CHEMICAL HYGIENE PLAN

Revised: September 1, 2022

California State Polytechnic University, Pomona

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ANNUAL CHEMICAL HYGIENE PLAN REVIEW

REVISION DATE	REVIEWER	PROGRAM *REVIEW/**UPDATE	SUMMARY OF CHANGES	APPROVED BY:
09-30-2019	Kennedy-Kiet Vu	*Program Update	New Campus CHP	
10-21-2019	Kennedy-Kiet Vu	*Program Update	Roles/Responsibilities Section, Procurement Section	
09-14-2020	Kennedy-Kiet Vu	*Review		
09-06-2021	Kennedy-Kiet Vu	*Review		
09-01-2022	Benjamin J. Lucas	*Review, **Program Update	Formatting, Hyperlinks, Training Section	

*REVIEW: Program was edited for grammatical errors and formatting, minor changes occurred
**UPDATE: Program was edited for changes in content

WE CERTIFY AT THE TIME OF REVIEW, THE INFORMATION PROVIDED ON THIS PLAN IS COMPLETE AND ACCURATE

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1. INTRODUCTION

Policy

The California State Polytechnic University, Pomona, hereinafter referred to as (CPP), is committed to providing a healthy and safe working environment for the campus community, free from recognized hazards in accordance to the Office of the Chancellor and CPP campus policies. It is essential that all faculty, staff, and students who use chemicals in a laboratory setting become familiar with and exercise this plan.

To ensure compliance with regulatory standards, any materials found to not be in conformance with this plan/and or the Hazard Communication Program may be disposed of as hazardous waste at the discretion of EH&S. In case of life safety matters or imminent danger to life or health, the Director/Manager of EH&S or designee has the authority to order the cessation of the activity until the hazardous condition is abated.

Purpose

The Chemical Hygiene Plan (CHP) establishes a formal written program for protecting laboratory personnel against adverse health and safety hazards associated with exposure to potentially hazardous chemicals and must be made available to all employees working with hazardous chemicals. The CHP describes the proper use and handling practices and procedures to be followed by faculty, staff, students, visiting scholars, and all other personnel working with potentially hazardous chemicals in laboratory settings.

The CHP complies with the California Occupational Safety and Health Administration, Title 8, CCR §5191 Occupational Exposure to Hazardous Chemicals in Laboratories. This plan is based on best practices identified in, among other sources, "Prudent Practices for Handling Hazardous Chemicals in Laboratories," published by the National Research Council, and the American Chemical Society's "Safety in Academic Chemistry Laboratories" (www.acs.org).

Scope

The provisions of this Chemical Hygiene Plan apply to all personnel who work in laboratory environments that use, store or handle potentially hazardous chemicals and all personnel who work in these facilities. The provisions of the CHP apply to but are not necessarily limited to: faculty; principal investigators; laboratory and stockroom technicians; technical assistants; student employees; registered volunteers, graduate students; building service engineers; and building trades and maintenance staff. This includes students enrolled in a laboratory class, students providing voluntary unpaid assistance to a faculty or staff member, and students in a laboratory because of a club or other co-curricular activity.

The CHP does not apply to research involving exclusively radiological materials, radiation producing machines, biological materials, or lasers, as these safety procedures and regulatory requirements are outlined in the Radiation Safety Manual, Bloodborne Pathogen Program

Manual, respectively. Research involving more than one type of hazard must comply with all applicable regulatory requirements and follow guidance outlined in the relevant safety manuals.

For the purpose of this document, the *laboratory use* of hazardous chemicals is defined as the use of hazardous chemicals in a facility in a way all the following conditions are met:

(1) Chemical manipulations are carried out on a scale in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person;
(2) Multiple chemical procedures or chemicals are used;
(3) The procedures involved are not part of a production process, or in any way simulate a production process; and
(4) "Protective laboratory practices and equipment" are available and in common use industry-wide to minimize the potential for employee exposure to hazardous chemicals

The use of hazardous chemicals on campus which does not meet these conditions shall be managed in accordance with Title 8, §5194, the Hazard Communication standard.

