2. Other Sources: * These and other references are available in the CHO's office or in the computer lab in Robinson 302.

- Manufacturer's SDSs posted on the internet
- "Prudent Practices in the Laboratory" *
- "CRC Handbook of Laboratory Safety"
- Bretherick's "Handbook of Reactive Chemical Hazards" *
- "Hawley's Condensed Chemical Dictionary" *
- "Safe Storage of Laboratory Chemicals" *
- "Hazardous Materials Classification Guide" *
- Sax's "Properties of Dangerous Materials" *
- The Merck Index

HAZARD ANALYSIS

The blueprint of any good safety program is hazard analysis. It is only by analyzing our processes, equipment and chemical usage and identifying potential hazards that we can put effective hazard controls in place. An overview of hazard sources, hazard types, hazard controls follow. A hazard analysis form is provided to assist with this process.

Hazard sources

The three categories of hazard sources can be summarized as *what* (reagents) is being used, *where* (conditions) it is being used, and *how* (activities) it is being used.

1. Reagents (chemicals): Chemicals can cause a variety of hazards. Some present health hazards, which could be chronic or acute or both and some present physical hazards. Some hazards are compounded or made more severe by the conditions under which they are used or other chemicals that they may react with. It is imperative that the hazards of each chemical be thoroughly understood prior to use and that the analysis of these hazards be examined in light of the overall procedure.
2. Conditions: It is important to consider the conditions under which all chemicals and equipment will be used. Questions to consider include but are not limited to: is there adequate lighting, maneuverability space and ventilation? Is the proper emergency equipment and spill kit available? Is all the equipment present that will be necessary? Are the floors clean and clear of trip hazards? Are transit paths clear? Has the equipment been properly maintained and is it in good working order with no sharp edges? Any hazardous condition that is discovered must be corrected immediately and before laboratory work can proceed. It is the responsibility of the person discovering the issue to report it to laboratory staff. It is the responsibility of lab staff to either correct the issue themselves or place a work order with Facility Services to have the issue corrected.
3. Activities/procedures: Sometimes it is not the chemical or equipment itself that poses the hazard, but how we are using it. For example, using a chemical in a solid, powder form that is only toxic if inhaled would pose a significantly more severe hazard if the process by which it was being used might disperse the powder in the air. Along with the basic question of how something is to be used the quantity of the substance must also be considered. Increasing the quantity used of a toxic substance increases the exposure to that toxicity. Increasing quantity can also significantly increase the hazard of reactive chemicals.

Hazard types

Hazards are generally divided into three main categories: health hazards, physical hazards and environmental hazards. Health hazards are generally synonymous with a chemical source, although they do not have to be. For example, a thermal burn is a health hazard, but could have come from a hot plate rather than a chemical. Physical hazards are those things that involve the physical world or properties that are generally studied in physics courses. These things include, but are not limited to, release of pressure, fire, release of stored energy and electrical shock. Chemicals can contribute to these hazards in significant ways. For example, a chemical oxidizer can greatly increase the severity of a fire. Fire itself could have a chemical or a non-chemical source. All possibilities must be considered, however this program focuses on chemical sources. The third hazard type that is often discussed, especially within the Globally Harmonized System of hazard classification, is Environmental Hazard. The university's efforts to prevent environmental pollution are represented in our Hazardous Waste Management Program and are not discussed in detail here. Health and Physical hazards are discussed in more detail below as well a select 'special hazards'. The Globally Harmonized System of hazard classification pictograms are the framework used to present these hazards and is not meant to be exhaustive, especially considering that not all hazards have a chemical source.

1. Health (irritant, toxic, corrosive, etc): For every type of health hazard it is important to consider the route of exposure and the dose, or amount of exposure. The four main routes of exposure are ingestion, inhalation, absorption and injection.
   1.1. Chronic health hazards consist of conditions such as cancer and reproductive toxicity. In general, these are things that either have long-term effects or effects that aren't obvious until well after the exposure. It is prudent to note that while many substances require extensive exposure to produce these effects, some do not. Adjacent is the GHS pictogram which represents respiratory sensitization, germ cell mutagenicity, carcinogenicity, reproductive toxicity, specific target organ toxicity (single and repeated exposure) and

aspiration hazards. More information specific to the handling and use of chemicals that pose these hazards are provided below under special hazards.

