Chemical Hygiene Plan

Fresno Pacific University

May 27, 2026

1.0 PURPOSE AND SCOPE

1.1 University Policy on Chemical Hygiene in Laboratories

Fresno Pacific University (FPU) is committed to providing a safe working environment for its students and employees. FPU employees have a right to know about health hazards associated with their work.

The University has the responsibility to adopt policies and procedures that minimize exposure of employees to hazardous chemicals present in the University's laboratories. It has the further responsibility to provide information and appropriate training to make employees aware of potential hazards and safe working practices. This document, the Chemical Hygiene Plan (CHP), specifies how these responsibilities will be discharged.

Employees have the responsibility to participate actively in training programs, to know and follow the policies and procedures contained in the CHP, and to conduct their work activities in a manner which minimizes their risk of exposure. Because the people who work in any given laboratory are best able to detect potential hazards in either the facility or in work procedures, when safety concerns arise, employees are encouraged to discuss their concerns with their supervisor for communication to the proper administrative authority.

Students in FPU laboratories, although not legally covered by the laboratory standard, are provided the same level of protection as FPU employees.

1.2 Scope of the Chemical Hygiene Plan

The OSHA Occupational Exposure to Hazardous Chemicals in Laboratories standard, commonly referred to as the Laboratory Standard, applies to all laboratories that use hazardous chemicals in accordance with the definitions of "laboratory", "laboratory use" and "laboratory scale" provided in the standard. California implements the standard as a set of California Occupational Safety and Health Administration (Cal/OSHA) requirements: California Code of Regulations (CCR) Title 8, Section 5191, Occupational Exposure to Hazardous Chemicals in Laboratories.

1.2.1 Definitions

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

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

(i) Chemical manipulations are carried out on a "laboratory scale;"

(ii) Multiple chemical procedures or chemicals are used;

(iii) The procedures involved are not part of a production process, nor in any way simulate a production process; and

(iv) "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals."

Laboratory scale means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of

materials.

1.2.2 Elaboration on scope

Departments that work with or use chemicals in a non-laboratory environment (e.g., custodial operations, facilities operations, art studios, etc.) are subject to the OSHA Hazard Communication Standard and other relevant standards. The Chemical Hygiene Plan does not define how the university implements compliance with respect to these standards.

Laboratories may also be subject to other standards which apply to laboratory settings (e.g., with respect to use of radioactive materials, biosafety, etc.). The Chemical Hygiene Plan does not define how the university implements compliance with respect to these standards.

1.3 Role of the Chemical Hygiene Plan

This document serves as the written guide for Fresno Pacific University's compliance with the Laboratory Standard and the CHP requirements contained therein. The CHP for FPU affirms the University's commitment to a safe working environment for all employees working in laboratories. The plan details the University's standards of acceptable operation regarding laboratory procedures; chemical procurement, labeling and storage; availability, inspection, and maintenance of laboratory facilities and protective equipment; and employee information and training programs. The plan also describes roles and responsibilities for implementing the standards. All units of FPU engaged in the laboratory use (as defined by this document) of hazardous chemicals are required to comply with this document.

1.4 Relation to the Hazard Communication Plan and Other OSHA Standards

The OSHA Laboratory Standard (8 CCR 5191) is connected to the OSHA Hazard Communication Standard (8 CCR 5194) since both address limiting employees' exposure to hazardous chemicals in the workplace. Therefore, the CHP must be consistent with the University's Hazard Communication Plan, particularly with regard to the availability of Safety Data Sheets (SDSs), procedures for chemical storage and labeling, and the provision of employee training. The CHP supersedes the Hazard Communication Plan at any point where a difference is necessary to address unique conditions of the University's laboratories.

Along with the Laboratory Standard, the following OSHA standards are particularly pertinent to laboratories. Their provisions apply, except where the CHP specifies a more stringent standard:

8 CCR 5191 General requirements - personal protective equipment
8 CCR 5193(d)(3)(J) Eye and face protection.
8 CCR 3314 Cleaning, repairing, servicing & adjusting prime movers, machinery & equipment.
8 CCR 3400 Medical services and first aid.
8 CCR 6151 Portable fire extinguishers.
8 CCR 5191(g) Access to employee exposure and medical records.
8 CCR 5193 Bloodborne pathogens

1.5 Availability

The CHP must be readily available to employees and employee representatives. The University Chemical Hygiene Officer will maintain a copy of the Plan. In addition, a copy of the Plan will be

placed in an area readily accessible to all employees during normal working hours.

1.6 Annual Review

The Chemical Hygiene Officer will review the CHP annually from its effective date.

2.0 RESPONSIBILITIES FOR CHEMICAL HYGIENE

2.1 Board of Trustees and President

The Board of Trustees and the President of FPU have the ultimate responsibility for providing safe working conditions within the University, including implementation of the University CHP and have delegated oversight of the CHP to the Provost.

2.2 Chemical Hygiene Officer

The Chemical Hygiene Officer (CHO) is appointed by the Provost and is responsible for overseeing implementation of the CHP. The CHO will have the following minimum qualifications:

a. Substantive academic background in chemistry, preferably a BS degree or higher;
b. Familiarity with state and federal occupational safety and health standards and regulations;
c. At least three years experience planning and implementing laboratory safety and/or chemical hygiene programs and
d. Familiarity with University laboratories and the safety issues underlying University science programs.

The responsibilities of the CHO are to:

a. Work with administrators and professors to develop and implement appropriate chemical hygiene policies and practices;
b. Work with faculty and staff to coordinate and monitor implementation of the CHP;
c. See that required inspections are performed and appropriate records are maintained;
d. Provide technical assistance to employees on the CHP;
e. Know the most current legal requirements concerning regulated substances and justify that the CHP is in accord with those requirements;
f. Respond to requests to use chemicals which are members of one of the classes described in the Hazardous Material Classes Requiring Approval component of this document;
g. Determine need for personal protective equipment beyond that specified for general laboratory use and
h. Implement appropriate chemical hygiene training for all University employees whose normal work locations include laboratory areas.

2.3 Executive Director of Campus Safety

a. Records and reporting

The Executive Director of Campus Safety will maintain required records of accidents, incidents, employee exposures per Section 9.4.

b. Training

For employees outside the School of Arts and Sciences, the Executive Director of Campus Safety (or a designee) will be responsible for providing chemical hygiene training to employees. The Executive Director of Campus Safety will maintain training records and ensure copies of training records are made available to the CHO.

c. Enforcement

The Director of the Department of Campus Safety, in conjunction with the CHO, will ensure the CHP safety provisions are enforced in laboratory settings and other settings in the University. See Appendix L for details.

2.4 School of Arts and Sciences

The Dean of the School of Arts and Sciences is responsible, within the School of Arts and Sciences, for implementation of the chemical hygiene program.

The school should employ one or more staff to directly support operations of the academic laboratories. The senior-most of these staff is referenced, in this document, as the Laboratory Manager.

The Laboratory Manager will act as proxy for the Dean with respect to responsibility for implementation of the chemical hygiene program. In this capacity, the Laboratory Manager assume(s) the responsibility to:

a. Ensure that employees have received appropriate training and have access to the CHP, SDSs, and other reference materials;
b. Coordinate a regular process for conducting chemical hygiene and housekeeping inspections, including routine inspections of emergency equipment;
c. Coordinate requests to the CHO for acquisition and use of chemicals which fall under the Hazardous Material Classes Requiring Approval component of this document;
d. Oversee purchase, storage, and disposal of chemicals in accordance with the CHP and
e. Maintain required records of training, current inventory, and inspections and maintenance of facilities and equipment.

2.5 Laboratory Worker

Individual lab workers (including both students and university employees) must accept a shared responsibility for operating in a safe manner once they have been informed about the extent of risk and safe procedures for their activities. All University lab workers whose normal work locations include a laboratory area have the specific responsibility to:

a. Maintain awareness of health and safety hazards through participating in required training programs and updating knowledge through optional training and consulting reference materials;
b. Plan and conduct daily activities in accordance with the University's chemical hygiene standards and procedures, including chemical preparation, handling, and disposal;
c. Use good personal chemical hygiene habits in their own work, as well as modeling and enforcing these habits for students and
d. Inform supervisors of accidents and work practices or working conditions they believe hazardous to their health or to the health of others.

2.6 Students

While students are not covered under the provisions of the Laboratory Standard, students should be made aware of chemical health and safety hazards in classroom situations and should be provided with information and equipment to protect themselves from those hazards. For courses with laboratory

components, instructors should specify safety guidelines in syllabi. Such syllabi should be made available to the CHO for review. Furthermore, instructors of courses with laboratory components should provide student training at the beginning of each course in which hazardous chemicals are used, and specific safety instructions should be provided at the beginning of each laboratory period.

3.0 ACCESS TO HAZARD INFORMATION

Identifying the specific hazards associated with a chemical greatly reduces chances of misuse by regular laboratory employees, new users, or visitors to the laboratory. The goal of the University's chemical hygiene program is to assure that all individuals at risk are adequately informed about: the physical and health hazards associated with hazardous chemicals present in the laboratory; the proper procedures to minimize risk of exposure; and the proper response to workplace accidents. This goal is achieved through two means:

1. Formal training;
2. Readily available hazard information on signs, labels, and safety data sheets.

3.1 Employee Training

All University employees whose normal work assignment includes working in a laboratory area shall participate in an ongoing chemical hygiene training program. This includes custodial and maintenance personnel, as well as appropriate teaching staff (including substitute teachers whose assignment is likely to include a laboratory area). Employees new to the University who possess records certifying their participation in chemical hygiene training with a previous employer will be excused from the general introductory training, but must participate in training that covers the specifics of the University's CHP.

The precise nature of the training that an employee receives is determined by the nature of his/her work assignment in the laboratory. For example, the training for science professors would include safe handling of chemicals during experimental procedures; training for custodians would include procedures for performing necessary cleaning operations in the possible presence of hazardous chemicals. The training approach will be directed to categories or groups of hazardous chemicals, rather than to the specific characteristics of many individual chemicals. Training may take the form of individual instruction, group workshops, audiovisual presentations, handout material, or any combination of these.

The general content of the training and information program will include:

1. An overview of chemical hygiene standards, including the contents of CCR Title 8 section 5154;
2. An overview of the University's CHP and where copies of the plan are available;
3. A description of safe practices for handling hazardous chemicals and transporting them within the facility;
4. A description of hazards of chemicals on the University site, including PELs or other exposure limits;
5. A description of procedures for requesting authorization to obtain and use chemicals considered too hazardous for general University laboratories;
6. A description of labeling and storage practices, and information to interpret labels, as outlined in the University's Hazard Communication Plan;
7. An overview of concepts necessary to understand reference materials, such as PEL, TLV, LD50, and routes of entry;
8. A description of the content of SDSs, and the location in each building of the SDSs for chemicals in that building, as well as the location and content of other reference materials on the properties, safe handling, storage, and disposal of hazardous chemicals;
9. An overview of proper use of available protective apparel and equipment;
10. Descriptions of signs and symptoms associated with exposures to hazardous chemicals used

in the laboratory;
11. Descriptions of methods and observations to detect the presence or release of hazardous chemicals; and
12. An overview of appropriate procedures for responding to and reporting accidents involving chemical exposures. Selected employees may, at the University's discretion, also receive training in the use of specialized emergency response equipment. At least one employee per building will be trained in first aid techniques.

After initial hire and training, an employee must, within the following three-year period, complete the refresher safety training course. After an employee completes a refresher safety training course, the employee must, within the three years following completion, begin his/her next refresher safety training course.

3.2 Safety Data Sheets

The SDS gives details about a chemical and the associated hazards. All SDSs supply the following information:

Identity
- Name of the chemical
- Name, address and phone number of the supplier
- Chemical formula and EPA number

Physical Characteristics
- Boiling point (special fire hazard for flammables)
- Vapor pressure (high values mean easy inhalation)
- Vapor density (accumulates in low areas)
- Water solubility
- Appearance and odor
- Specific gravity
- Water reactivity (important for cleanup operations)

Special hazards
- Flashpoint (lowest temperature at which vapor will ignite with a spark)
- Auto-ignition temperature (lowest temperature at which material will ignite spontaneously)
- Fire-fighting information – extinguishing material to use (dry chemical, CO_2, etc.).
- Explosive limits (maximum concentrations of vapors allowed)

Reactivity Data
- Stability and reaction paths of dangerous decomposition

Health Hazard Data
- Routes of exposure (inhalation, absorption through skin, etc.)
- Health symptoms (irritant, corrosive, carcinogen, etc.)
- Emergency first aid

Personal Protective Equipment

- Respiration, goggles, gloves
- Types of ventilation required
- Hygiene procedure -washing hands after use, etc.

Hazardous Waste Disposal
- Protective equipment to use
- Spill cleanup
- Method of disposal

The University will maintain the most current SDS received for all chemicals stored and/or used in University laboratories. SDSs will be readily accessible to employees working in the University's laboratories. The system used must facilitate immediate access in an emergency situation. The CHO will maintain a master set of SDSs for all chemicals in the University.

3.3 Laboratory Signs

Warning signs should allow both employees and those unfamiliar with the laboratory surroundings to identify hazardous chemical use and storage areas, safety facilities, emergency information, protective equipment and exit routes. Signs will be clearly posted in all laboratory, preparation, and chemical storage areas. The University will provide standard signage, including:

a. Telephone numbers of emergency response personnel (fire, medical, chemical spill, and poison control) and the university Campus Safety department;
b. Exit signage compliant with NFPA 101-2000;
c. Location signs for safety showers, eyewash stations, fire extinguishers, fire blankets, first aid kits, and other safety equipment;
d. Labels identifying waste receptacles, including used chemical containers, and associated hazards; and
e. Warnings at areas or equipment where special or unusual hazards exist, such as lasers, vacuum, radiation, or biohazards.

3.4 Labels

Identity labels will be placed on all containers used for stock preparations, reagents for laboratory procedures, and used chemical receptacles. Labels will either conform to the conventional OSHA HCS system, or alternatively, to the labeling requirement of 1910.1200(f)(6). The latter provides additional flexibility for working with complex mixtures, allowing such mixtures to referred to using an unambiguous code, formula, or abbreviation. In such cases, a document must be readily available which clearly communicates the hazards associated with a given complex mixture.

Labels on stock bottles will not be removed or altered. Additional information labels may be affixed, if they do not obscure the original labels.