The information presented in the CHP is not intended to be all inclusive. Departments, divisions or other work units engaged in work with potentially hazardous chemicals that have unusual characteristics or are otherwise not sufficiently covered in the written CHP, must customize the document by adding additional sections addressing the hazards and how to mitigate their risks, as appropriate. Such customizations must receive prior approval from the PI/Laboratory Supervisor and/or the CPP Office of Environmental Health and Safety (EH&S). For information on specific chemical safety topics not covered in the CHP, please contact the EH&S at: (909) 869-**4697** or ehs@cpp.edu

Regulatory Requirements

Implementation of the necessary work practices, procedures, and policies outlined in this CHP is required by the following:

- *Title 8, CCR, §5191, "Occupational Exposure to Hazardous Chemicals in Laboratories*
- *Title 8, CCR, Article 110, §5200-5220 regulated carcinogens including, but not limited to:*
  - *§5203, "Carcinogen Report of Use Requirements"*
  - *§5209, "Carcinogens"*
- *Title 8, CCR, §5154.1, "Ventilation Requirements for Laboratory – Type Hood Operations"*

Other applicable regulations include those promulgated by the U.S. Department of Labor including Title 29 CFR §1910.1450 "Occupational Exposure to Hazardous Chemicals in Laboratories" (the "Laboratory Standard"). EH&S will review and evaluate the effectiveness of this Plan at least annually and update it as necessary.

Rights and Responsibilities

Employees and other personnel who work in or maintain (i.e., custodial staff) laboratories have the right to be informed about the potential health hazards of the chemicals in their work areas and to be properly trained to work safely with these substances.

Employees have the right to file a complaint with Cal/OSHA if they feel they are being exposed to unsafe or unhealthy work conditions and cannot be discharged, suspended, or otherwise disciplined by their employer for filing a complaint or exercising these rights. All personnel working with hazardous chemicals are encouraged to report (anonymously, if preferred) any concerns about unsafe work conditions to EH&S at (909) 869-**4697**.

Responsibilities for the health and safety of the campus community extend to the highest administrative levels at CPP. The President and Vice Presidents are responsible for the implementation of the CSU's Environmental Health and Safety Policy at all facilities and properties under campus control and adherence with the CSU Executive Order 1039. Deans and Department Heads are responsible for establishing and maintaining programs in their areas and for providing a safe and health work environment.

The day-to-day responsibility for the management of laboratory safety and adherence to safe laboratory practices rests with the PI/Laboratory Supervisor within individual laboratory units associated departments. All personnel, including PIs/Laboratory Supervisors, employees and students, have a duty to fulfill their obligations with respect to maintaining a safe work environment. Safety is everyone's responsibility.

All employees and other personnel working with potentially hazardous chemicals have the responsibility to conscientiously participate in training seminars on general laboratory safety and review and be familiar with the contents of the CHP. Those working with chemicals are responsible for staying informed about the chemicals in their work areas, safe work practices and proper personal protective equipment (PPE) required for the safe performance of their job. Failure to comply with these requirements will result in progressive disciplinary action in accordance with CSU policy, and may result in temporary suspension of laboratory activities until corrective action is implemented.

Specific duties and responsibilities of personnel who work in areas where potentially hazardous chemicals are present have been compiled in the document entitle *General Rules for Laboratory Work*, found in Appendix A.

Responsibilities Deans, Directors, and Department Chairs

Deans, Directors, and Department Chairs are to work with their organizational units to ensure that affected employees are trained on the provisions of the University Chemical Hygiene Plan and are acting to comply with its requirements. These individuals should:

1. Implement the institutional Chemical Hygiene Plan
2. Identify all laboratories and chemical handling areas in their organizational unit.

3. Assign Responsible Party/Lab Supervisor for each laboratory/chemical handling area one is currently not assigned.

Responsibilities of Principal Investigator (PI), Faculty or Another Laboratory Supervisor

The PI/Laboratory Supervisor has responsibility for the health and safety of all personnel working in his or her laboratory who handle hazardous chemicals. The PI/Laboratory Supervisor may delegate safety duties but remains responsible for ensuring that delegated safety duties are adequately performed.