1.2. Acute health hazards are conditions that appear soon after exposure, the effects of which can either be permanent (such as blindness caused by acid exposure) or temporary (such as skin irritation). Below are three different GHS pictograms used to describe various acute health hazards. Certain class titles are repeated; the differences are in the severity of the hazard which is indicated by the category number. On a scale of 1-4, 1 is the most hazardous category and 4 is the least hazardous. Specific definitions exist within GHS and are not repeated here.

1.2.1. Exclamation Mark: represents acute toxicity (cat4), skin irritation (cat2), eye irritation(cat2), skin sensitization (cat1), specific target organ toxicity-single exposure (cat3).

1.2.2. Skull and Crossbones: acute toxicity (categories 1,2,&3) Note that while the skull and crossbones symbol can alert the user to the inherent toxicity of a chemical, it is incumbent upon the user to understand the toxicity in light of dose and route of exposure.

1.2.3. Corrosive: Corrosive to metals (cat 1), skin corrosion (cat 1A, 1B, &1B), serious eye damage (cat1). As with other symbols, degree of severity is not conveyed and it is up to the user to fully understand the hazards prior to use.

2. Physical

2.1. Fire: Flammable gases (cat1), flammable aerosols (cat1,2), flammable liquids (cat1,2,&3), flammable solids (cat 1&2), self-reactive (types B,C,D,E&F and cat 1,2), Pyrophoric liquids (cat 1), pyrophoric solids (cat1), emit flammable gas in contact with water (1,2&3), organic peroxide (types B,C,D,E&F). Each hazard class has a separate classification and ranking system. This symbol can indicate the presence of any one of these hazards.

2.2. Oxidizer: Oxidizing gases (cat1), oxidizing liquids (cat1,2,&3), oxidizing solids (cat1,2,&3). An oxidizer is any substance that through the contribution of oxygen causes or contributes to the combustion of another material. It is to be noted that this symbol and the 'fire' symbol look very similar. Special care should be taken to identify these symbols correctly because flammable substances and oxidizers must be kept separate from one another.

2.3. Gases under pressure: Compressed gas, liquefied gas, refrigerated liquefied gases, dissolved gases. This symbol covers a broad range of hazards that include cryogenic (super cold) materials, totally inert gases and everything in-between. The common factor is that they are all stored under pressure. A sudden, unexpected release of that pressure then is an obvious hazard, however the user must be careful to fully understand and implement hazard controls for any additional hazards presented by the substance itself up to and including asphyxiation due to oxygen displacement.

2.4. Unstable explosives: Explosives of divisions 1.1, 1.2, 1.3, &1.4, self-reactive (types A&B), and organic peroxides (types A&B). You will notice that explosives are referred to by divisions rather than categories or types. This mirrors the terminology and definitions found within hazardous material transportation regulations.

2.5. Special hazards (WAC 296-828-20005(3)(d))

3. Special Hazards

3.1. Carcinogens and Reproductive Toxins: It is important to consider and eliminate unnecessary exposures to chemicals that may affect future health and reproductive ability, especially in a laboratory setting with young and inexperienced persons. Faculty may have a pressing need to use carcinogens or reproductive toxins in their research, however, in such cases exposure must be prevented to the greatest extent possible. Information from the chemical's Safety Data Sheet and other resources should be used to complete a thorough hazard analysis in order to develop use protocols that include protective measures, engineering controls (fume hood, glove box), work practices and personal protective equipment (PPE). Emergency response procedures and waste management should also be addressed. Chemical hygiene protocols for PPE use need to be established in order to prevent the spread of contamination. Such protocols include practices such as removing contaminated items

(gloves, lab coat) prior to leaving the designated work area and hand washing. Use of carcinogens and reproductive toxics is restricted to these designated work areas and appropriate decontamination is completed after use. As would be the case after any chemical exposure, workers who have been exposed to carcinogens or reproductive toxins have the right to medical attention. All exposures are to be reported immediately to Human Resources and Chemical Hygiene Officer.

For the purposes of this program a carcinogen is any chemical which:

- Is regulated as a carcinogen by OSHA or DOSH; or
- Is listed in the category "known to be carcinogen" in the latest National Toxicity Program (NTP) Report on Carcinogens (http://ntp-server.niehs.nih.gov/Main_pages/NTP_8RoC_pg.html); or
- Is listed in Group I, "carcinogenic to humans," in the latest edition of the international Agency for Registration of Carcinogens (IARC) monographs (http://193.51.164.11/); or
- Is listed in Group 2A or2B by IARC or under the category "reasonably anticipated to be carcinogenic" by NTP and causes statistically significant tumor incidence in experimental animals as described in WAC 296-62-40003(25)(d).