The labels described above are not required for "secondary use" containers that are prepared and will be used and emptied within the same day, and are only handled by the employee preparing them. Secondary use containers are only required to be labeled with the identity of the chemical and its concentration, where applicable.

An additional label will be affixed to all containers of chemicals which are classified under one of the categories described in the Hazardous Material Classes Requiring Approval component of this document. This additional label will list the date that use of the chemical was approved and the

designated areas, if any, to which its use is restricted.

4.0 STANDARD OPERATING PROCEDURES

4.1 Qualifications of individuals using laboratories

Only persons with proper qualifications and training will use laboratory facilities. Any employee assigned to work in a classroom or other area in which laboratory procedures are performed must receive appropriate training as specified in the CHP, even if that employee's assigned work does not entail laboratory procedures.

4.2 General Principles Guiding Handling and Use of Chemicals

Understand the Hazards Before Using any Chemical. The Permissible Exposure Limits (PELs) and Threshold Limit Values (TLVs) of chemicals approved for use in the laboratories of FPU are available to employees in the SDS for each chemical, and in publications such as OSHA 3112, "Air Contaminants - Permissible Exposure Limits", NIOSH Pocket Guide to Chemical Hazards, or the Manual of Safety and Health Hazards in the School Science Laboratory. The University will train employees in how to find and use this information. Employees, in turn, will make use of this information to familiarize themselves with the hazards associated with the chemicals.

Minimize All Chemical Exposures. It is prudent to minimize all chemical exposures because few laboratory chemicals are without hazards. Employees will follow the standard general precautions listed in this Plan for handling all laboratory chemicals. Other specific procedures must also be followed for chemicals with particular hazardous properties, such as corrosive, flammable, toxic, or oxidizers.

Do Not Underestimate Risks. Employees must not underestimate the risk involved in any given laboratory procedure. Exposure to substances of unknown risk should be minimized. The decision to use a particular substance in the University laboratory must be based on the best available knowledge of the chemical's particular hazards and the availability of proper facilities and equipment to store, handle, use, and dispose of the chemical. Substitutions, either of chemicals or procedures, often can be made to reduce hazards without sacrificing instructional objectives. When the risk outweighs the instructional benefit and no safer substitutes are available, then the experiment or procedure MUST NOT be performed.

Adequate Ventilation is Essential. The best way to prevent exposure to airborne substances is to prevent their accumulation in the working atmosphere. General laboratory ventilation will be maintained at specified levels, and additional devices such as hoods and auxiliary ventilation will be used when necessary to keep airborne concentrations below the PEL or TLV for the chemicals in use.

Follow the CHP. The chemical hygiene program specifies laboratory practices designed to minimize employee exposure to hazardous chemicals. Because of the large number of chemicals that may be stored and used in the University's laboratories, employees must follow the practices specified in the CHP in order to minimize their health and safety risks. When employees are in doubt about particular procedures and safeguards in the CHP, they must consult with their supervisor. If the supervisor is unsure of the appropriate response, he/she should consult the CHO before proceeding.

4.3 General Laboratory Procedures

1. Planning
    a. Consult the relevant SDSs before undertaking an activity. Textbooks, laboratory manuals, and other instructional materials often designate safety precautions needed for a particular laboratory activity. However, total reliance on such publications to provide complete and accurate information is not advisable. Each SDS specifies handling precautions, spill cleanup and storage guidelines.
    b. Do not perform a laboratory procedure unless the following three criteria have been met:
        i. All persons involved in the procedure are knowledgeable about the hazards of the procedure and can perform the manipulations required;
        ii. All necessary facilities and protective equipment and apparel are available and in good operating condition for use during the procedure; and
        iii. The instructional benefits to be gained from the procedure clearly outweigh the risks involved in the procedure.
    c. Adjust the scale of procedures to minimize risk of exposure and to reduce generation of used or waste chemicals.
2. Conduct
    a. Do not eat, drink, smoke, chew gum, apply cosmetics, manipulate contact lenses, or other such activities in the laboratory.
    b. Do not perform procedures using unauthorized chemicals.
    c. Avoid working alone in the laboratory whenever possible. Otherwise, inform another person where you will be and what you will be doing.
    d. Do not engage in horseplay, practical jokes, or other behavior, which might confuse, startle, or distract another person in the laboratory.
    e. Do not leave the laboratory unattended while operations are ongoing.
    f. Use laboratory equipment only for its designed purpose.
3. Chemical Handling
    a. Read the label on a chemical container at least twice - once when you get the container, and again before you dispense the chemical.
    b. Work in the fume hood whenever the PEL for a chemical is 50 ppm or less. Hood sash should remain closed, except when placing or removing apparatus. The hood fan should be kept on whenever chemicals are present in the hood.
    c. Always use the proper method of transporting chemicals within the facility. Use acid/base carriers when moving corrosive materials. Use cylinder carts when transporting cylinders. Make sure that any carts used to transport chemicals are sturdy and tight, without loose connections.
    d. Avoid inhalation of chemicals; do not “sniff” to test chemicals. Do not taste chemicals.
    e. Do not mouth pipette anything; use suction bulbs.
    f. When mixing solutions, always pour the more concentrated solutions into water or into the less concentrated solutions. Pour slowly, while stirring to dissipate heat.
    g. Do not mix chemicals known to have incompatible properties. Prior to mixing, check the SDS for all chemicals (Appendix B).
    h. Know the symptoms of exposure for the chemicals being used, and the precautions

necessary to prevent exposure.

4. Apparel – Appropriate laboratory attire will vary depending on the nature of the work being performed and the associated hazards. Principle investigators (PIs), laboratory managers, and faculty are primarily responsible for ensuring those present in the laboratory environment wear appropriate personal attire and PPE. Laboratory activity may not be conducted if required personal attire is not worn or required PPE is not available and used. In addition to following the guidelines for PPE described in section 7.2, individuals engaged in activities in a laboratory setting should adhere to the following standards:
    a. Confine long hair and loose clothing. Remove jewelry from fingers, wrists, and neck. Wear shoes at all times, but do not wear sandals, open-toed or perforated shoes.
    b. Contact lenses normally should not be worn in the laboratory when fumes are present that could adhere to the lenses. If contact lenses are worn for other laboratory procedures, appropriate eye protection MUST be worn at all times.
5. Inspections and Maintenance
    a. Perform a visual inspection of safety equipment prior to beginning a chemical procedure in the laboratory. The purpose of such visual inspections is to check for obvious problems with equipment. It is not intended to substitute for thorough periodic inspections. Any safety equipment not operating to the general standards must be taken out of service and reported to the CHO.
    b. Know how to use all protective equipment - eyewash, shower or drench hose, fire extinguisher, and fire blanket. If you are uncertain, request assistance from your supervisor or instructor. DO NOT PERFORM LABORATORY WORK UNTIL YOU CAN USE PROTECTIVE EQUIPMENT TO RESPOND TO AN EMERGENCY.
    c. Be alert to unsafe conditions and see that they are corrected. Ensure that aisle ways, exits, and paths to safety equipment are unblocked.
    d. Know the location of safety devices wherever you are working - in the stockroom, preparation areas, and laboratories.
    e. Check that equipment is in good operating condition, and that glassware is free of chips and cracks.
6. Housekeeping and Personal Hygiene
    a. Keep rooms clean and in orderly condition. Keep floors, shelves, and tables clear of chemicals not in use. Clean-up the work area on completion of an operation or at the end of the day.
    b. Wash areas of exposed skin well before leaving the laboratory.
    c. Never use the same refrigerator to store both chemicals and food.
    d. Place excess reagents and reaction products in proper used chemical containers; do not return reagents to the stock containers.
    e. Promptly clean-up spills, using appropriate protective apparel and proper procedures.
    f. Keep aisles and passageways to all exits and safety equipment clear. Do not store materials near doorways.
    g. Before leaving the laboratory, turn off all services (gas, water, electricity). Lower the fume hood sash. Lock the laboratory door.
    h. Clean chemical storage rooms prior to the opening of University and at the close of the academic year, under supervision of a trained and qualified employee.

4.5 Procedures for Specific Chemical Hazards

Materials which present physical and/or health hazards can be used safely if the specific hazards are understood, appropriate equipment and facilities are available, and proper procedures are followed. If appropriate precautions are not taken, personal injury or property damage may occur. See the glossary in Appendix A for definitions of the hazard classes discussed below.

Additionally, certain chemicals cannot be safely mixed or stored with other chemicals because of the danger of severe reaction or toxic products. See Appendix B for guidance regarding incompatible chemicals.

1. Toxic Chemicals
    a. Use nonpermeable gloves when handling containers of toxic chemicals. Wash affected areas immediately if the chemicals come in contact with skin.
    b. If the PEL or TLV for a substance is less than 50 ppm or its LC50 is less than 200 ppm, the substance should only be handled in a properly functioning fume hood.
    c. Know the signs and symptoms of exposure to toxic substances. Review emergency response procedures.
2. Flammable Chemicals
    a. Store flammable liquids in flammable storage cabinets compliant with the NFPA 30 standard.
    b. Ground safety cans and other metal containers of flammable liquids used near electrical equipment or other sources of electrostatic fields.
    c. When working with flammable chemicals, be certain that there are no open flames, hot surfaces, sparks, or other sources of ignition near enough to cause a fire or explosion in the event of a vapor release or liquid spill.
    d. Ensure that appropriate fire extinguishers are in the area.
    e. Have vermiculite, absorbent pillows, or another chemical absorbent available for use in the event of a spill.
3. Corrosive Chemicals
    a. Eye protection and appropriate apron and gloves should always be used when handling corrosive materials. An eyewash and safety shower or drench hose must be readily accessible to areas where corrosives are used and stored.
    b. Carry bottles of acids or bases in protective carriers to reduce possibility of breakage or spills.
    c. Acid or base exposure demands immediate attention! Splashes should be washed off immediately with plenty of water for 15 minutes. Remove all affected clothing and seek medical help. Exposure can occur through direct skin contact, ingestion, inhalation of vapors or skin exposure to mists in the air. Symptoms of exposure include:
        i. irritation of skin, eyes, nose, throat or lungs
        ii. dermatitis
        iii. skin and eye burns
        iv. difficulty breathing
    d. Mineral acids (e.g. sulfuric, nitric, hydrochloric) are quite reactive with metals, generating flammable hydrogen gas.
    e. When performing dilutions, always pour acid into water, never the reverse.
    f. Completely neutralize a spill (with baking soda for acid spills, vinegar for base spills) before cleaning up the area with plenty of water.
4. Reactive Chemicals

a. Oxidizers: Know the reactivity of the materials involved in the reaction. Ensure that there are no extraneous materials in the area, which could become involved in a reaction. Use shields or other methods for isolating the process if the reaction is expected to be violent.
b. Water Reactive (react with water to produce a flammable or toxic gas): Safe handling of water reactive materials depends on the specific materials and the conditions of use and storage. See the SDS for specific instructions.
c. Pyrophoric (ignite spontaneously upon contact with air): Pyrophoric chemicals should be used and stored in inert environments. Often the flame is invisible.
d. Peroxidizable (materials which react with air to form explosive peroxides): Peroxides can explode with impact, heat, or friction. Peroxides can form even when the container has not been opened. Date all peroxidizables upon receipt and upon opening. Dispose of after three months. Do not open any container, which has obvious solid formation around the lid.
e. Light-Sensitive (degrade in the presence of light): Light sensitive materials can form new compounds that may be hazardous, or may cause pressure build-up in containers. Store in a cool, dark place in amber colored bottles.

5. Allergens and Sensitizers – A variety of allergens may be encountered in the laboratory. Exposure of skin or the respiratory tract to these agents may elicit dermatitis, asthma, or other responses. The special problem with allergic responses is one of sensitization, and difficulties arise because the cause of the allergic response may not be readily identifiable. Usually there is no physical reaction at the time of initial exposure, but this is the point where sensitization occurs. The reaction takes place upon a subsequent exposure to the allergen.
   Because of the wide variety of chemicals that may produce allergic responses or adverse reactions in sensitive individuals, and because of the varying response of individuals to such substances, it is essential to minimize exposure of eyes, hands and forearms, and lungs by working with adequate ventilation and appropriate protective apparel, resistant to permeation by the chemical.

4.6 Procedures for Specific Physical Hazards

Materials and equipment, which present physical hazards, can be used safely if the specific hazards are understood, appropriate equipment and facilities are available, and proper procedures are followed. If appropriate precautions are not taken, personal injury or property damage may occur.

1. Electrical Safety
   a. Water can turn anything into an electrical conductor, so don't stand in water or have water on your hands when using electrical equipment.
   b. Electrical shocks are caused from electrical current flowing into your body as an easy path to ground is formed, not only from high voltage. Be very cautious when dealing with voltages high enough to generate this current. Current as low as fifty milliamperes can kill.
   c. Use only one hand when probing for voltage readings, as two hands allows a path through the heart. The best procedure is to rest your elbow on a grounded surface so that, if a circuit is accidentally completed, the current will flow in your hand and out your elbow, avoiding your heart.

d. All electrical outlets should carry a grounding connection requiring a three-prong plug. All electrical equipment should be wired with a three-prong plug, unless the equipment is double-shielded. Never remove the ground post from a three-prong plug.
e. The condition of wiring, plugs, and cords should be checked regularly. Confirm that the insulation on electrical cords and cables is intact and not frayed or cracked. Breaks in the insulation can cause shocks.
f. All laboratories should have circuit breakers readily accessible. Employees should know how to cut off electrical service to the laboratory in case of emergency. Laboratory lighting should be on separate circuits from electrical outlets, in case electric service must be cut off in an emergency.
g. If electrical equipment shows evidence of undue heating, unplug it immediately.
h. When unplugging electrical equipment, grasp the plug instead of pulling on the cord.
i. In case of an electrical fire, don't touch the burning object or douse it with water. If possible, turn off the current. For a small fire, extinguish it with a CO_2 or multipurpose ABC extinguisher, or with baking soda.