The PI/Laboratory Supervisor is responsible for:

1. Knowing all applicable health and safety rules and regulations, training and reporting requirements and standard operating procedures associated with chemical safety for regulated substances.
2. Identifying hazardous conditions or operations in the laboratory or other facility containing hazardous chemicals and determining safe procedures and controls and implementing and enforcing standard safety procedures.
3. Maintaining an updated roster through Risk and Safety Solutions **Profile** application and conducting a formal hazard **Assessment** in order to mitigate the hazards found.
4. Ensuring the availability of all appropriate personal protective equipment (PPE), after conducting responsibility #3 above, which properly fits the wearer (e.g., laboratory coats, gloves, eye protection, etc.), training on the selection, care, use and proper storage, ensuring the PPE is maintained in working order.
5. Ensuring that Standard Operating Procedures (SOPs), (general and protocol specific) are written and maintained in the Laboratory Safety Manual. Consult EH&S for SOP development support.
6. Providing prior-approval for the use of hazardous chemicals in the PI/Laboratory Supervisor's laboratory or other facility with hazardous chemicals.
7. Consulting with EH&S on the use of higher risk materials, such as use of particularly hazardous substances, or conducting higher risk experimental procedures so that special safety precautions may be taken.
8. Maintaining an updated **chemical inventory** (RSS Chemicals) for the laboratory or facility.
9. Ensuring laboratory or other personnel under his/her supervision have access to and are familiar with the appropriate Safety Manual(s), (i.e., Radiation Safety Manual, Biosafety Safety Manual, etc.).
10. Training all laboratory or other personnel he/she supervises to work safely with hazardous materials and maintain written records of laboratory-specific or other specialized training in the appropriate Safety Manual(s). Training must include information on the location and availability of hazard information.
11. Promptly notifying EH&S and/or Facilities Management should he/she become aware that work place engineering controls (e.g., fume hoods) and safety equipment (e.g., emergency showers/eyewashes, fire extinguishers, etc.) become bypassed, disabled or non-operational.
12. Promptly reporting accidents and injuries to EH&S. Fatalities and serious injuries **MUST** be reported to EH&S immediately to allow for compliance with the CAL/OSHA **8-hour** reporting time frame. Any doubt as to whether an injury is serious should favor reporting.
13. Providing funding for exposure monitoring and medical surveillance and/or medical consultation and examination for laboratory and other personnel, as required.
14. Informing facilities personnel, other non-laboratory personnel and any outside contractors of potential laboratory-related hazards when they are required to work in the laboratory environment.

15. Identifying and minimizing potential hazards to provide a safe environment for repairs and renovations.

Responsibilities of All Personnel Who Handle Hazardous Chemicals

All personnel in research or teaching laboratories that use, handle or store hazardous chemicals are responsible for:

1. Reviewing and following requirements of the CHP and all appropriate Safety Manuals (i.e., Radiation Safety Manual, Biosafety Safety Manual, etc.) and Policies.
2. Following all verbal and written laboratory safety rules (Appendix A), regulations, and standard operating procedures (SOPs) required for the tasks assigned.
3. Following the UCLA Procedures for Safe use of Pyrophoric Liquid Reagents and Procedures for Safe Use of Pyrophoric Solids when utilizing such materials.
4. Developing good personal chemical hygiene habits, including but not limited to, keeping the work areas safe and uncluttered.
5. Planning, reviewing and understanding the hazards of materials and processes in their laboratory research or other work procedures prior to conducting work.
6. Utilizing appropriate measures to control identified hazards, including consistent and proper use of engineering controls, personal protective equipment, and administrative controls.
7. Understanding the capabilities and limitations of PPE issued to them.
8. Gaining prior approval from the PI/Laboratory Supervisor for the use of restricted chemicals and other materials.
9. Consulting with PI/Laboratory Supervisor before using these particularly hazardous substances (PHS), pyrophoric chemicals, explosives and other highly hazardous materials or conducting certain higher risk experimental procedures.
10. Immediately reporting all accidents and unsafe conditions to the PI/Laboratory Supervisor.
11. Completing all required health, safety and environmental training and providing written documentation to their supervisor.
12. Participating in the medical surveillance program, when required.
13. Informing the PI/Laboratory Supervisor of any work modifications ordered by a physician as a result of medical surveillance, occupational injury or exposure.
14. When working autonomously or performing independent research or work:
    a. Reviewing the plan or scope of work for their proposed research with the PI/Laboratory Supervisor.
    b. Notifying in writing and consulting with the PI/Laboratory Supervisor, in advance, if they intend to significantly deviate from previously reviewed procedures (Note: Significant change may include, but is not limited to, change in the objectives, change in PI, change in the duration, quantity, frequency, temperature or location, increase or change in PPE, change in scale, and reduction or elimination of engineering controls.).
    c. Preparing SOPs and performing literature searches relevant to safety and health that are appropriate for their work.
    d. Providing appropriate oversight, training and safety information to laboratory or other personnel they supervise or direct.