For the purposes of this program a reproductive toxic is any chemical which:

- Affects the reproductive capabilities including chromosomal damage (mutations), effects on fetuses (teratogenesis), and effects on fertility. These are listed on the latest edition of the Proposition 65 list as a "chemicals known to the State [of California] to cause reproductive toxicity". (http://www.oehha.org/prop65/899lsta.htm)

3.2. Controlled substances: The use of psychotropic drugs, such as narcotics, for research purposes is regulated by the Federal government (DEA) and requires special licensure. These chemicals are classified as Schedule I – V Controlled Substances or as "Listed Chemicals" which generally are drug precursors. Schedule I-V listings can be found at 21 CFR 1308.11 through 1308.15. Listed Chemicals are described in regulations at 21 CFR 1310.02. Whitworth University does not currently have any "Listed Chemicals", nor does it have the proper license to own any of these chemicals. Listed Chemicals may NOT be purchased by any person or department without first coordinating with the Chemical Hygiene Officer and obtaining the proper license and paying the associated fees.

The Chemistry department has a small number of chemicals that have been historically categorized as "controlled substances", even though they are not "listed chemicals". These substances will be handled according to the following guidelines:

- They will be kept in a sealed container separate from the general chemicals.
- They will be secured in the same manner as the rest of the chemical inventory and only those with proper authorization will have access.

3.3. Highly toxic: All substances can be toxic, depending on the dose. Special consideration should be given to work that makes use of materials that are toxic at very low doses. Toxic doses are often reported as an LC_{50} or LD_{50} number. These abbreviations indicate that the associated dose was fatal to 50% of the test population. Doses are usually presented in milligrams per kilogram of test subject mass, or ppm for LC50. Table 4.1 from *Prudent Practices in the Laboratory*, The National Academies Press: 2011, gives general toxicity categories (see below). Other resources and regulatory bodies define "highly toxic" in slightly different ways (see International Fire Code definitions below). In general substances with an LD50 of less than or equal to 50mg/kg warrant specialized work practices and precautions as described below. As with all materials, basic chemical safety guidelines should be followed when using highly toxic materials. Special consideration should be given to the establishment of a 'designated area', containment devices such as fume hoods and glove boxes and decontamination procedures. All waste should be handled according to Whitworth University's Hazardous Waste Management Program. Note that waste regulations define 'toxic' differently than presented here. Refer to the Safety Data Sheets and the Registry of Toxic Effects of Chemical Substances (RTECS) for information on the toxicity of different materials. Special care should be taken to note the various routes of exposure and their

particular toxicity as this is an important factor in the development of safe work practices. Chapter 3 of "Prudent Practices in the Laboratory" also has a great deal of useful information for evaluating potential hazards. Use information from these resources to develop safe work practices. These should include engineering controls (such as fume hoods, glove boxes or biosafety cabinets), safe work procedures and personal protective equipment (such as protective clothing, gloves and eye protection). All procedures should be included in written lab procedures or as separate safety SOPs, so they will not have to be re-developed each time the chemical is used. Guidelines for work with substances of high acute toxicity (LD50 ≤ 50mg/kg) should include:

- Prior approval and training before beginning work
- "Designated areas" – specific, separate areas where work is to be performed.
- Storage and labeling practices, including secondary containment
- Use of engineering controls such as fume hood or glove box. As a rule of thumb, materials with a TLV exposure limit of less that 50ppm should be used in a fume hood.
- A response plan to handle small spills and how/when to evacuate and who to call in case of a large spill.
- A waste management plan coordinated with the CHO.

Toxic Definition References:

Prudent Practices Table 4.1:

Toxicity Rating	**Oral LD_{50} – Rat**	**Skin LD_{50} – Rabbit**	**Inhalation LC_{50} – Rat**	
Highly toxic	<50 mg/kg	<200 mg/kg	<200 ppm, 1 hr	<2,000 mg/m^3, 1 hr
Moderately Toxic	50 – 500 mg/kg	200 –1,000 mg/kg	200 – 2,000 ppm, 1 hr	2,000 – 20,000 mg/m^3, 1 hr
Slightly Toxic	500 – 5,000 mg/kg	1,000 – 5,000 mg/kg	2,000 – 20,000 ppm, 1 hr	20,000 – 200,000 mg/m^3, 1 hr

Globally Harmonized System Chapter 3.1 Acute Toxicity. An excerpt from Table 3.1.1:

Exposure Route	Cat 1	Cat 2	Cat 3	Cat 4
Oral	5 mg/kg	50 mg/kg	300 mg/kg	2000mg/kg
Dermal	50 mg/kg	200mg/kg	1000mg/kg	2000mg/kg

The International Fire Code defines a highly toxic chemical as one that meets any of the following criteria:

- A chemical that has a lethal dose (LD50) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
- A chemical that has a median lethal dose (LD50) of more than 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.