2. Glassware
    a. Adequate hand protection (heavy gloves) should be used when inserting glass tubing into rubber stoppers or corks or when placing rubber tubing onto glass tubing. Tubing must be fire polished and lubricated and hands should be used close together to minimize the possibility of fracturing the glass.
    b. Use leather gloves when picking up broken glass, or use tools such as brooms, dustpans, forceps, etc.
    c. Glassware should be stored on well-lighted stockroom shelves designed to prevent the pieces from falling off.
    d. Select glassware that is designed for the type of work planned. In particular, be sure that glassware to be used in vacuum apparatus is constructed for that purpose.
    e. When cutting glass tubing or rod, place a towel over the strike mark and break away from the body. Fire polish all glass before use. After heating glassware, allow ample time for cooling to occur. Hot glass looks the same as cool glass.
    f. Glass containers of acids, alkalis, or flammable chemicals should be transported in carriers to protect from breakage and to contain leaks.
    g. Each laboratory should have a container specifically designated and labeled for broken glass. Do not place broken glass in the general trash container.
3. Laser Safety
    a. It is imperative that personnel do not look down the barrel of any laser while it is in operation. (Wavelengths of 200 - 315 nm are absorbed by the cornea of the eye, causing "welders flash." Wavelengths of 315 - 400 nm are absorbed by the lens and iris of the eye. Wavelengths of 400 - 1400 nm pass through the ocular media of the eye and burn the retina.) Even low energy output He-Ne lasers can cause eye damage.
    b. Protection for the eyes requires goggles that have sufficient protective material and so fitted that stray light cannot come in from any angle.
    c. Be particularly careful about reflections of the laser beam. Specular reflections (from polished, flat surfaces) are the most seriously damaging to the eye, due to the collimated nature of the laser beam. No protection is offered by distance from the source.

    d. Working conditions must be in compliance with ANSI Z136.1-1993, the American National Standard for Safe Use of Lasers. In the lab area, warning signs are required.
4. Vacuum Safety
    a. All reduced-pressure or vacuum conditions present serious hazards. Don't assume that 10^{-3} Torr is less dangerous than 10^{-11} Torr.
    b. One of the biggest dangers associated with working under vacuum is the danger of implosion. When the vacuum vessel is constructed of glass or other shatterable materials, this danger can be extreme. Even stainless steel vacuum systems will occasionally have some component made of glass. Take the necessary precautions like taping the vessel in a criss-cross pattern if it doesn't have to be heated, or work behind a mechanical shield with safety glasses.
    c. Achieving and measuring vacuum often involves dangerous mechanical motions (e.g. rotary pumps). Cover belts and wheels with guards, and exercise caution so as not to get body parts and clothing caught in these devices; cover exposed high voltage sources.
5. Compressed Gases
    a. Laboratories using compressed gases comply with Compressed Gas Association guidelines contained in CGA P-1 (1965), "Safe Handling of Compressed Gases".
    b. Always use the minimum-sized cylinder adequate to perform the desired laboratory activity.
    c. Cylinders of compressed or liquefied gases must not be stored in the laboratory. They should be kept in a storage area, securely restrained by straps or a suitable stand. Do not expose cylinders to temperatures above 50°C. Always store cylinders upright, secured, with the cap threaded on.
    d. Never transport a cylinder without the safety cap in place. Use a cylinder cart for transporting.
    e. Never force threaded connections.
    f. Teflon tape should not be used on a new Swagelok fitting as it will tend to deform the threads prematurely.
    g. When a cylinder is empty or before moving, replace the protective cap. Do not bleed a cylinder completely empty. Leave a slight pressure to keep contaminants out.
    h. Do not interchange gauges, regulators, or fittings, especially with oxygen cylinders. Use only the appropriate gauges, fittings, and materials compatible with the particular gas being handled.
    i. Do not use a cylinder that cannot be positively identified.
    j. Always wear safety goggles when handling or using compressed gases.
    k. Note specific handling requirements for cylinders of toxic, corrosive, or reactive gases, especially requirements for ventilation (i.e., using in a fume hood).
6. Cryogens
    a. Liquified gases that condense oxygen from the air create an oxygen rich atmosphere and increase potential for fire if flammable or combustible materials and a source of ignition are present. Mixtures of gases or fluids should be strictly controlled to prevent formation of flammable or explosive mixtures.
    b. Pressure is a hazard due to the large expansion ratio from liquid to gas, causing pressure build up in containers. Containers and systems containing cryogens should have pressure relief mechanisms.

c. Many materials become brittle at extremely low temperatures. Containers and systems should be capable of withstanding extreme cold without becoming brittle.
d. Always wear safety glasses with side shields or goggles when handling. If there is a chance of a splash or spray, a full-face protection shield, an impervious apron or coat, cuffless trousers, and high-topped shoes should be worn. Watches, rings, and other jewelry should not be worn. Brief contact with materials at extremely low temperatures can cause burns similar to thermal burns. Gloves should be impervious and sufficiently large to be readily thrown off should a cryogen spill. Potholders could also be used.

7. Other Hazards
    a. When using a centrifuge, be sure the arms are balanced, and that it is securely anchored.
    b. Reactions should never be carried out in, nor heat applied to, an apparatus that is a closed system (stoppered or fitted with a septum). A pressurized apparatus should have an appropriate relief device. An inert gas purge or bubbler system is usually appropriate.

5.0 CHEMICAL PROCUREMENT AND STORAGE

5.1 Ordering and Receiving Chemicals

Prior to ordering any chemical, the need should be verified, based on the desired use of the chemical. All chemical orders will request the latest SDS from the vendor.

Before new chemicals are ordered or used, employees will be trained about their hazards, handling, and proper storage.

5.2 Hazardous Material Classes Requiring Approval

Any chemical which falls into any of the hazardous material classes described below requires approval *prior to* purchasing, or otherwise obtaining, the chemical.

A. Select carcinogens

A select carcinogen is here defined as any chemical which is listed under any of the following:

- the Cal/OSHA Regulated Carcinogens list (https://www.dir.ca.gov/title8/sb7g16a110.html)
- substances "Known To Be Human Carcinogens" or substances "Reasonably Anticipated To Be Human Carcinogens" as listed in the most recent Report on Carcinogens published by the National Toxicological Program (https://ntp.niehs.nih.gov/ntp/roc/content/listed_substances_508.pdf)
- agents classified as Group 1, Group 2A, or Group 2B carcinogens the International Agency for Research on Cancer (https://monographs.iarc.who.int/list-of-classifications/)

B. Particularly hazardous substances due to high acute toxicity

A chemical with high acute toxicity has an oral, inhalation, and/or dermal LD50 and LC50 values below the following threshold values:

- oral LD50 (rats): < 50 mg/k
- dermal LD50 (rabbits): < 200 mg/kg
- inhalation LC50 (rats): < 200 ppm in air

This data should be available in Section 11 of the corresponding SDS.

C. Reproductive toxicants

The corresponding SDS should be referenced to determine whether a chemical is a reproductive toxicant. Any chemical considered a teratogen, or that presents a hazard with respect to any other aspect of reproduction, is considered a reproductive toxicant.

D. Pyrophorics

A pyrophoric is a chemical that spontaneously ignites when exposed to air. Examples of pyrophorics include tert-butyl lithium, trimethylaluminum, silane, and methylmagnesium bromide.

E. Explosives

The corresponding SDS should be referenced to determine whether a chemical is an explosive. Examples of explosives include trinitrotoluene and dry picric acid.

F. Flammable substances which are classified under Category 1 as defined by 29 CFR 1910.106 (https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.106).

Examples include diethyl ether, pentane, ligroin, heptane, petroleum ether.

G. Compressed gasses

This document defines a compressed gas as any material or mixture contained at an absolute pressure exceeding 40 psi (pounds per square inch) at 70°F or, regardless of the pressure at 70°F, having an absolute pressure exceeding 140 psi at 130°F.

H. Select agent toxins

Select agent toxins are defined here as biological agents or toxins as identified in 42 CFR 73.3(d)(7) and/or at the USDA "Permissible Toxin Amounts" page (https://www.selectagents.gov/sat/permissible.htm).

H. Controlled substances

A controlled substance is any compound included in Schedules II – V of the Controlled Substances Act, 21 U.S.C. sec. 801 et seq. Requirements for ordering and working with controlled substances should be defined in a separate institutional document.

I. Radioactive compounds

Requirements for ordering and working with radioactive compounds should be defined in a separate institutional document.

5.3 Requests to use chemicals classified under Hazardous Material Classes Requiring Approval

Employees wishing to obtain and use chemicals classified under one of the categories described in the Hazardous Material Classes Requiring Approval component of this document must submit a request to the CHO. The request will include the following information:

a. Name of person submitting the request;
b. Chemical name, common name(s) (if any), and Chemical Abstract Service (CAS) Registry Number of the desired chemical;
c. Name and address of the supplier and quantity of the chemical desired;
d. Name of course and copy of the specific laboratory activity for which the chemical is needed, together with rationale for performing the activity;

e. Justification that adequate facilities, equipment, and apparel are present at the University laboratory to provide a safe working environment in which exposures will not exceed PEL or TLV for the chemical;
f. Description of specific handling guidelines (such as National Cancer Institute or NIOSH).
g. Documentation that the employee has appropriate certification, as well as sufficient knowledge and skills to handle the chemical in the prescribed manner;
h. Estimate of the length of time the chemical will be stored in the University building and justification that University storage facilities are appropriate for housing the chemical;
i. Plan for proper disposal of used chemical products and excess reagents; and
j. Date that use of the chemical is desired.

Upon receiving the request, the CHO will, within two weeks, determine whether the request will be approved. A copy of the determination and rationale will be sent to the employee making the request and to the supervisor of the employee.

The CHO will maintain records of such requests along with the response to each request. Records will be kept at least five years. Refer to Appendix F.

If the request is approved, the CHO will authorize the marking of any necessary designated areas as the only areas where work with the chemical will be conducted. Appropriate signs will be placed to identify the designated area and to indicate the hazards of the chemical to be used therein. Special labels will be affixed to all containers of the chemical indicating the date of its approval for use and designated areas to which its use is restricted. Refer to Appendix F for form.

5.4 Chemical Storage Facilities

FPU has multiple designated chemical storage rooms with suitable shelving, cabinets, and ventilation for the nature of the chemicals housed. The Inspection Report to be utilized to ensure that the chemical storage room is in compliance with the CHP can be found in Appendix D. Chemical storage rooms will have the following features:

a. Lockable door to restrict access by unauthorized persons. Deadbolt locks or hasp locks are not permitted, since they may inadvertently trap someone inside.
b. Ventilation sufficient to prevent buildup of vapors above recommended levels. OSHA 1910.106 specifies six room changes per hour (calculated), exhausted to the outside air.
c. Temperature controlled to remain in a moderate range, not to exceed the flash point of stored flammable substances, at all times during the year (including summer months).
d. Shelves or cabinets are firmly secured to the wall, with maximum shelf height of six feet. Shelf clips (if present) are corrosion-resistant.
e. ABC fire extinguisher and fire blanket near storeroom exit or within 25 feet of storage area. If reactive metals (sodium, magnesium, etc.) are stored, a Class D extinguisher will be available within 25 ft. of the storage area.
f. Eyewash and either a shower or drench hose, within 25 feet of storage area. Each unit will comply with the most recent revision of ANSI Z358.1.
g. Ceiling-mounted smoke or fire detector with outside alarm.
h. Dedicated cabinets for flammables and acids.
i. Spill control kit, with chemical splash goggles, chemical-resistant gloves, appropriate neutralizing materials and absorbent material, plastic bags, and scooper.
j. Separate, lockable storage to restrict access to highly toxic chemicals or hazardous chemicals.

k. Dedicated explosion-proof refrigerator for storage of volatile flammable materials or biological specimens (if present).

5.5 Chemical Storage Procedures (General)

a. Chemicals are arranged in chemically compatible families, not in alphabetical order.
b. Amounts stored should correspond to no more than one year's projected supply.
c. The Uniform Fire Code UFC 79.202A(2) states that when more than 10 gallons of flammable or combustible liquids (total) are present in a building, they must be stored in a dedicated cabinet meeting NFPA specifications. If the cabinet is vented, the ductwork will not be less fire-resistant than the cabinet. The amount of material stored in the cabinet will not exceed its specified rating.
d. Chemical storerooms are not to be used as prep rooms for repackaging chemicals or preparing solutions.
e. When opening newly received chemicals, immediately read the warning label to be aware of any special storage precautions like refrigeration or segregation from other chemicals.
f. No chemicals are to be stored in aisles or stairwells, on desks or laboratory benches, on floors or in hallways, or in fume hoods.
g. Maintain a complete inventory in the room where chemicals are stored, and update the inventory annually.
h. Mark the acquisition dates on all containers; dispose of peroxide-forming chemicals after six months.
i. Chemicals stored on shelves will not be stored on any shelf where the top of the shelf surface is located over 6 feet above the floor or on any shelf where the top of the shelf surface is less than 2 feet above the floor.
j. Do not crowd bottles on shelves so that some containers must be moved in order to remove the desired container.
k. Inspect bottles at least annually and dispose of those that show signs of corrosion or leakage.
l. Gas cylinders must be secured in place, with protective caps to prevent valve damage in case the cylinder falls. Store away from heat and direct sunlight.

5.6 Guidelines for Storing Chemicals from Specific Hazard Classes

Flammable Liquids

Conditions for Storage:

- Store in a cool place away from heat, sun or sources of ignition.
- Automatic fire detection equipment and spray devices should be used.
- Adequate ventilation should be provided to prevent vapor buildup.
- Use approved storage cabinets or safety cans for flammable liquids.
- Ground metal containers.

Store away from:

- Oxidizers.
- Chemicals capable of spontaneous heating.

- Explosives.
- Materials that react with air or moisture to liberate heat.
- Ignition sources.

Corrosive Chemicals

Conditions for storage:

- Separate acids from bases.
- Separate oxidizing acids (e.g., nitric acid) from other acids.
- Cabinets should be non-corroding or covered with fume resistant paint.
- Corrosives should not be stored above eye level.
- Use bottle carriers for transporting containers of corrosives.
- Have spill control pillows and neutralizing materials readily available.

Store away from:

- Toxic materials.
- Active metals (sodium, magnesium, etc.)
- Substances that release corrosive, toxic or flammable fumes on reaction.
- Organic materials.
- Flammable substances.
- Uncoated structural material.

Toxic Chemicals

Conditions for storage:

- Store away from heat, moisture and fire hazards areas.
- Protect from contamination with acids and fumes.

Store away from:

- Acids and other corrosives.
- Reactive chemicals.
- Fire hazards.
- Heat.
- Moisture.