Responsibilities of the Departmental Safety Coordinator

Department Safety Coordinators (DSC) are optionally appointed by Deans, Directors, or Department Chairs/Heads to assist them in their duty of maintaining an accident-free environment within the area of their jurisdiction. They receive their authority directly from Deans, Directors, or Department Chairs/Heads and, at their discretion, are thereby limited to specific assigned duties. Their main function is to serve as a resource to their department and to be the department's liaison with the EH&S Office.

Responsibilities of Department Safety Coordinators normally will include, but are not limited to, the following:

1. Assist the Dean, Director, or Department Chair/Head in the development and implementation of a Health and Safety Program for the School or Department based on regulations and procedures established by the EH&S Office.
2. Conduct internal semi-annual safety inspections of facilities, equipment and projects to identify unsafe conditions and practices.
3. Complete and submit the Department Health and Safety Inspection Report, make recommendations concerning equipment, methods, training, maintain inspection and corrective action records.
4. Receive and handle internal safety-related complaints and suggestions and assist in their evaluation within the department.
5. Expedite correction of identified deficiencies as applicable.
6. Act as liaison with the EH&S Office on all matters pertaining to inspection, accident/injury investigations, personnel safety training, reports, and technical advisement. Also act as the primary department resource person for coordinating these activities.
7. Providing guidance and support to the departmental and organizational safety committees
8. Providing technical assistance to laboratory workers.
9. Facilitating the implementation of the Chemical Hygiene Plan and assisting in establishing a safe work environment by collaborating with EH&S, faculty, other researchers and lab personnel.
10. Providing guidance on laboratory safety compliance and technical subjects.
11. Coordinating or providing training on occupational health and safety requirements.
12. Serving as a liaison between the laboratory and EH&S in helping maintain safety and regulatory information, including Safety Data Sheets (SDS), ensure that all markings, labeling, and identifications per regulatory requirements are in place.
13. Requesting information and clarification on regulatory requirements from EH&S.
14. Assisting EH&S in evaluating program effectiveness.
15. Assisting in responding to any regulatory actions or investigations.
16. Participating in the development of the department emergency operations plan.
17. Ensure that all regulatory information is disseminated.
18. Provide access to all department employees for safety concerns without fear of reprisal.
19. Encouraging compliance with the General Rules for Laboratory Work (Appendix A).

Responsibilities of the Office of Environmental Health and Safety and campus Chemical Hygiene Officer (CHO)

EH&S is responsible for administering and overseeing institutional implementation of the Laboratory Safety Program. The campus Chemical Hygiene Officer (CHO), Kennedy-Kiet Vu, is designated by EH&S, and is qualified by training and experience, to provide technical guidance in the development and implementation of the provisions of the CHP. In case of life safety matters or imminent danger to life or health, the Director/Manager of EH&S or designee has the authority to order the cessation of the activity until the hazardous condition is abated. EH&S provides technical guidance to personnel at all levels of responsibility on matters pertaining to laboratory use of hazardous materials.

The CHO is a member of EH&S and, with support from other EH&S personnel, is responsible for:

1. Informing PIs/Laboratory Supervisors of all health and safety requirements and assisting with the selection of appropriate safety controls, including laboratory and other workplace practices, personal protective equipment, engineering controls, training, etc.
2. Conducting periodic inspections and immediately taking steps to abate hazards that may pose a risk to life or safety upon discovery of such hazards.
3. Performing hazard assessments, upon request.
4. Helping to develop and implement appropriate chemical hygiene policies and practices.
5. Having working knowledge of current health and safety rules and regulations, training, reporting requirements and standard operating procedures associated to regulated substances. Such knowledge may be supplemented and developed through research and training materials.
6. Working with research staff to review existing SOPs and assist with developing new SOPs for handling hazardous chemicals.
7. Providing technical guidance and investigation, as appropriate, for laboratory and other types of accidents and injuries.
8. Helping to determine medical surveillance requirements for potentially exposed personnel.
9. Reviewing plans for installation of engineering controls and new facility construction/renovation, as requested.
10. Reviewing and evaluating the effectiveness of the CHP at least annually and updating it as appropriate.