- A chemical that has a median lethal concentration (LC50) in air of 200 ppm 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 1 hour) to albino rats weighing between 200 and 300 grams each.

3.4. Peroxide formers: Certain solvents and other chemicals are known to form potentially explosive peroxides. Many of these are organic solvents; some are inorganic solids. An inhibitor is added to most peroxide-forming solvents by the manufacturer; this is usually effective until the container is first opened. After that, the inhibitor begins to be depleted. It can also become depleted during long storage without opening. High-purity solvents (e.g., HPLC grade) sometimes have no inhibitor added. Peroxides present a significant explosive hazard. If they are present in a solvent, the hazard is compounded by the presence of a flammable liquid along with the explosive peroxide. Peroxides are also often shock sensitive compounds that can explode if subjected to mechanical shock, intense light, rapid changes in temperature, heat, friction, or in some cases, by spontaneous reaction. Chemicals that can potentially form peroxides (peroxidizables) are categorized into three classes (A-C) defined below. Included below are examples of chemicals in each class. These lists are not comprehensive. Detailed guidelines regarding purchasing, storing, testing and using these chemicals are provided on the Peroxide Formers SOP. For additional information, see section 4.D.3.2 and 6.G.3 in *Prudent Practices in the Laboratory*, The National Academies Press: 2011.

3.4.1. Class A: Chemicals that form explosive levels of peroxides without concentration (in other words, without having been concentrated by evaporation or distillation) are Class A Peroxide Formers.

Isopropyl ether	Sodium amide
Butadiene	Tetrafluoroethylene
Chlorobutadiene(chloroprene)	Divinyl acetylene
Potassium amide	Vinylidene chloride
Potassium metal	

3.4.2. Class B: These chemicals are a peroxide hazard upon concentration (distillation/evaporation). A test for peroxide content should be performed if concentration is intended or suspected.

Acetal	Dioxane (p-dioxane)
Cumene	Ethylene glycol dimethyl ether
Cyclohexene	Furan
Cyclooctene	Methyl acetylene
Cyclopentene	Methyl cyclopentane
Diaacetylene	Methyl-isobuyl ketone
Dicyclopentadiene	Tetrahydrofuran
Diethylene glycol dimethyl ether	Tetrahydronaphthalene
Diethyl ether	Vinyl ethers

3.4.3. Class C: Unsaturated monomers that may autopolymerize as a result of peroxide accumulation if inhibitors have been removed or are depleted.

Acrylic acid	Styrene
Butadiene	Vinyl acetate
Chlorotrifluoroethylene	Vinyl chloride
Ethyl acrylate	Vinyl pyridine
Methyl methacrylate	

3.4.4. Types of compounds that are likely to autoxidize to form peroxides:

- Ethers containing primary and secondary alkyl groups (never distill an ether before it has been shown to be free of peroxide)
- Compounds containing benzylic hydrogens
- Compounds containing allylic hydrogens (C=C—CH)
- Compounds containing a tertiary C—H group (e.g., decalin and 2,5-dimethylhexane)
- Compounds containing conjugated, polyunsaturated alkenes and alkynes (e.g., 1,3-butadiene, vinyl acetylene)
- Compounds containing secondary or tertiary C—H groups adjacent to an amide (e.g., 1-methyl-2-pyrrolidinone)

3.5. Biological/Bloodborne Pathogens (BBP): Activities utilizing or involving blood or other potentially infectious material and the individuals that conduct them are subject to the University's Bloodborne Pathogens Program. It is the responsibility of each department to identify and document employees with occupational exposure and provide that information to Human Resources. Further, each department is to ensure that universal precautions are understood and executed by employees and that appropriate work practice controls and personal protective equipment is provided. For more detailed information please reference Whitworth University's Bloodborne Pathogens Program. Guidelines for the use of potentially infectious organisms are provided by the Centers for Disease Control (CDC) and the National Institutes of Health (NIH). Any laboratory or researcher wishing to use potentially infectious substances or microorganisms must consider which Biosafety Level is appropriate and abide by all the requirements thereof. Certain research must also be approved by the University's Institutional Review Board (IRB), Institutional Biosafety Committee (IBC) and or the Institutional Animal Care and Use Committee (IACUC). See the Sponsored Programs website for more information.