Reactive Chemicals

Conditions for storage:

- A fire sprinkler, except where water sensitive chemicals are stored.
- Protect from extremes of temperature and rapid changes in temperature;
- Store oxidizers away from flammable or combustible materials, and away from reducing agents such as zinc and alkaline earth metals
- Store peroxide-forming chemicals in airtight containers and label with receiving and

disposal dates (these chemicals can form explosive peroxides which can be detonated by shock or heat)
- Store light-sensitive chemicals in amber bottles.

Store away from:

- Organic materials.
- Flammable materials.
- Corrosives.
- Toxic materials.

Water- and Air-Sensitive Chemicals

Conditions for storage:

- Store in waterproof, fire-resistant cabinet or room.
- Smoke and/or heat detector should be provided in storage areas.
- Eliminate all ignition sources.

Store away from:

- Water and moist air.
- Solutions of aqueous acids and bases.
- Flammable storage area.
- Reactive chemicals.

6.0 LABORATORY FACILITIES

6.1 Laboratory Design

The design of the laboratory facility will provide sufficient space for safe work by the number of persons assigned to be in the laboratory. No current legal mandate prescribes special limits on class size in science laboratories. However, guidance is provided by a number of organizations. Examples of such guidance include:

1. the Whole Building Design Guide (published by the National Institute of Building Sciences; accessible at https://www.wbdg.org/),

2. Prudent Practices in the Laboratory (published by the National Research Council; accessible at https://www.ncbi.nlm.nih.gov/books/NBK55878/)

3. the Standards and Guidelines published by the American Chemical Society (accessible at https://www.acs.org/education/policies/two-year-college/guidelines/infrastructure.html)

4. NFPA 101, Life Safety Code Handbook (published by the National Fire Protection Association; https://www.nfpa.org)

All such guidance should be taken into consideration when establishing maximum enrollments for laboratory courses. The University Registrar will enforce such course densities.

Exit doors of each science laboratory will be clearly marked and free of obstructions to permit quick, safe escape in an emergency. Furniture will be arranged for maximum use of available space while maintaining safe conditions. Desks will be separated from lab benches and aisles will be unobstructed.

Classroom areas will be assigned for use for science laboratory activities only if they meet the standards for facilities, safety equipment, and safe operating procedures specified in the CHP. The use of laboratory facilities for purposes such as teaching classes outside the subject area, monitoring study halls, or other non-laboratory-based University functions should be avoided (such uses have implications for employee training and risk management procedures).

The design of new laboratories and renovation of existing laboratories will incorporate safety features as specified in the CHP. Deficiencies in existing facilities identified during inspections will be addressed in a written action plan developed by the CHO, approved by the President, and kept on file by the CHO. Non-critical facility deficiencies requiring major structural work will typically be addressed in the normal schedule of renovation. Refer to Laboratory Inspection Report in Appendix C.

6.2 Laboratory Ventilation

The movement of air in the general ventilation system for a building will be from non-laboratory areas and corridors into the laboratories. Air from laboratories will be exhausted outdoors and not recycled. Thus, air pressure in the laboratories will be slightly negative with respect to the rest of the building. General laboratory ventilation will be adequate to exchange room air no less than 6 nor more than 12 times per hour (calculated) when chemicals are in use in the laboratory. This may be achieved through use of a switchable auxiliary exhaust system.

Any change in the laboratory facility, particularly in the ventilation system, will be instituted only if a thorough analysis of its effects demonstrates that employees will continue to have adequate protection from hazardous concentrations of toxic substances.

6.3 Fume Hoods

Laboratories in which the airborne concentration of approved chemicals has the potential to exceed listed PELs or TLVs will be equipped with a fume hood or other mechanism for exhaust to the outside air, away from air intake ports. Fume hoods will be inspected at least annually for performance capabilities and proper usage.

Although fume hoods are local ventilation devices to be used to prevent toxic, offensive, or flammable vapors from entering the laboratory atmosphere, hoods also offer other significant protection. Placing a reacting chemical system within a hood, especially with a hood sash closed, also places a physical barrier between the workers in the lab and the chemical reaction. This barrier can afford workers significant protection from chemical splashes, fires and minor explosions.

To determine whether a fume hood is needed for handling a particular chemical, assess the SDS. Some SDS terminology may indicate a need for special ventilation, such as: use with adequate ventilation; avoid vapor inhalation; use in a fume hood; or provide local exhaust ventilation.

For use of hazardous chemicals warranting local ventilation controls, the following guidelines should be observed:

1. Conduct all operations, which may generate air contaminants at or above the appropriate PEL or TLV inside a fume hood.
2. Equipment and chemicals kept in the hood will interrupt the even airflow. Fume hoods are not intended for the primary storage of chemicals. Minimize chemicals and apparatus present in the hood to include only those items being used for the current procedure. Keep all apparatus at least 6 inches back from the face of the hood and keep the slots in the hood baffle free of obstruction by apparatus or containers. Large equipment should be elevated at least two inches off the base of the fume hood, to allow for the passage of air underneath the apparatus.
3. Do not use the hood as a waste disposal mechanism except for very small quantities of volatile materials.
4. Keep the hood sash closed at all times except when the hood is in use.
5. Do not have sources of ignition inside the hood when flammable liquids or gases are present.
6. Use sash as a safety shield when boiling liquids or conducting an experiment with reactive chemicals.
7. Periodically check the airflow in the hood using a continuous monitoring device or another source of visible airflow indicator. If airflow has changed, notify the responsible university office for an inspection or repair.

Fume hood sashes will be marked in the position at which they are calibrated to deliver ~100 fpm. The hood will only operate efficiently when the sash is in this position. The sash should not be left in the fully open or fully closed position for an extended period or the efficiency of the fume hood is diminished. Fume hoods will be equipped with a manometer, pressure differential meter, velometer, or similar device to verify adequate airflow before each use. The system must be checked prior to each use to assure it is operating. Never work with hazardous chemicals if the hood is not working properly.

6.4 Designated Areas

Some chemicals may have hazards (toxicity, volatility, carcinogenic/mutagenic, etc.) for which the facilities and protective equipment of standard laboratories provide inadequate protection. Such

chemicals are not permitted in the general University laboratories. However, the chemical may be approved for use in a “designated area” equipped to handle and use the chemical with minimal risk. A designated area may be an entire laboratory, a specific area of a laboratory, or a device such as a specified fume hood.

Designated areas will be clearly marked with signs indicating the chemicals for which they are designated. In addition, containers of the chemicals will be marked with a special label indicating that their use is restricted to the designated areas.

7.0 PROTECTIVE EQUIPMENT

Maintaining a safe laboratory environment is the responsibility of both FPU and its employees. Personal protective devices and safety equipment must be provided to all employees under the appropriate circumstances and employees have the responsibility of properly using such equipment and apparel.

The SDS will provide some information on the personal protective equipment and safety procedures recommended for a given chemical, though the SDS may not provide sufficient information concerning the specific type of safety equipment required (for example, it may say “use gloves” but not list the best glove to use).

In accordance with OSHA General Requirements (29 CFR 1910.132), the CHO will oversee and document a hazard assessment (walk-through survey) of each laboratory, considering the following types of hazards:

- Impact
- Penetration
- Compression (roll-over)
- Chemicals
- Heat
- Harmful dust
- Light (optical) radiation

After the survey has been completed, the CHO shall identify protective equipment and apparel to suit the hazards. Employees who purchase their own equipment and apparel must follow the same criteria the University uses. Employee training will specifically address use and maintenance of protective equipment and apparel.

The following standards (Sections 7.1 and 7.2) shall apply to all laboratory areas, except where the hazard assessment results in more stringent requirements for specific laboratories or designated areas.

7.1 Protective Equipment in Laboratories

Each laboratory will contain the following protective equipment:

a. At least one eyewash fountain with double nozzle, conforming to the standards described in the most recent revision of ANSI Z358.1. Eyewash(es) will be located within 40 feet or 10 seconds travel from any point in the laboratory under normal working conditions. Eyewash must be within 25 feet of areas where chemicals with pH≤2.0 or ≥12.5 are used. (Note: A drench hose may not be used in place of an eyewash unit.)
b. At least one fire extinguisher, type ABC (up to ten pound charge), mounted in accordance with NFPA Standard 10, and available within 50 feet from any point in the laboratory under normal working conditions. One fire extinguisher will be located near the exit from the laboratory area. In laboratories with risk of metal fire (magnesium, sodium, etc.), a Class D fire extinguisher will also be available within 75 feet from any point in the laboratory.
c. Non-asbestos fire blanket within 50 feet from any point in the laboratory.
d. Laboratories using chemicals with pH ≤ 4.0 or ≥ 9.0 will have a safety shower or drench hose within 100 feet from any point in the laboratory under normal working conditions. The shower (required in chemistry labs only) or drench hose will conform to the standards described in the most recent revision of ANSI Z358.1.

e. Ceiling-mounted smoke or fire detector.
f. Chemical spill kit, containing: chemical splash goggles, chemical-resistant gloves, appropriate neutralizing materials and absorbing materials for the chemicals to be used in the laboratory, plastic bags, and scooper.

The following items will be immediately accessible to each laboratory area (but not necessarily located within the laboratory):

a. Master cut-offs for gas and electricity
b. First aid kit, containing only items approved by the CHO as appropriate for first aid administered by employees
c. Fire alarm actuator
d. Telephone or other communication means for use in emergencies
e. Means to sterilize goggles and other protective eyewear

7.2 Personal Protective Equipment

The following personal protective items will be readily available to all persons involved in using any University laboratory area:

a. Laboratory aprons made of chemically-inert material. Lab coats made of ordinary, non-chemically-resistant material are not acceptable.
b. Safety goggles, specifically conforming to ANSI Standard Z87.1-1989 as acceptable protection against chemical splash. Where other hazards exist (e.g., lasers, flying particles) appropriate protective eyewear, approved under ANSI Z87.1-1989, will be available. Impact goggles must not be worn when danger of a splash exists.
c. Non-permeable gloves for employee use while handling hazardous chemicals. Disposable gloves will also be available for laboratory occupants as needed.

The availability of the above items does not guarantee that they will serve as appropriate PPE for any given experiment. All students and employees working with hazardous chemicals in a University laboratory are responsible for evaluating, maintaining, and using appropriate PPE. Appropriate PPE for working with a chemical can be determined by consulting the associated SDS, the supervising faculty, or the Chemical Hygiene Officer.

7.2.1 Eye Safety Guidelines

The OSHA standard for eye safety (29 CFR 1910.133) requires the use of eye and face protection when workers are exposed to eye or face hazards such as flying objects, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.

Wearing appropriate eye protection is required whenever

i) working with chemicals if there is any chance of splashing or an aerosol or dust being formed,
ii) working with any apparatus under pressure, or
iii) handling animals in the laboratory setting.

Eye safety must be addressed during any manipulation of vials or other sealed containers during extreme temperature transitions.

Safety glasses or goggles must be ANSI-approved.

Individuals requiring eyesight correction must comply with guidance provided by OSHA. The following are acceptable approaches to address this situation:

1. use goggles that can fit comfortably over corrective eyeglasses without disturbing the alignment of the eyeglasses
2. use goggles that incorporate corrective lenses
3. use prescription glasses meeting ANSI Z87.1 standards

7.2.2 Guidelines for lab aprons, gowns, and coats

Wear an appropriate a lab apron, lab gown, a lab coat, or an appropriate combination thereof, whenever directly handling hazardous materials, working with an apparatus under pressure, engaging in a chemical spill cleanup, handling animals in a laboratory setting, or when working with biohazards in risk group 1 or risk group 2 (http://www.absa.org/riskgroups/index.html).

For PPE which are reusable, such as a reusable lab coat, arrangements should be in place to ensure that the PPE is cleaned either on-site or by a service. Students and employees should not take such PPE home for cleaning.

7.2.3 Guidelines for gloves

Wear gloves whenever there is potential for contact with hazardous chemicals or with biohazardous materials in risk group 1 or risk group 2, when handling animals in a laboratory setting, when engaged in chemical spill cleanup, or when directly handling any other hazardous material. Select the appropriate type of glove with respect to the hazard(s) under consideration (e.g., selection criteria may include factors apart from chemical permeability such as heat resistance or cut resistance). Check gloves for pinholes. Gloves should never be worn in common areas (e.g., cafeterias, lunch rooms, or offices).

7.2.4 Selecting appropriate PPE

The PPE described above is not comprehensive. Alternative or additional PPE should be used, as appropriate to the circumstances and risks associated with any protocol.

7.2.4.1 Examples of selecting PPE appropriate to a given procedure

- use of a lab coat instead of a lab apron when working with a small volume of a non-corrosive liquid
- use of a face shield in addition to safety glasses or goggles when working with a large volume of a hazardous material- when working with a corrosive substance, use of specialized gloves known to be of low permeability for that substance
- use of safety glasses with side-shields while working in the vicinity of an individual handling liquid nitrogen
- use of loose-fitting thermal gloves when handling liquid nitrogen

- ensuring long pants do not have cuffs when handling liquid nitrogen

8.0 INSPECTIONS AND MAINTENANCE

One of the most important sections of the OSHA Laboratory Standard states that all safety equipment in the laboratory must always be in good operating condition, whether the equipment is required or optional under the CHP. Employees are expected to check operation of safety equipment prior to engaging in any laboratory procedure. The inspection process in this section describes formal procedures for ensuring that equipment is performing to standards.

8.1 Responsibility for Inspections and Reporting

The Laboratory Manager is responsible for working with the CHO to coordinate, oversee and document inspections of all laboratory areas in the University at least three times during the academic year: before the end of the first month of the academic calendar, at the end of the first semester, and at the close of the academic year.

The University will provide standard forms with which to carry out all required inspections. Inspection records will be maintained by the Laboratory Manager, with copies sent to the CHO. Equipment will be tagged following the inspection, showing the date and results.