3.6. Compressed gas/cryogens: The use of compressed gases presents several different hazards. First, and perhaps most obvious, is the potential to damage the tank and violently release the contents. Compressed gas cylinders have been known to become very dangerous projectiles when damaged. Users of compressed gas must also be aware of the inherent dangers of the gas. Some gases are corrosive or flammable and even those that are inert and considered harmless can displace oxygen in an enclosed space and present and asphyxiation hazard. All standard compressed gas tank precautions should be observed. Cryogens most commonly used are liquid nitrogen and liquid helium. In these cases, the gases have not only been compressed, but also cooled to such a degree that the gas condenses into liquid form. They must be handled with care in order to prevent frost bite. Refer to the Compressed gas/cryogen SOP for specific care and handling instructions.

3.7. Pyrophoric: A pyrophoric substance is one that ignites spontaneously in contact with air or upon mechanical shock. Pyrophoric substances must be handled with extreme caution and precise methods. Use and transfer of pyrophoric substances must be done in an inert atmosphere or with transfer techniques that preclude air exposure, such as the use of a cannula. The professors that make use of pyrophorics in their research are the experts in their care and handling and should be consulted for thorough training prior to use by any other personnel. The use of pyrophoric chemicals in a regular teaching laboratory should be avoided.

3.8. Radiation: Radiation comes from a variety of sources and presents different levels of hazard based on type and intensity. Naturally occurring sources are held by the physics department. Chemical sources are held by the chemistry department and mechanical sources (x-ray, laser) are held by both physics and chemistry. Radiation is considered either ionizing or non-ionizing. Ionizing radiation is radiation that is energetic enough to free electrons from an atom, thus 'ionizing' them. Less energetic radiation that does not have sufficient energy to ionize an atom is referred to as 'non-ionizing' radiation. Ownership, storage, use, handling and disposal of radioactive materials and radiation producing equipment are subject to the Radiation Protection Rules, WAC 246-220 through 246—254, administered by the Washington State Department of Health. Washington state Department of Occupational Safety and Health has established permissible exposure limits for non-ionizing radiation and requirements for employee supervision, training, equipment labeling and signage, see WAC 296-

62-09005. Certain sources also require registration with the United States Nuclear Regulatory Commission. We currently do not have any registered sources. For source specific use guidelines please refer to the Radiation Safety SOP.

3.9. Non-chemical hazard sources: Although the focus of this plan is chemical hazards, it is prudent to mention a few other related hazards that could be found in a laboratory. Fill out an incident report form if incidents from these or any other hazards occur.

3.9.1. Heat/fire: Keep flammable materials and ignition sources separate. Tie back long hair. Use caution when using flammable liquids. No smoking in lab. Use caution when using any source of heat in the lab. Check to be sure items are cool enough to handle before picking them up. For emergency response use a fire extinguisher, emergency gas shut off, fire alarm and evacuation depending on the size and nature of the fire. After evacuation, gather at the designated meeting spot and report to instructor or building monitor. For burns, cool affected area with water and apply burn cream from the first aid kit. Seek further medical attention if it blisters.

3.9.2. Broken equipment/lacerations: Never pickup broken glass with bare hands. Report sharp edges on equipment so they can be repaired. Always cut away from yourself and the fingers on your other hand. If chemical contamination is suspected and the cut is minor, rinse with copious amounts of water. Apply pressure to the wound. Use first aid kit for minor cuts. Seek medical attention for more severe lacerations.

3.9.3. Electrical shock: Keep electrical equipment and water separate. Do not use equipment that is damaged. Instead, report it so that it can be removed from service. Do not touch a person being electrocuted until they are 'disconnected' from the source of shock. Summon emergency medical services immediately. A person can be disconnected by using a non-conducting material to physically move the person from the hazard.

3.9.4. Clutter/slips/falls: Keep aisles clear of obstacles. Warn others about spills and clean up promptly. Watch where you are walking.

3.9.5. Pressurized vessels or vacuum systems: Pressure vessels must be purchased from a reputable manufacturer that can provide documentation of the tested safe operating parameters of the device. The use of 'homemade' pressure vessels is prohibited. Pressure vessels must be used in strict accordance with manufacturer's specifications regarding pressure, temperature and chemical compatibility and amount. They must be cleaned, inspected and maintained in proper working order. Any anomaly must be reported immediately to the professor in charge of the equipment and not used until the situation is corrected.

3.9.6. Sound: Exposure to loud noises can cause hearing damage. Those working with or around sources of loud noise should consult Whitworth's Hearing Conservation Program, located here for more information and guidance.

HAZARD CONTROLS

Once hazards have been identified, it is essential to implement appropriate hazard controls. Hazard controls are implemented in a hierarchical manner starting with elimination, moving to engineering and administrative solutions and finally ending with personal protective equipment (PPE).

1. Eliminate: The first step when seeking to control a hazard is to see if it can be completely eliminated. In many cases that isn't possible, but it is important to ask the question. Of course inherent hazards can't be removed from a substance, but this is talking about eliminating the substance or the item from the process. For example, choosing to avoid a particular process or chemical would 'eliminate' the hazard associated with it.
2. Engineer: Hazards can often be effectively controlled with some sort of engineered device. This might be a guard on a table saw, a sound proof box for noisy equipment or a fume hood, but in any case the hazard still exists essentially unchanged, it just now has an engineering control restricting its ability to do harm.

3. Administer: Administrative controls are often employed in conjunction with other levels of controls and include policies, procedures, protocols and rules. These types of guidelines seek to control human interaction with the hazard, rather than the hazard itself.
4. Personal Protective Equipment (PPE): PPE is last on the list of hierarchical controls, but in some cases is the most essential. If the hazard still exists, as it often does, after the other types of controls have been implemented, it is essential to protect the individual by using protective equipment such as goggles, gloves and lab coat or apron. Other types of personal protective equipment include thermal gloves, face shield, impact resistant eyewear and safety toed shoes.

HAZARD COMMUNICATION

Once hazards have been identified and controls selected, that information must be effectively communicated to the affected individuals. In this context 'hazard communication' refers specifically to the communication of chemical hazards as defined by the Globally Harmonized System for Hazard Classification and discussed in the Hazard Analysis section of this program. Acknowledging that many other types and sources of hazards exist in the laboratory, but using the term 'hazard communication' to refer strictly to chemical hazards is the common regulatory practice. There are three branches of hazard communication: Safety Data Sheets (SDS), container labels and signage.

1. SDS maintenance and availability: Safety Data Sheets contain information on chemical identification, composition, physical properties along with health, physical, and environmental hazards. They also discuss engineering controls for handling the material and personal protective equipment that should be used. Most SDSs also provide stability and reactivity information, toxicology, ecological information, disposal considerations, transport and regulatory information. Chemical manufacturers and distributors must provide SDSs, and chemical users must have them available in the workplace during all working hours. Paper copies are also required, because computer systems might not always be working or workers might not have access to a computer. Each academic department must ensure that paper copies of SDS for all of the chemicals in their inventory are available to students, staff and faculty. These should be kept in the department office, computer lab or other common area closest to the chemical use for each department. The CHO will assist with this recordkeeping process. For more information, see the Chemical Procurement section of this program and department specific procurement SOPs.
2. Labeling: Chemical containers must be labeled appropriately so that the user is made aware of the chemical identity and the potential hazards. To accomplish this, certain pieces of information are required on chemical container labels. Original containers and secondary containers used as stock bottles (as though they were original containers) must include the following information:
    - The chemical name
    - GHS pictogram
    - GHS Signal word
    - GHS hazard statements
    - GHS precaution statements
    - Manufacturer information

    If the container is too small to contain all of this information on the label it may be provided to the user by another means, such as on a safety sheet. Additionally, department protocols require the concentration, the date and preparer's initials to be added to labels of solutions prepared in house. Containers that are for immediate use only require the chemical name, but they must remain under the control of the user/creator and must be used up within their lab time or shift, otherwise it must be more thoroughly labeled.
3. Signage: Placing signs on doors and equipment is an important component of hazard communication. Departments shall ensure that appropriate signage is placed on equipment, such as 'no food for human consumption' warning on laboratory refrigerators. Lab spaces shall have signs indicating authorized entrants and other appropriate warnings, such as PPE required and no food or drink. Rooms that are used to store chemicals shall have the NFPA diamond

placard with appropriate numbers displayed on the door(s). This is imperative in order to assist and ensure the safety of our fire department emergency responders.

CHEMICAL MANAGEMENT (DAY-TO-DAY OPERATIONS/PROCEDURES)

Safety Levels (WAC296-828-20005(3)(b-c,f)): There are three guiding rules or principles that are applicable in every lab setting to varying degrees. These principles are Suit Up, Wise Up and Clean Up. Everyone working in a laboratory must dress appropriately, wear the proper PPE, be informed of the potential hazards, implement proper hazard controls, be prepared for potential emergencies, clean up after themselves and dispose of waste properly. The degree to which each of these principles/rules are applied is dependent upon the specific nature and intensity of the hazards present. To simplify and standardize the process of applying these rules we use a safety level rating system. This system can be applied at the procedure level, the course level, or the room/location level.