8.2 Department-Level Inspection Responsibilities and Standards

The Laboratory Manager will oversee inspections of laboratory facilities, preparation areas, and storage rooms for compliance with the following standards:

a. Number of laboratory occupants does not exceed available working area
b. Area is free of clutter; aisles and evacuation routes are unobstructed
c. Appropriate signage is readily viewable
d. Chemicals are labeled appropriately and stored in the proper arrangement
e. All required protective equipment and apparel are present

The Laboratory Manager will oversee inspection and documentation of the operating condition of the following protective equipment and apparel for compliance with listed standards:

a. Eyewash - continuous flow of ambient-temperature water at no less than 1.5 liters per minute; eyewash stations will be flushed until all stagnant water is flushed from both the unit and from all "dead leg" supply piping associated with the unit; eyewash stations will be flushed bi-monthly
b. Safety shower - continuous flow of ambient-temperature water at no less than 75.7 liters per minute; showers will be flushed until all stagnant water is flushed from both the unit and from all "dead leg" supply piping associated with the unit; showers will be flushed on a quarterly basis
c. Fire extinguisher - ABC class, fully charged
d. Goggle sanitizer (if present) - UV bulb and timer operating properly
e. Master cutoff switches for gas and electricity - operating properly
f. Safety apparel (goggles, gloves) - Usable condition, without holes or other damage that would permit exposure of eyes or skin
g. Chemical spill kit - all components present and in usable condition

8.3 University-Level Inspection Responsibilities and Standards

University-assigned or contracted personnel, under the direction of the CHO, will inspect and document the operation condition of the following protective equipment for compliance with listed standards:

a. Fume hoods - face velocity 80-100 linear feet per minute (average from measurements across opening) and with minimum turbulence (smoke test)
b. Laboratory ventilation - 6-8 room changes per hour (calculated)
c. Laboratory smoke or fire detectors - sensitivity within rated specifications
d. Fire alarm - proper operation when actuated

8.4 Maintenance and Repair of Protective Equipment

Any deficiencies revealed in an inspection will be communicated in a written report to the CHO. The CHO will monitor the progress of correcting the deficiencies.

Maintenance and repair of protective equipment will be provided by qualified University personnel or by other qualified persons contracted by the University for that purpose. In particular, maintenance of fume hoods will be performed only by persons specifically trained to do so.

Equipment that has been identified as inoperative or operating below standards will be clearly tagged and removed from use. Such equipment must not be used under any circumstances until proper repairs have been carried out and the equipment is certified as operating within standards.

9.0 RECORDKEEPING

9.1 Chemical Inventory

The Laboratory Manager will oversee an annual inventory of all chemicals stored in any University building housing educational or research laboratories. Inventory information shall include the following:

- Chemical name
- Quantity on hand
- Hazard information
- Storage location

The inventory will note any chemical classified under one of the categories described in the Hazardous Material Classes Requiring Approval component of this document. The individual(s) responsible for the inventory process will verify that permission has been obtained to use such chemicals.

The inventory, and the corresponding order records, will be maintained by the Laboratory Manager (see Section 2.6), with a copy sent to the CHO. The CHO will maintain a combined inventory of all chemicals in the University and will ensure that updated inventories are made available to local agencies (fire, chemical response, etc.) in compliance with pertinent regulations. Inventory records will be kept on file for at least five years.

9.2 Maintenance and Inspection Records

Records of required inspections will be completed and retained by the appropriate Laboratory Manager, with copies sent to the CHO. Equipment will be tagged to indicate the date and the results of the last inspection.

When deficiencies are noted in equipment or facilities, a written report describing the deficiencies will be submitted to the CHO. The University will act to correct any such deficiencies. The CHO will monitor the progress of correcting the deficiencies. The CHO will maintain records documenting maintenance performed to bring equipment or facilities up to standards. Maintenance and inspection records will be kept at least five years.

9.3 Training Records

Records documenting the dates and content of chemical hygiene training sessions for each employee will be completed and retained by the CHO. Training records will be kept for at least one year after an employee leaves a position, see Appendix E for CHP training record forms.

9.4 Incident/Accident Reports

Incident and accident reports are retained in the office of the Director of the Department of Campus Safety. A report copy will be sent to the CHO for any accident or incident associated with laboratory or chemical safety. Reports are kept for at least ten years, see Appendix G for Laboratory Accident/ Incident Report Form.

9.5 Medical and Exposure Records

OSHA regulations in CCR 5191, sections (c), (d), (j) require that records of air concentration monitoring, exposure assessments, medical consultations, and medical examinations be maintained for at least 30 years after the employee leaves the University. The CHO will keep these records.

10.0 RESPONDING TO INCIDENTS AND EXPOSURES

10.1 General Accident Procedures

While the practices and procedures specified in the CHP will help to minimize risk of exposure to hazardous chemicals, employees must be knowledgeable about what to do should an accident occur. Types of emergencies that should be anticipated are:

- Thermal and chemical burns
- Chemicals in the eye
- Skin contact and irritation by chemicals
- Inhalation, ingestion, or skin absorption of chemicals
- Cuts and puncture wounds

Laboratory employees must be familiar with their work area and know the location and procedures for using the following safety items:

- Fire extinguisher and fire blanket
- Eyewash and shower/drench hose
- Chemical spill clean-up kits
- First aid kits
- Master utility cut-offs (gas and electricity) for the laboratory
- Emergency telephone and emergency phone numbers

If a specific laboratory area does not have immediate access to a telephone, a standard procedure will be developed for use by employees in notifying the Campus Safety department in the event of an emergency.

In the event of a laboratory accident:

a. Follow the appropriate steps to contain and/or isolate the hazard, if the nature and scope of the accident allow individual employee action. When helping another person, remember to evaluate the potential danger to yourself before taking action. Otherwise evacuate the area immediately.
b. Report the nature and location of the emergency to the appropriate fire or medical facility. Give your name, telephone number, building, and room number. If individuals are involved, report how many, whether they are unconscious, burned, or trapped, whether an explosion has occurred, and whether there has been a chemical or electrical fire. Do not make any other phone calls unless they directly relate to the control of the emergency.
c. Notify the University's administration and others in the immediate area about the nature of the emergency.
d. Meet the emergency personnel at the indicated location, or send someone to meet them.
e. Do not move any injured person unless they are in further danger. Use general first aid techniques, if appropriate (see Section 10.7).

10.2 Chemical Accidents Involving Persons

If a chemical spills on any part of a person, treatment must begin immediately. Often the volume

spilled is not as important as the toxicity or corrosive properties of the chemical. When the situation has stabilized, check the SDS to see if any delayed effects should be expected.

a. If chemicals are in the eyes, lead the victim to the eyewash station, help them hold both eyes open, and irrigate with plenty of water for at least 15 minutes. Check for and remove contact lenses.
b. For a chemical splash to other parts of the body, do not attempt to wipe the clothes. Remove all contaminated clothing, shoes, and jewelry immediately and wash the skin with soap and water. Flush the skin for at least five minutes. For splashes covering major portions of the body, use the shower or drench hose to flood the affected area before removing contaminated clothing. Use caution when removing pullover garments to prevent contamination of the eyes. It is advisable to seek medical attention even for minor chemical burns. Do not use creams or lotions.
c. If chemicals are ingested, encourage the victim to drink large amounts of water en route to medical assistance. Contact the medical staff and poison control center for further instructions. Be sure to note which chemical is believed to have been ingested.

10.3 Dealing With Chemical Spills

a. If there is no fire hazard and the material is not particularly volatile or toxic, confine the spill, cover the liquid with absorbent from the spill kit, scoop into a plastic disposal bag, and follow disposal instructions listed on the SDS. Wear appropriate gloves and other personal protective equipment. Clean the contaminated area with soap and water after removing the spill.
b. If a corrosive material is spilled, confine the spill and neutralize with appropriate agent (baking soda for acids, vinegar for bases). Cover the liquid with absorbent from the spill kit, scoop into a plastic disposal bag, and follow disposal instructions listed on the SDS. Wear appropriate gloves and other personal protective equipment. Clean the contaminated area with soap and water after removing the spill.
c. If a volatile, flammable material is spilled, immediately extinguish flames and turn off electrical apparatus. Evacuate the area by established routes. Cover the liquid with absorbent from the spill kit, scoop into a plastic disposal bag, and follow disposal instructions listed on the SDS. Wear appropriate personal protective equipment. If the quantity exceeds the employee's ability or training to handle, seal the area until appropriately trained personnel arrive.
d. If a volatile, toxic material is spilled outside the hood, evacuate the area by established routes and seal until personnel trained to use appropriate breathing apparatus arrive.
e. If a nonvolatile, toxic material is spilled, isolate the area of the spill. Consult the SDS for appropriate clean-up procedures and wear appropriate personal protective equipment. If the quantity or toxicity of the chemical exceeds the employee's ability or training to handle, evacuate the area until appropriately trained personnel arrive.
f. Use care in cleaning spills involving multiple chemicals, so that reactive combinations do not occur in used chemical receptacles. Treat absorbing material as chemical waste and dispose accordingly; do not dispose in ordinary trashcans.

10.4 Fire Accidents Involving Persons

a. If a person's clothing is on fire, douse the individual with water or wrap the person in a

coat, blanket, or whatever is immediately available and roll the victim on the floor to smother the flames. Use fire blankets with caution, because wrapping the body can force flames toward the face and neck.

b. Quickly remove any clothing contaminated with chemicals. Use caution removing pullover garments to prevent contamination of the eyes.
c. Douse the burned areas with water to remove heat and place clean, wet, cold cloths on burned areas. Wrap the injured person to avoid shock and exposure.
d. Get medical attention promptly.

10.5 Dealing With Fires

a. A fire contained in a small vessel can often be suffocated by covering the vessel with an inverted container. Do not use dry towels or cloths. Remove nearby flammable materials.
b. Do not discharge a fire extinguisher at an uncontained pool of burning liquid. Avoid breathing gases and smoke from the fire. Always fight the fire from a position of escape.
c. In fires that appear controllable, direct the discharge from a fire extinguisher at the base of the flames. Use the proper fire extinguisher for the type of fire:
    a. Water extinguishers are effective against burning paper and trash (Class A fires). Do not use water for extinguishing electrical, liquid, or metal fires.
    b. Carbon dioxide and dry powder extinguishers are effective against burning liquids and electrical fires (Class B and C). They are less effective against burning paper or metal fires. Avoid using dry powder extinguishers in areas with delicate instruments and computers, due to the clean-up efforts required afterward.
    c. Met-L-X and certain dry chemical extinguishers have special formulations for use against burning metals (Class D fires), such as magnesium or sodium.
d. If the fire is too large to be suffocated quickly and simply, or if it is believed to produce toxic fumes, vacate the area following established evacuation routes, sound the fire alarm, and notify the fire department. On arrival, inform fire fighters what chemicals are involved, or may become involved.
e. In case of a fire involving an electrical device (like a hotplate), shut off the electricity to the affected outlet.
f. Immediately after the fire, all extinguishers used must be recharged or replaced with full ones.

10.6 Power Outages

If emergency lighting and alarms are not operable, evacuate the building after the following steps have been taken:

a. Place lids on all open containers of volatile chemicals
b. Lower the sash on chemical fume hoods
c. Shut down all equipment (leave cooling water and purge gases on as necessary)
d. Turn off ignition sources
e. Secure or isolate reactions that are underway (boiling liquid on a hot plate, distillations)
f. Close fire doors
g. Take your books, coats, purse/wallet, keys, etc.
h. Lock outside door to lab

10.7 Personal Injury and First Aid

When an employee or student is injured in a life-threatening manner, call the appropriate emergency response personnel immediately. If the victim requires immediate attention, consider the following priorities:

a. First, make sure you are not endangering yourself by entering the scene. Watch for unstable structures, radiation hazards, electrical wires, toxic fumes, chemical spill, fires, etc.
b. Pulse: Check the pulse at the side of the throat under the jaw. If there is no pulse, CPR should be started, but only by a trained individual. Do not attempt CPR if you're not trained.
c. Bleeding: Stop bleeding by applying either a bandage or your hand firmly over the wound. If no fractures are suspected, wrap the wound with a firm bandage and elevate the injury. Never use a tourniquet. Do not apply any ointments or creams.
d. Shock: When victims look pale and say they are cool, elevate the legs 10 to 12 inches and cover them with something. Do not move victims unless there is a life and death situation (fire, etc.), otherwise keep them still and as comfortable as possible.
e. Burns: Stop burning by cooling if necessary. Cover the area with a dry, clean dressing. Chemical burns in the eyes or on other parts of the body should be flushed with large amounts of water. Do not put any ointments or creams on burns.

10.8 Accident/Incident Reporting

All incidents and accidents must be reported on the approved form (see Appendix G), even if no injuries occurred. Attach reports from eyewitnesses. Copies of incident reports will be kept by the CHO. These reports will be carefully analyzed to prevent recurrence, with the results distributed to all who might benefit. A periodic review of incident reports will look for problem areas that need special attention. Refer to Appendix G for reports.

Violations of CHP standards by faculty or by any students under a faculty's supervision will be reported in writing and become a part of that faculty member's permanent file. Any violation may result in disciplinary action.

10.9 Exposure Assessment

It is the policy of the University to investigate in a prompt manner all employee-reported incidents in which there is a possibility of overexposure to a toxic substance. Events or circumstances that might reasonably constituting overexposure include:

a. A hazardous chemical leaked or was spilled or was otherwise rapidly released in an uncontrolled manner.
b. A laboratory employee had direct skin or eye contact with a hazardous chemical.
c. A laboratory employee manifests symptoms, such as headache, rash, nausea, coughing, tearing, irritation or redness of eyes, irritation of nose or throat, dizziness, loss of motor dexterity or judgment, etc., and
d. Some or all of the symptoms disappear when the person is taken out of the exposure area and breaths fresh air, and
e. The symptoms reappear after the person returns to the affected workplace.
f. Two or more persons in the same work area have similar complaints.

If evidence is sufficient, investigation of an incident may result in the decision to conduct a formal

exposure assessment. It is not the purpose of an exposure assessment to place blame for the incident on any person or source. It is to gather facts regarding the possible exposure and the chemical(s) involved. The exposure assessment will include: interviews with involved persons; environmental monitoring results; and determinations regarding chemicals involved and control measures in use at the time of the incident.

10.10 Monitoring

Highly toxic substances are not commonly used in the University laboratory program, and regular instrumental monitoring of airborne concentrations is not justified or practical. Initial monitoring may be necessary for laboratories under renovation involving changes in general ventilation or hood installation.

Monitoring for specific airborne substances shall be performed in cases of suspected or known employee exposure. If the measured concentration exceeds the PEL, TLV, or other specified action level, then steps will be taken immediately to reduce the level to permissible limits. All laboratory employees will be notified of the results of the measurement within fifteen days, and further monitoring will be undertaken in compliance with CCR Title 8 section 5191 c,d,j to verify that the steps to reduce the exposure have been effective. Monitoring will be discontinued after levels are shown to be consistently below the action level for the specific material.

10.11 Medical Consultations

University laboratory workers do not regularly handle significant quantities of materials that are acutely or chronically toxic. Therefore, regular medical surveillance is not justified.