1. Safety Level 1: No usage of chemicals or chemical products beyond "household" products, such as paint, glue, and cleaners. No physical or mechanical hazards.
   1.1. Suit Up: Street clothes – No restrictions. PPE - Follow the manufacturer's recommendation regarding the use of gloves with a specific product.
   1.2. Wise Up: Household chemical products should remain in the original container and be used in an amount and manner consistent with household use. (Ammonia and bleach are not considered household products for purposes of this plan.) Labels shall be maintained as clearly legible.
   1.3. Clean Up: Follow established waste disposal protocols. Recycle whenever possible.
2. Safety Level 2: The same as Safety Level 1 with regards to chemical use (household products only) AND, in addition, has physical hazards (mechanical equipment such as lathe, drill press, etc).
   2.1. Suit Up: Street clothes – Long pants, shoes that cover the entire foot. Tie back long hair. No loose items that could get caught or tangled. PPE – Impact resistant safety glasses as appropriate for the use of certain equipment. Follow the manufacturer's recommendation regarding the use of gloves with a specific product.
   2.2. Wise Up: Ensure that each operator is fully trained on each piece of equipment prior to use. Have operating instructions readily available. Do not work alone. Do not work when the building is unoccupied. Do no leave on-going operations unattended.
   2.3. Clean Up: Clean up equipment after use.
3. Safety Level 3: Standard chemical hazards such as acids, bases, flammables, toxics and chemically preserved specimens. Only small or incidental physical hazards, no large equipment.
   3.1. Suit Up: Street clothes – Long pants, shoes that cover the entire foot. Tie back long hair. No loose items that could get caught or tangled. PPE - Lab coat or lab apron. Splash goggles. Gloves, as appropriate based on chemicals in use.
   3.2. Wise Up: Ensure that all chemical containers are labeled with the appropriate GHS hazard warnings. Use volatile and toxic chemicals only within a fume hood. Staff and faculty should avoid working in the building alone. Students are not allowed to work alone in a laboratory without first checking in with a supervisory staff or faculty member. The designated supervisory staff/faculty member must be present in the building while the student works. Do no leave on-going reactions or operations unattended without adequate safety measures in place.
   3.3. Clean Up: Follow established waste disposal protocols. Keep all waste containers in secondary containment and tightly closed. Wash hands thoroughly after use.
4. Safety Level 4: Special or exceptional physical or chemical hazards (lasers, carcinogens, highly toxic substances, etc.).
   4.1. Suit Up: Street clothes – Long pants, shoes that cover the entire foot. Tie back long hair. No loose items that could get caught or tangled. PPE - Dependent upon specific hazard. PPE should include lab coat or apron, splash goggles, and may include special gloves, face shield or eyewear.

4.2. Wise Up: Ensure that a hazard analysis has been completed and follow all recommendations for hazard controls. Use volatile and toxic chemicals only within a fume hood. Staff and faculty should avoid working in the building alone, especially evenings and weekends. Students are not allowed to work alone in a laboratory without first checking in with a supervisory staff or faculty member. The designated supervisory staff/faculty member must be present in the building while the student works. Do not leave on-going reactions or operations unattended.

4.3. Clean Up: Follow chemical specific waste protocols. See the CHO for assistance. Keep all waste containers in secondary containment and tightly closed. Wash hands thoroughly after use.

Basic Chemical Safety Procedures

As discussed above, safe practices are often dependent upon the specific nature of the hazard and a judgement of how likely that hazard is to affect you. With that said, there are some basic chemical safety procedures that should be followed whenever working with chemicals.

- Containers should be closed unless adding or dispensing material.
- Avoid carrying more than one bottle at a time. Use secondary containment on a cart for more than one bottle.
- Do not carry bottles up or down the stairs, use the elevator.
- Use a shatter proof carrying case when transporting a single bottle of a corrosive material.
- When transporting chemicals, wear the same PPE required for use. Be careful not to transfer chemical contamination by touching door handles and the like with gloved hands.
- Do not eat, drink, chew gum, smoke, or apply cosmetics around chemicals. Do not consume food stuffs used in a laboratory setting.
- Horseplay, practical jokes, or other acts of carelessness are prohibited.
- Do not taste chemicals. Avoid smelling chemicals and do not mouth-pipette.
- Wash hands frequently and always after chemical use, even if gloves had been worn.

Basic Spill Cleanup and Housekeeping Procedures

Procedures for handling chemical emergencies are covered in the Chemical Emergencies section of this program. The most common incidents are very small and very minor, but still need to be cleaned up promptly and correctly. Ideally, the person that causes the spill should be responsible to clean it up, in practice however spills are often discovered and cleaned up by lab personnel during housekeeping operations. Specific housekeeping protocols vary by department and laboratory space, see department SOPs for more information.

Inventory Control

1. Chemical Procurement: Strict chemical procurement procedures are the key to keeping track of what chemicals are stored in a building and making sure that the appropriate safety precautions are in place and necessary information is on hand. Accurate inventory information also allows the university to fulfill its obligations to inform emergency response agencies of the potential risks within our facilities. There are two main ways or reasons why a chemical might need to be ordered and each has a distinct process. These processes also vary depending on whether or not the chemical is new to Whitworth or is replenishing stock. Each department has specific ways in which they handle each of these scenarios. See the Chemical Procurement SOPs for more information.
2. Chemical Inventory and Storage: Hazardous chemical reactions can occur when incompatible materials mix because of accidental breakage, container failure, fires, natural disasters, or mixing from poorly closed containers. Hazardous reaction products can include: heat or fire generation, evolution of toxic or flammable gases, pressurization of containers, violent dispersion of material or polymerization. Below are guidelines necessary to ensure that chemicals are stored properly in order avoid incompatibility issues and to maintain compliance with storage quantity limits. Departments have freedom to implement these guidelines in ways that complement their internal processes. For additional guidance see the CHO and the Chemical Compatibility & Storage SOP.

2.1. Keep chemical inventory to a minimum and do not store excess quantities of any hazardous materials. Maintain an accurate chemical inventory, updating it as chemicals are received, used up or disposed of. The inventory should include the amount of chemical, storage class and designated storage location for each container among other useful information the department may wish to maintain.

2.2. Separate all chemicals according to Whitworth's Chemical Compatibility Storage SOP and store them in labeled storage areas or cabinets. Some general guidelines are:
- Separate acids and bases. Corrosive cabinets are preferable, but do not store acids and bases together.
- Store cyanides on upper shelves so that any accidental acid spills cannot drip onto them.
- Keep oxidizers away from flammables and reducing agents.
- Store flammable and combustible materials in flammable cabinets. NFPA Class III-B may be stored on open shelving.
- Store materials that are highly water-reactive in an area separate from other chemicals.

2.3. Keep all chemical storage areas secured and prevent unauthorized access.

2.4. Containers must be in good condition and compatible with their contents. Degraded, spilled or leaking containers must be packed into a non-leaking larger container, labeled as waste and handled accordingly.

2.5. All containers must be legibly labeled with chemical name and GHS compliant hazard warnings, as described in the Hazard Communication section of this program. Abbreviations and chemical formulae should be avoided, unless necessary, and then only if definitions are posted in the lab or other rooms where the container may be used or stored.

2.6. Extra labeling is required for highly hazardous materials requiring specific storage conditions, for example: peroxide formers and chemicals that react with either air or water.

2.7. According to department specific procedures, containers should be dated when received. Peroxide formers and other chemicals that degrade over time must also be dated when opened and should not be stored longer than their published shelf life. See the Peroxide Former and Other Potential Explosives SOP for more detailed information. Whenever possible, unstable chemicals, such as peroxide formers, should be purchased with a stabilizer or inhibitor additive.

2.8. Avoid storing excess quantities of flammable materials and use a flammable storage cabinet whenever possible.

2.9. Do not keep flammable materials in a 'domestic' or 'household' refrigerator; use a flammable storage refrigerator that is labeled as such. Refrigerators used for food storage should be labeled accordingly and that chemicals are prohibited. Refrigerators used for chemical storage should be labeled accordingly and that food storage is prohibited.

2.10. Secure gas cylinders to walls, tank racks or benchtops with chains or straps. Store cylinders with valve covers securely screwed on.

2.11. As much as possible, store chemicals at eye level and below. Avoid using high shelves unless absolutely necessary. Chemical storage shelves must have a 1inch lip on all sides.

Waste: It is imperative that chemical waste is managed in an environmentally responsible manner and in accordance with all applicable regulations. All individuals and departments that use chemicals and chemical products are responsible to ensure that their waste enters into the waste management process established and described in Whitworth's Hazardous Waste Management Program. For more information, contact the Chemical Hygiene Officer.

REVIEW

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