The University will provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances:

1. When an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee must be provided an opportunity to receive an appropriate examination.
2. Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the Permissible Exposure Limit) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected employee as prescribed by the particular standard.
3. Whenever an event takes place in the work area, such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee shall be provided an opportunity for a medical consultation. Such consultations shall be for the purpose of determining the need for a medical examination.

All medical consultations and examinations must be performed by or under the direct supervision of a licensed physician and must be provided without cost to the employee, without loss of pay and at a reasonable time and place.

The University shall provide the following information to the physician:

1. The identity of the hazardous chemical(s) to which the employee may have been exposed.

2. A description of the conditions surrounding the exposure, including available quantitative exposure data.
3. A description of the signs and symptoms of exposure that the employee is experiencing, if any.

The University shall obtain a written opinion from the examining physician, which shall include the following:

1. Any recommendation for further medical follow-up.
2. The results of the medical examination and any associated tests.
3. Any medical condition, which may be revealed in the course of the examination, which may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace.
4. A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment. The written opinion of the physician shall not reveal specific finding of diagnoses unrelated to occupational exposure.

A record of the results of the consultation, including tests performed and conclusions reached, will be maintained by the University personnel office. Other employees working under the same conditions will be notified of the results of the consultation.

11.0 USED AND WASTE CHEMICALS

The aim of the used and waste chemical program is to assure that minimal harm to people, other organisms, and the environment will result from the disposal of waste laboratory chemicals from this University. The first priority in the program is to reduce the amount and variety of used and waste chemicals generated. This is achieved by:

a. Planning experiments to reduce types of products generated;
b. Reducing the scale of experiments to limit the amounts of products generated;
c. Purchase of chemicals only in the amounts needed; and
d. Recovery of chemicals from reaction products.

11.1 Chemical waste guidelines

All chemical wastes will be disposed of in accordance with the guidelines in this document. Indiscriminate disposal of chemical waste by pouring down the drain, by adding to mixed refuse for landfill burial, or by evaporating volatiles in the hood is not acceptable.

11.1.1 Definition of a chemical waste

For the purposes of the Chemical Hygiene Plan, a "waste" is defined as any material that should be disposed of as it no longer has clear and obvious utility. A material is a "waste" if a student or employee

i. has decided the material is no longer needed or desired in his/her work area and
ii. the material will not be used or reused

If such a material is in the form of a solution, gel, or solid (e.g., powder, crystalline, etc.), it is a chemical waste.

If a chemical waste is, or has come in contact with, a hazardous chemical, biological, or radiological substance, it is classified as a "hazardous chemical waste".

Biological and radiological hazardous wastes must be segregated and stored in separate, appropriate containers. Consult the Chemical Hygiene Officer if you have questions regarding appropriate segregation and storage of biological or radiological wastes.

11.1.2 Identifying hazardous chemical waste

Any chemical not listed in Appendix M (Non-hazardous chemical waste list) must be treated as a hazardous waste.

11.1.3 Examples of hazardous chemical waste

Examples of hazardous wastes include

· most organic solvents (e.g., benzene, toluene, acetone, methylene chloride, or tetrahydrofuran)
· hazardous chemicals for which there is no longer an intent to use the chemical (e.g., a partially spent lecture bottle of a strong oxidant gas)

· a solution of 10% ethidium bromide
· butyl lithium
· 60% hydrogen peroxide
· bromine
· acrylamide

11.1.4 Collecting hazardous chemical waste

Do not use chemical evaporation or drains to dispose of hazardous waste.

The container for hazardous waste

- must be labeled properly as soon as the first hazardous waste enters the container;
- must be kept sealed except when in use (i.e., when adding waste to the container.
- must be compatible with the hazardous waste;
- must be in good condition (e.g., non-leaking);
- must *not* be completely filled (e.g., leave appr. 2" at the top)
- must be in use for no longer than 9 months from the initial use date.

Broken mercury thermometers will be placed in a separate container.

11.1.4.1 Hazardous waste container labeling

Hazardous waste containers shall be labeled with the following:

a. one or more chemical hazard classes (this can be found on the corresponding SDS);
b. name of chemical(s) in the container (formulas and/or abbreviations are not acceptable);
c. approximate percentage or concentration (as appropriate) of each chemical (if a mixture);
d. date waste initially added to container; and
e. name of responsible individual (this must be an employee of the University)

11.1.4.1.1 Example of acceptable hazardous waste container label

An example of an acceptable hazardous waste container label is shown on the following page.

Date waste first generated: _____

Chemical hazard class(es): _____

Responsible individual:

Last name: _____

First name: _____

Components of hazardous waste:

Component	% or concentration (indicate units if concentration)
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

11.1.5 Disposal of non-hazardous chemical wastes

Appendix M (Non-hazardous chemical waste list) lists specific chemicals which may be disposed of through drain disposal or via the conventional solid waste stream of the University.

Chemicals listed as permissible for drain disposal are permissible for drain disposal only when the University's drain system connects to a sanitary sewer system that ultimately flows to a wastewater treatment facility.

11.1.6 Disposing of hazardous chemical waste

Dispose of hazardous waste at the end of the work day or, for a teaching lab, at the completion of the lab session. Hazardous waste may be accumulated through the completion of a longer-term project only with written permission from the Chemical Hygiene Officer. **Do not abandon the waste so that someone else must deal with it**.

Dispose of hazardous waste by moving it to the Satellite Accumulation Area

11.1.7 The Satellite Accumulation Area

The School of Arts and Sciences laboratories use a single Satellite Accumulation Area located in AIH 236.

The Satellite Accumulation Area is intended for accumulation of small amounts of hazardous chemical waste, at or near the point of generation, associated with the ongoing operations of the university laboratories.

The Satellite Accumulation Area

- cannot accumulate more than 55 gallons total of hazardous wastes;
- cannot accumulate more than one quart of any single extremely or acutely hazardous waste

Once a chemical waste container is moved to the SAA, students and employees may not handle or transport the containers without specific authorization from the CHO. Chemical waste will be transported only by University employees or contractors specifically certified and authorized to do so.

Within the School of Arts and Sciences, requests for pickup and disposal of waste will originate from the Laboratory Manager. The CHO will respond by arranging pickup and disposal of waste at regular intervals in accordance with local, state, and federal regulations. The CHO will maintain appropriate records for waste storage and disposal. Refer to Appendix J for Request to Remove Used Chemicals form.

11.2 Unknown chemical wastes

On occasion a reagent container has lost a label or the label is stained or otherwise unreadable. On occasion, students, staff, and/or faculty simply neglect to label waste containers.

Any student or employee generating hazardous chemical waste is responsible for ensuring all chemical wastes under his/her control are identified and clearly labeled.

In the event that a chemical container is found, is not empty, and the contents of the container are

unknown, the following steps should be taken:

- Attempt to identify the contents of the container. Communicate with students, staff, and/or faculty as appropriate to attempt to determine who generated the waste, how the waste was generated, and the composition of the waste.
- If the contents still cannot be identified, attach a hazardous chemical waste label to the container and write the word “UNKNOWN” in the section describing the chemical composition of the waste.
- Notify the Chemical Hygiene Officer that you have an unknown chemical waste.
- If necessary, move the container containing the unknown to the SAA.
- The institution should arrange for characterization and/or disposal of the container in compliance with federal, state, and local regulations.

Chemical Hygiene Plan Appendices

Appendix A. Glossary of Terms

ACGIH. The American Conference of Governmental Industrial Hygienists is a voluntary membership organization of professional industrial hygiene personnel in governmental or educational institutions. The ACGIH develops and publishes recommended occupational exposure limits each year called Threshold Limit Values (TLV's) for hundreds of chemicals, physical agents, and includes Biological Exposure Indices (BEI).

Action Level. A concentration designated in CCR Title 8 section 5191 b for a specific substance, calculated as an eight hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Acute. Severe, often dangerous exposure conditions in which relatively rapid changes occur.

Acute Exposure. An intense exposure over a relatively short period of time.

Allergen. An agent capable of producing an immunologic reaction.

ANSI. The American National Standards Institute is a voluntary membership organization (run with private funding) that develops national consensus standards for a wide variety of devices and procedures.

Asphyxiant. A chemical (gas or vapor) that can cause death or unconsciousness by suffocation. Simple asphyxiants such as nitrogen, either use up or displace oxygen in the air. They become especially dangerous in confined or enclosed spaces. Chemical asphyxiants, such as carbon monoxide and hydrogen sulfide, interfere with the body's ability to absorb or transport oxygen to the tissues.

Autoclave. A device to expose items to steam at a high pressure in order to decontaminate the materials or render them sterile.

Biohazard. Infectious agents that present a risk or potential risk to the health of humans or other animals, either directly through infection or indirectly through damage to the environment.

Boiling Point. The temperature at which the vapor pressure of a liquid equals atmospheric pressure or at which the liquid changes to a vapor. The boiling point is usually expressed in degrees Fahrenheit. If a flammable material has a low boiling point, it indicates a special fire hazard.

"C" or Ceiling. A description usually seen in connection with a published exposure limit. It refers to the concentration that should not be exceeded, even for an instant. It may be written as TLV-C or Threshold Limit Value--Ceiling (See also THRESHOLD LIMIT VALUE).

Carcinogen. A substance that may cause cancer in animals or humans.

C.A.S. Number. Identifies a particular chemical by the Chemical Abstracts Service, a service of the American Chemical Society that indexes and compiles abstracts of worldwide chemical literature called "Chemical Abstracts."

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

Chemical Hygiene Plan. A written program developed and implemented by the department which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting students, instructors and other personnel from the health hazards presented by the hazardous chemicals used in that particular workplace.

Chronic. An adverse effect with symptoms that develop slowly over a long period of time or that frequently recur.

Chronic exposure. A prolonged exposure occurring over a period of days, weeks, or years.

Combustible. According to the DOT and NFPA, COMBUSTIBLE liquids are those having a flash point at or above 100 deg.F (37.8 deg. C), or liquids that will bum. They do not ignite as easily as flammable liquids. However, combustible liquids can be ignited under certain circumstances, and must be handled with caution. Substances such as wood, paper, etc., are termed "Ordinary Combustibles."

Concentration. The relative amount of a material in combination with another material. For example, 5 parts (of acetone) per million (parts of air).

Corrosive. A substance that, according to the DOT, causes visible destruction or permanent changes in human skin tissue at the site of contact or is highly corrosive to steel.

Cutaneous/Dermal. Pertaining to or affecting the skin.

Cytotoxin. A substance toxic to cells in culture, or to cells in an organism.

Decomposition. The breakdown of a chemical or substance into different parts or simpler compounds. Decomposition can occur due to heat, chemical reaction, decay, etc.

Designated Area. An area, which may be used for work with "select carcinogens," reproductive toxins or substances that have a high degree of acute toxicity. This area may be the

entire laboratory or an area under a device such as a laboratory hood.

Dermatitis. An inflammation of the skin.

Dilution Ventilation. See GENERAL VENTILATION.

DOT. The United States Department of Transportation is the Federal agency that regulates the labeling and transportation of hazardous materials.

Dyspnea. Shortness of breath, difficult or labored breathing.

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

EPA. The Environmental Protection Agency is the governmental agency responsible for administration of laws to control and/or reduce pollution of air, water, and land systems.

EPA Number. The number assigned to chemicals regulated by the Environmental Protection Agency (EPA).

Epidemiology. The study of disease in human populations.

Erythema. A reddening of the skin.

Evaporation Rate. The rate at which a material is converted to vapor (evaporates) at a given temperature and pressure when compared to the evaporation rate of a given substance. Health and fire hazard evaluations of materials involve consideration of evaporation rates as one aspect of the evaluation.

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

Flammable Gas. A gas that, at an ambient temperature and pressure, forms a flammable mixture with air at a

concentration of 13 percent by volume or less; or, a gas that, at an ambient temperature and pressure forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit.

Flash Point. The lowest temperature at which a liquid gives off enough vapor to form an ignitable mixture and burn when a source of ignition (sparks, open flames, etc.) is present. Two tests are used to determine the flash point: open cup and closed cup. The test method is indicated on the SDS after the flash point.

Fume. A solid particle that has condensed from the vapor state.

Gas. Chemical substances that exist in the gaseous state at room temperature.

General Ventilation. Also known as general exhaust ventilation, this is a system of ventilation consisting of either natural or mechanically induced fresh air movements to mix with and dilute contaminants in the workroom air. This is not the recommended type of ventilation to control contaminants that are highly toxic, when there may be corrosion problems from the contaminant, when the worker is close to where the contaminant is being generated, and where fire or explosion hazards are generated close to sources of ignition (See LOCAL EXHAUST VENTILATION).

Grams per Kilogram (g/kg) —- This indicates the dose of a substance given to test animals in toxicity studies. For example, a dose may be 2 grams (of substance) per kilogram of body weight (of the experimental animal).

Health Hazard. A chemical for which there is scientifically valid evidence that acute or chronic health effects may occur in exposed persons. Included are: allergens, embryotoxicants, carcinogens, toxic or highly toxic agents, reproductive toxicants, irritants, corrosives, sensitizers, hepatotoxins (liver), nephrotoxins (kidneys), neurotoxins (nervous system), hematopoietic systems agents (blood), and agents which damage the lungs, skin, eyes, or mucous membranes.

Hazardous Chemicals. Any chemical for which there is significant evidence that acute or chronic health effects may occur in exposed personnel. The term “health hazard" includes chemicals that are carcinogens, toxins, irritants, corrosives, sensitizers or other agents that can damage the lungs, skin, eyes or mucous membranes.

Ignitable. A solid, liquid or compressed gas waste that has a flash point of less than 140 deg. F. Ignitable material may be regulated by the EPA as a hazardous waste, as well.

Incompatible. The term applied to two substances to indicate that one material cannot be mixed with the other without the possibility of a dangerous reaction.

Ingestion. Taking a substance into the body through the mouth as food, drink, medicine, or unknowingly as on-contaminated hands or cigarettes, etc.

Inhalation. The breathing in of an airborn substance that may be in the form of gas, fumes, mists, vapors, dusts, or aerosols.

Inhibitor. A substance that is added to another to prevent or slow down an unwanted reaction or change.

Irritant. A substance that produces an irritation effect when it contacts skin, eyes, nose, or respiratory system.

Laboratory-type Hood. A device constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory.

Laminar Air Flow. Airflow in which the entire mass of air within a designated space moves with uniform velocity in a single direction along parallel flow lines with a minimum of mixing.

Lethal Concentration 50 (LC50). The concentration of an air contaminant that will kill 50 percent of the test

animals in a group during a single exposure.

Lethal Dose 50 (LD50). The dose of a substance or chemical that will kill 50 percent of the test animals in a group within the first 30 days following exposure.

Local Exhaust Ventilation (Also known as exhaust ventilation.). A ventilation system that captures and removes air contaminants at the point they are being produced before they escape into the workroom air. The system consists of hoods, ductwork, a fan and possibly an air-cleaning device. Advantages of local exhaust ventilation over general ventilation include: removing the contaminant rather than diluting it; less airflow making it a more economical system over the long run; and conservation or reclamation of valuable materials. However, the system must be properly designed with the correctly shaped and placed hoods, correctly sized fans and correctly connected ductwork.

Lower Explosive Limit (LEL) (Also known as Lower Flammable Limit-LFL). The lowest concentration of a substance that will produce a fire or flash when an ignition source (flame, spark, etc.) is present. It is expressed in percent of vapor or gas in the air by volume. Below the LEL or LFL, the air/contaminant mixture is theoretically too "lean" to bum (See also UEL).

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

Melting Point. The temperature at which a solid changes to a liquid. A melting range any be given for mixtures.

MSDS. Material Safety Data Sheet. Use of MSDS is now obsolete. Superseded by the Safety Data Sheet (SDS).

MSHA. The Mine Safety and Health Administration; a Federal agency that regulates the mining industry in the safety and health area.

Mutagen. Anything that can cause a change (or mutation) in the genetic material of a living cell.

Narcosis. Stupor or unconsciousness caused by exposure to a chemical.

Neoplastigen. Chemical capable of causing non-cancerous tumors.

NFPA. The National Fire Protection Association is a voluntary membership organization whose aims are to promote and improve fire protection and prevention. NFPA has published 16 volumes of codes known as the National Fire Codes. Within these codes is Standard No. 704, "Identification of the Fire Hazards of Materials." This is a system that rates the hazard of a material during a fire. These hazards are divided into health, flammability, and reactivity hazards and appear in a well-known diamond system using from zero through four to indicate severity of the hazard. Zero indicates no special hazard and four indicates severe hazard.

NIOSH. The National Institute for Occupational Safety and Health is a Federal agency that among its various responsibilities trains occupational health and safety professionals, conducts research on health and safety concems, and tests and certifies respirators for workplace use.

Occupational Safety and Health Administration (OSHA). A Federal agency under the Department of Labor that publishes and enforces safety and health regulations for most businesses and industries in the United States.

Odor Threshold. The minimum concentration of a substance at which a majority of test subjects can detect and identify the substance's characteristic odor.

Oxidation. The process of combining oxygen with some other substance or a chemical change in which and atom loses electrons.

Oxidizer. Is a substance that gives up oxygen easily to stimulate combustion of organic material.

Oxygen Deficiency. An atmosphere having less than the normal percentage of oxygen found in normal air. Normal air contains 21% oxygen at sea level.

Permissible Exposure Limit (PEL). An exposure limit that is published and enforced by OSHA as a legal standard. PEL may be either a time-weighted-average (TWA) exposure limit (8 hour), a 15-minute short-term exposure limit (STEL), or a ceiling (C). The PELs are found in Tables Z-1, Z-2, or Z-3 of OSHA regulations 1910.1000. (See also TLV).

Personal Protective Equipment. Any devices or clothing worn by the worker to protect against hazards in the environment. Examples are respirators, gloves, and chemical splash goggles.

Physical Hazard. A chemical that has scientifically valid evidence proving it to be a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

Polymerization. A chemical reaction in which two or more small molecules combine to form larger molecules that contain repeating structural units of the original molecules. A hazardous polymerization is the above reaction with an uncontrolled release of energy.

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

RAD. The unit of absorbed dose equal to 100 ergs per gram or 0.01 joules per kilogram of absorbing material.

Reactivity. A substance's susceptibility to undergoing a chemical reaction or change that may result in dangerous side effects, such as explosion , burning, and corrosive or toxic emissions. The conditions that cause the reaction, such as heat, other chemicals, and dropping, will usually be specified as "Conditions to Avoid" when a chemical's reactivity is discussed on a MSDS.

Respirator. A device, which is designed to protect the wearer from inhaling harmful contaminants.

Respiratory Hazard. A particular concentration of an airborne contaminant that, when it enters the body by way of the respiratory system or by being breathed into the lungs, results in some bodily function impairment.

SDS. Safety Data Sheet

Sensitizer. A substance that may cause no reaction in a person during initial exposures, but afterwards, further exposures will cause an allergic response to the substance.

Short Term Exposure Limit. Represented as STEL or TLV-STEL, this is the maximum concentration to which workers can be exposed for a short period of time (15 minutes) for only four times throughout the day with at least one hour between exposures. Also, the daily TLV-TWA must not be exceeded.

"Skin". This designation sometimes appears alongside a TLV or PEL. It refers to the possibility of absorption of the particular chemical through the skin and eyes. Thus, protection of large surface areas of skin should be considered to prevent skin absorption so that the TLV is not invalidated.

Systemic. Spread throughout the body; affecting many or all body systems or organs; not localized in one spot

or area.

Teratogen. An agent or substance that may cause physical defects in the developing embryo or fetus when a pregnant female is exposed to that substance.

Threshold Limit Value. Airborne concentrations of substances devised by the ACGIH that represent conditions under which it is believed that nearly all workers may be exposed day after day with no adverse effect. TLVs are advisory exposure guidelines, not legal standards that are based on evidence from industrial experience, animal studies, or human studies when they exist. There are three different types of TLVs: Time Weighted Average (TLV-TWA), Short Term Exposure Limit (TLV-STEL) and Ceiling (TLV-C). (See also PEL).

Time Weighted Average. The average time, over a given work period (e.g. 8-hour workday) of a person's exposure to a chemical or an agent. The average is determined by sampling for the contaminant throughout the time period. Represented as TLV-TWA.

Toxicity. The potential of a substance to exert a harmful effect on humans or animals and a description of the effect and the conditions or concentration under which the effect takes place.

Trade Name. The commercial name or trademark by which a chemical is known. One chemical may have a variety of trade names depending on the manufacturers or distributors involved.

Unstable (Reactive). A chemical that, in its pure state or as commercially produced, will react vigorously in some hazardous way under shock conditions (i.e., dropping), certain temperatures, or pressures.

Upper Explosive Limit. Also known as Upper Flammable Limit, is the highest concentration (expressed in percent of vapor or gas in the air by volume) of a substance that will burn or explode when an ignition source is present. Theoretically, above this limit the mixture is said to be too "rich" to support combustion. The difference between the LEL and the UEL constitutes the flammable range or explosive range of a substance. That is, if the LEL is l ppm and the UEL is 5 ppm, then the explosive range of the chemical is 1 ppm to 5 ppm. (See also LEL).

Vapor. The gaseous state of substances, which are normally in the liquid or solid state (at normal room temperature and pressure). Vapors evaporate into the air from liquids such as solvents. Solvents with low boiling points will evaporate.

Vapor Pressure. The pressure that a solid or liquid exerts when it is in equilibrium with its vapor at a given temperature.

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

Appendix B. Incompatibility of laboratory chemicals

Refer to the SDS provided by the manufacturer to determine the chemical incompatibilites of any chemical.

Appendix C. Laboratory inspection report

Laboratory Inspection Report

School: _____ Building: _____ Room: _____
Inspector: _____ Date: _____

Does this laboratory contain a "designated area"? ☐ YES ☐ NO

A "desiginated area" is an area which may be used for work with "selected carcinogens", reproductive toxins, or substances which have a high degree of acute toxicity

If YES, list the chemical(s) designated or attach a copy of the inventory to this report.

Item	Standard	Ref	Meets Standard	Below Standard	Comments
Room appearance	General cleanliness; aisles clear	4.3.6			
Ventilation	General ventilation operative; auxiliary ventilation to outside	5.4			
Fume hood (see note 1)	draw approx. 100 ft/min and sash marked at 100 fpm point; exhausts to outside	6.3			
	not used for storage	5.5 and 6.3.2			
Fire extinguishers	Type ABC, available within 50 ft. from any point; one extinguisher near exit; Class D available within 75 ft. for Mg, Na, etc.	7.1, 8.2			
Fire blanket	Non-asbestos, available within 50 ft from any point in lab.	7.1			
Eyewash(es)	Double-nozzle; delivers continuous stream of water at minimum 1.5 L per min. for 15 min.; available within 40 ft from any point in lab (within 25 ft if lab uses chemicals with pH≤2 or ≥12	7.1			
	Prominent sign posted?	3.3			
Shower (see note 2)	available within 100 ft; deliver continuous stream for 10 min. at 75.7 L per min	7.1			
	Prominent sign posted?	3.3			
Smoke and/or fire detector	mounted in ceiling in central part of lab	7.1			
Master cut-offs	readily accessible cutoffs for gas and electricity (but not necessarily within the lab)	7.1			
Chemical spill kit	contains splash goggles, chemically resistant gloves, neutralizing & absorbing materials, plastic bags, and scooper; available within lab	7.1			
First aid kit	Readily accessible to lab; contains items approved by DCHO	7.1			
Protective eyewear	accessible means to sterilize goggles	7.1			
	ANSI-approved (Z87.1-1989) safety goggles readily available to all persons in lab area	7.2			
Lab apron	chemically-resistant material; readily available to all persons in lab area	7.2			
Gloves	non-permeable gloves for preparation and handling; disposable gloves for lab work	7.2			
Used chemical container(s)	present for substances in use; appropriately labeled	11.1			
Broken glass container	Present in lab area; clearly labeled and clearly visible	11.1			
Labels	stock bottles have labels conforming to conventional OSHA HCS system or to 1910.1200(f)(6)				
	"secondary use" containers (prepared and emptied within 24 h) are labeled				

Posted information and LOCATOR SIGNS:	Ref	Sign Clearly Visible	Sign- Not Clearly Visible	Sign Missing	Not Applicable	**Comments**
Emergency phone numbers						
Standard lab procedures, safety precautions, and emergency medical procedures	3.3					
Exit signs						
Evacuation routes						
Designated area(s)	3.3					

LOCATOR SIGNS for Safety Equipment:	Ref	Sign is Clearly Visible	Sign- Not Clearly Visible	Sign Is Missing	Not Applicable	**Comments**
fire extinguisher	3.3					
fire blanket	3.3					
first aid kit	3.3					
utility cut-offs						

Other comments and concerns:

Inspector's signature _____ Date _____

Chemical Hygiene Officer signature _____ Date _____

Appendix D. Chemical Storeroom Inspection Report

Chemical Storeroom Inspection Report

Complete and submit to the University Chemical Hygiene Officer

School _____ Building _____ Room _____

Inspector _____ Date _____

Is the chemical storage area a separate, locked room? Yes _____ No _____

If not, what means exist to limit access to stored chemicals? _____

Item	Standard	Ref	Meets Standard	Below Standard	Comments
Room appearance	general cleanliness; aisle ways clear; shelves not crowded; no containers should be stored in a manner where the base of the container is either (a) over 6' above the floor or (b) less than 2' above the floor	5.5			
Organization	Chemicals organized by compatible families; organization posted	5.5			
Shelving	Secured to wall; shelf "lips", if cabinet doors are present are shelf lips still used or do the doors latch to prevent them from opening during an earthquake	5.4			
	No chemical storage on shelving above eye level or below knee level	5.4 and 5.5			
Containers	All containers labeled appropriately; no "bulk" quantities	5.5 and 3.4			
Ventilation	Continuous; exhausted to outside air	5.4			
Fire extinguisher & fire blanket	Near exit or within 25 ft. (15 sec) of storeroom; Class ABC extinguisher; Class D if reactive metals (Na, Mg, etc.) are stored	5.4			
Eyewash and shower	Available within 25 ft.; continuous stream for 15 min. at 1.5 L per min (eyewash), 75.7 L per min (shower)	5.4			
Smoke/heat detector	Ceiling mounted	5.4			
Flammable storage	Separate, approved cabinet; venting (if present) of equal integrity to cabinet	5.6			
Corrosive storage	Separate, approved cabinet; nitric acid stored separate from others	5.6			
Gas cylinders	Secured; protective caps in place; upright	5.5			
Temperature	Doesn't exceed flashpoint of stored substances	5.4			
Refrigerator	Explosion-proof; used only for biological or volatile chemicals, and sign designation	5.4			
Spill kit	Near exit or within 25 ft of storeroom; goggles, gloves, plastic bags, scooper, neutralizing and absorbing materials	5.4			

Other comments and concerns:

Inspector's signature _____ Date _____

Chemical Hygiene Officer signature _____ Date _____

Appendix E. University Employee Chemical Hygiene Training Record

(To be retained by the Chemical Hygiene Officer)

Employee Name:	Employee ID #:
Job Assignment:	Job Location:
Training Location:	Training Date:

Trainer Name(s) _____

Training Method (workshop, videotape, individual orientation, etc.): _____

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

Topic	**Verified by**
Federal and state chemical hygiene standards, including 29 CFR Part 1910.1450	_____
Location and content of the Chemical Hygiene Plan, and roles and responsibilities under the CHP	_____
Safe practices for handling hazardous chemicals in general; specific practices for designated areas; dealing with used, surplus, and waste chemicals	_____
Information on concepts necessary to understand reference materials, such as PEL, TLV, LD50, and routes of entry; information on hazards of chemicals on the university site, including PELs or other exposure limits	_____
Proper procedures for requesting authorization to obtain and use chemicals considered too hazardous for general university laboratories	_____
Labeling and storage practices and information to interpret labels	_____
Location and content of MSDS and other reference materials on the properties, safe handling, storage, and disposal of hazardous chemicals in the building	_____
Location and proper use of available protective apparel and equipment	_____
Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory	_____
Methods and observations to detect the presence or release of hazardous chemicals used in the laboratory	_____
Appropriate procedures for responding to and reporting accidents involving chemical exposures	_____
Appropriate first aid techniques (at least one employee per building)	_____

Appendix F. Request to Procure and Use a Hazardous Chemical

(Complete and submit to the Chemical Hygiene Officer for consideration)

Employee name: _____ Position: _____ Date: _____

School: _____ Room #: _____

Name of chemical requested:_____

Common names, if any CAS Registry #: _____

Name and address of Supplier: _____

Quantity requested to obtain: _____ Cost: _____

Desired date(s) of use: _____

Name of course in which the chemical will be used: _____

Attach the following materials to support the request. (Incomplete requests will be automatically denied)

a. Copy of the specific laboratory activity for which the chemical is needed, together with your rationale for needing to perform the activity;

b. Specific description of the hazards associated with the chemical (including PEL or TLV), along with justification that adequate facilities, equipment, and safety apparel are present at the school laboratory to provide a safe working environment in which exposures will not exceed PEL or TLV for the chemical;

c. Description of specific handling guidelines (if any), such as from National Cancer Institute, NIOSH, or other recognized agency;

d. Documentation that the employee has appropriate certification, as well as sufficient knowledge and skills to handle the chemical in the prescribed manner;

e. Estimate of the length of time the chemical will be stored in the school building and justification that school storage facilities are appropriate for housing the chemical;

f. Plan for proper disposal of waste products and excess reagents

Employee's signature: _____ Date: _____

Chemical Hygiene Officer signature: _____ Date: _____

Appendix G. Laboratory Accident/Incident Report

(Complete and submit to the Executive Director of Campus Safety)

Staff member completing the report: _____ Position: _____

Date and time of accident/incident: _____

Location of the accident/incident: _____

Name/address of supervising employee: _____

Name/address of other persons involved in the accident/incident (reports attached):

_____

Staff/student(s) who witnessed the accident/incident:

Staff (reports attached)	Students (reports attached)

Total number of witness reports attached: _____

Description of the accident/incident:

_____

_____

_____

Immediate action taken (including first aid administered):

_____

_____

_____

Actions taken or recommended to avoid a repeat of the accident/incident in the future:

_____

_____

_____

Signature of person completing report: _____ Date report completed: _____

Signature of Director, DCS: _____ Date: _____

Appendix H. Laboratory Accident/Incident: Staff Witness Report

(Attach to Accident/Incident Report)

Staff member completing the report: _____ Position: _____

Date of accident/incident: _____

Time of the accident/incident: _____

Location of the accident/incident: _____

Your eyewitness description of the accident/incident:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Are additional pages attached? □ If so, indicate the number of attached pages: _____

Signature of witness: _____ Date: _____

Appendix I. Used Chemical Inventory Form

Requestor's Room #: _____ Date: _____

Contact Person: _____ Phone: _____

List each used chemical container as a separate item. Be sure that the containers are labeled with the same item numbers.

Item #: _____ Location: _____

Form (circle one): solid liquid gas solution

Quantity (volume or mass): _____

Contents: Chemical Name and Approx. Percentage (if mixture)

_____

_____

_____

_____

Item #: _____ Location: _____

Form (circle one): solid liquid gas solution

Quantity (volume or mass): _____

Contents: Chemical Name and Approx. Percentage (if mixture)

_____

_____

_____

_____

Item #: _____ Location: _____

Form (circle one): solid liquid gas solution

Quantity (volume or mass): _____

Contents: Chemical Name and Approx. Percentage (if mixture)

_____

_____

_____

_____

All used chemicals must be stored in approved, labeled containers and housed in a designated, approved location.

Signature of person preparing inventory: _____

Date: _____

Appendix J. Request to Remove Used Chemicals

(Send this form to the Chemical Hygiene Officer)

School: _____ Date: _____

Contact Person: _____ Phone: _____

Use this form to initiate the removal process for any used chemicals no longer to be kept on school premises. List each used chemical container as a separate item (be sure the container is labeled with the same item number).

Item #: _____ Location: _____

Form (circle one): solid liquid gas solution

Quantity (volume or mass): _____

Contents: Chemical Name and Approx. Percentage (if mixture)

_____

_____

_____

_____

Item #: _____ Location: _____

Form (circle one): solid liquid gas solution

Quantity (volume or mass): _____

Contents: Chemical Name and Approx. Percentage (if mixture)

_____

_____

_____

_____

Item #: _____ Location: _____

Form (circle one): solid liquid gas solution

Quantity (volume or mass): _____

Contents: Chemical Name and Approx. Percentage (if mixture)

_____

_____

_____

_____

Item #: _____ Location: _____

Form (circle one): solid liquid gas solution

Quantity (volume or mass): _____

Contents: Chemical Name and Approx. Percentage (if mixture)

_____

_____

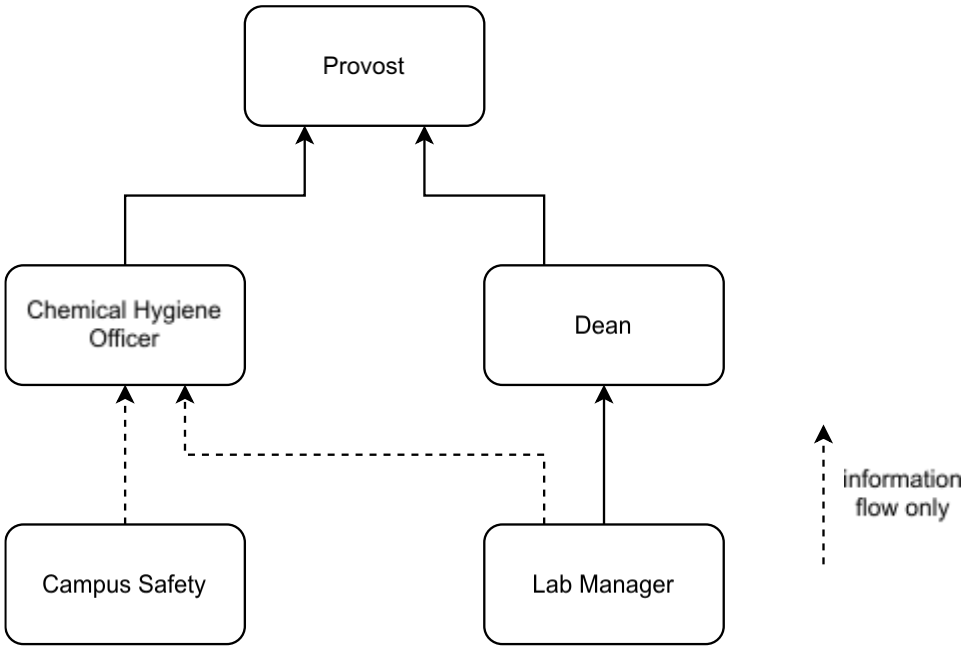
_____

_____

Signature of person filing request: _____

Date: _____

Appendix K. Organizational Flow Chart



Appendix L. Executive Director of Campus Safety

Roles and Responsibility

Records and Reporting

The Executive Director of Campus Safety will maintain required records of accidents, incidents, employee exposures per Section 9.4. Appendix H (Laboratory Accident/Incident Report) will be used to document all lab accidents/incident and inspections whether a violation was noted or not. This report will then be shared with the CHO, the Dean of the corresponding school, the CFO, the Provost, and the Director of Facilities.

Training

For employees outside the School of Arts and Sciences, the Director, Department of Campus Safety, (or a designee) will be responsible for providing chemical hygiene training of employees. The Director, Department of Campus Safety, will maintain training records and ensure copies of training records are made available to the CHO.

Enforcement

The Executive Director of Campus Safety will work with faculty and staff, in conjunction with the CHO, to ensure the CHP safety provisions are enforced in laboratory settings and other settings in the University. These efforts may include announced or unannounced inspections of the labs and areas of the university campus where hazardous materials are known to be used. If, during such an inspection, conditions or practices which do not comply with the CHP are noted, a report will be prepared by the individual conducting the inspection.[1,2] Such a report will document the nature of noncompliance and identify the individual in supervisory capacity for the activity or area which was out of compliance. Each report will be reviewed by the CHO, or, for situations of noncompliance which are more severe, by a review team. In the latter case, the review team will document (1) a recommended course of action to ensure compliance and (2) a response, ranging from a written warning and up to and including a recommendation of termination, associated with the individual in supervisory capacity for the activity or area which was out of compliance.

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1 In the case of a gross violation, the individual conducting the inspection will terminate any activities in the area and faculty, staff, or student(s) in the area will be strongly encouraged to leave the area until the unsafe condition is addressed.

Appendix M. Non-hazardous chemical wastes list[3]

Chemical Name	Qualities	Disposal Method
Acid, pH over 4	Contains only non-metal acid and water	Drain Disposal
Actin	Any Concentration	Liquid: Drain Disposal Solid: Trash
Agar	Any Concentration	Liquid: Drain Disposal Solid: Trash
Agarose	Any Concentration	Liquid: Drain Disposal Solid: Trash
Alcohol	Alcohol <24%	Drain disposal
Alanine	Any Concentration	Liquid: Drain Disposal Solid: Trash
Albumin, bovine	Any Concentration	Liquid: Drain Disposal Solid: Trash
Ammonium Acetate	Any Concentration	Solid: Trash
Ammonium phosphate dibasic	Any Concentration	Solid: Trash
Ammonium sulfate	Any Concentration	Solid: Trash
Amylase	Any Concentration	Liquid: Drain Disposal Solid: Trash
Amylose	Any Concentration	Liquid: Drain Disposal Solid: Trash
Antifoam A Emulsion	Any Concentration	Liquid: Drain Disposal Solid: Trash
Asparagine	Any Concentration	Liquid: Drain Disposal Solid: Trash
Aspartic Acid	Any Concentration	Liquid: Drain Disposal Solid: Trash
Base, pH less than 11	Contains only non-metal base and water	Drain Disposal
Boric Acid	Any Concentration	Liquid: Drain Disposal Solid: Trash
Cage Klenz 250-280	Any Concentration	Drain Disposal
Calcium Acetate	Any Concentration	Solid: Trash
Calcium chloride dehydrate	Any Concentration	Solid: Trash
Calcium Citrate	Any Concentration	Solid: Trash
Calcium Phosphate, Monobasic	Any Concentration	Liquid: Drain Disposal Solid: Trash
Calcium Sulfate	Any Concentration	Liquid: Drain Disposal Solid: Trash

[3] Adapted from Caltech's Hazardous Waste Management Guide (2018).

Celite (diatomaceous earth)	Any Concentration	Solid: Trash
Collagen	Any Concentration	Liquid: Drain Disposal Solid: Trash
Dextrose Monohydrate	Any Concentration	Liquid: Drain Disposal Solid: Trash
EDTA (acid free)	Any Concentration	Solid: Trash
EDTA Disodium salt	Any Concentration	Solid: Trash
Egg Albumin	Any Concentration	Liquid: Drain Disposal Solid: Trash
Ethidium Bromide (agarose gel)	<0.1%	Solid: Trash
Ferric Citrate	Any Concentration	Solid: Trash
Ferrous Sulfate Hexahydrate	Any Concentration	Solid: Trash
Fetal Bovine Serum	Any Concentration	Liquid: Drain Disposal Solid: Trash
Folic Acid	Any Concentration	Liquid: Drain Disposal Solid: Trash
Fructose	Any Concentration	Liquid: Drain Disposal Solid: Trash
Gelatin	Any Concentration	Liquid: Drain Disposal Solid: Trash
Glucose	Any Concentration	Liquid: Drain Disposal Solid: Trash
Glutamic Acid	Any Concentration	Liquid: Drain Disposal Solid: Trash
Glycerol	Any Concentration	Drain Disposal
Glycine	Any Concentration	Liquid: Drain Disposal Solid: Trash
Inositol	Any Concentration	Liquid: Drain Disposal Solid: Trash
Lactose Monohydrate	Any Concentration	Liquid: Drain Disposal Solid: Trash
L-cysteine	Any Concentration	Liquid: Drain Disposal Solid: Trash
L- glutamic acid	Any Concentration	Liquid: Drain Disposal Solid: Trash
L-histidine	Any Concentration	Liquid: Drain Disposal Solid: Trash
L-leucine	Any Concentration	Liquid: Drain Disposal Solid: Trash
Lysine hydrochloride	Any Concentration	Liquid: Drain Disposal; Solid: Trash
Manganese Chloride	Any Concentration	Solid: Trash
Manganese Sulfate Monohydrate	Any Concentration	Solid: Trash

Maltose	Any Concentration	Liquid: Drain Disposal Solid: Trash
Mannitol	Any Concentration	Liquid: Drain Disposal Solid: Trash
Niacin	Any Concentration	Liquid: Drain Disposal Solid: Trash
Pectin	Any Concentration	Liquid: Drain Disposal Solid: Trash
Potassium Chloride	Any Concentration	Liquid: Drain Disposal Solid: Trash
Potassium Phosphate dibasic	Any Concentration	Liquid: Drain Disposal Solid: Trash
Potassium Phosphate monobasic	Any Concentration	Liquid: Drain Disposal Solid: Trash
Potassium Sulfate	Any Concentration	Liquid: Drain Disposal Solid: Trash
Riboflavin	Any Concentration	Liquid: Drain Disposal Solid: Trash
Sodium Bicarbonate	Any Concentration	Liquid: Drain Disposal Solid: Trash
Sodium Carbonate Monohydrate	Any Concentration	Liquid: Drain Disposal Solid: Trash
Sodium Chloride	Any Concentration	Liquid: Drain Disposal Solid: Trash
Sodium Citrate	Any Concentration	Liquid: Drain Disposal Solid: Trash
Sodium Phosphate dibasic anhydrous	Any Concentration	Liquid: Drain Disposal Solid: Trash
Sodium Phosphate monobasic, monohydrate	Any Concentration	Liquid: Drain Disposal Solid: Trash
Sodium Sulfate, anhydrous	Any Concentration	Liquid: Drain Disposal Solid: Trash
Sorbitol	Any Concentration	Liquid: Drain Disposal Solid: Trash
Sucrose	Any Concentration	Liquid: Drain Disposal Solid: Trash
Tetraethylammonium chloride monohydrate	Any Concentration	Liquid: Drain Disposal Solid: Trash
Thiamine Hydrochloride	Any Concentration	Liquid: Drain Disposal Solid: Trash
Tris Base	Any Concentration	Liquid: Drain Disposal
Trypsin	Any Concentration	Liquid: Drain Disposal
Yeast Extract	Any Concentration	Solid: Trash

Revisions

Date Approved	Approved By	Comments
2025-04-23	D.A. Thompson, Chemical Hygiene Officer	--
2026-05-13	D.A. Thompson, Chemical Hygiene Officer	--