Responsibilities of the Chemical Hygiene Committee

The Chemical Hygiene Committee shall function as a cooperative effort between colleges for information dissemination and to ensure that the CHP procedures are followed. The Chemical Hygiene Committee is charged with assessing the use of chemicals in instructional, research, and industrial operations to ensure that chemicals are appropriately procured, stored, protected, and used. This will include the review of Environmental Health and Safety (EH&S) safety plans including but not limited to the Chemical Hygiene Plan and Hazardous Materials Management Plan. Additionally, the committee will provide recommendations and guidance to EH&S regarding campus procedures for chemical procurement and delivery and ensure that chemical inventories are properly updated during this process.

2. CHEMICAL HAZARD COMMUNICATION

Regulatory Requirements

CPP is responsible for providing information about the hazardous substances in our workplace, the associated hazards, and the control of these hazards, through a comprehensive hazard communication program that is summarized below. CPP has an established Hazard Communication Program that complies with the Cal/OSHA Hazard Communication Standard, Title 8 CCR §5194. The purpose of CPP's Hazard Communication Program is to ensure that all employees and, upon request, their personal physicians, have the right to receive information regarding the hazardous substances to which they may have been exposed at work. The requirements of the Hazard Communication Program apply to laboratory environments at CPP due to the potential for large scale experiments and for activities that may occur outside of areas where engineering controls are available. Proper hazard communication involves the active participation of the PI/Lab Supervisor, the EH&S Chemical Hygiene Officer, and the Laboratory/Safety Coordinator, who are each responsible for providing consultation and safety information to employees working with hazardous chemicals.

List of Hazardous Substances

Each laboratory group is required to maintain a current chemical inventory that lists the chemicals and compressed gases used and stored in the labs and the quantity of these chemicals. and specific information on any associated health or safety hazards must be made readily available to all laboratory personnel, typically through Safety Data Sheets (SDSs).

Hazard Determination

Faculty/ Laboratory Supervisors are responsible for verifying if any items on their chemical inventory are subject to the requirements of the hazard communication regulation.

The term "hazardous substance" refers to any chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed individuals.

Hazardous substances may include, but are not limited to, those chemicals listed in the following:

1. "The Hazardous Substance List", prepared by the Cal/OSHA Title 8 CCR §339
2. "Toxic and Hazardous Substances, Air Contaminants", Tile 8 CCR §5155
3. "Threshold Limit Values for Chemical Substances in the Work Environment", ACGIH, 2012;
4. Most Recent "Annual Report on Carcinogens", NTP
5. "Monographs", IARC, WHO
6. SDSs for reproductive toxins and cancer-causing substances
7. "Chemicals Known to the State to Cause Cancer or Reproductive Toxicity" (Proposition 65), Title 22 CCR 12000.

Inventory items found on the above lists are subject to the requirements outlined below.

Safety Data Sheets (SDS)

An SDS must be available for each hazardous substance in a laboratory's chemical inventory. SDSs are available from the CSU online SDS library, available through **MSDSonline**. PIs/Laboratory Supervisors are responsible for keeping SDSs current and making them accessible to all laboratory employees throughout the work day by storing them in a dedicated laboratory safety binder. Electronic copies of SDSs (bookmarked webpages (i.e., **MSDSonline**), document on cloud services, flash drive, etc.) provided that they can be **accessed immediately in the event of an emergency or** can be produced when requested.

New chemical substances synthesized or produced in a laboratory, and used or shared outside of a laboratory suite, require the preparation of an SDS for each synthesized substance. Contact EH&S through (909) 869-**4697** for more information on preparing new SDSs.

New Global Harmonization System (GHS) requires the standardization of SDSs. The minimum information required for an SDS is:

1. **Identification of the substance or mixture and of the supplier**
   - GHS product identifier.
   - Other means of identification.
   - Recommended use of the chemical and restrictions on use.
   - Supplier's details (including name, address, phone number, etc.)
   - Emergency phone number.

2. **Hazards Identification**
   - GHS classification of the substance/mixture and any national or regional information.
   - GHS label elements, including precautionary statements. (Hazard symbols may be provided as a graphical reproduction of the symbols in black and white or the name of the symbol, e.g., flame, skull and crossbones.) Symbols are required to be in a red border/red diamond.
   - Other hazards which do not result in classification (e.g. dust explosion hazard) or are not covered by the GHS.

3. **Composition/Information on ingredients**
   - Substance
     - Chemical identity
     - Common name, synonyms, etc.
     - CAS number, EC number, etc.
     - Impurities and stabilizing additives which are themselves classified and which contribute to the classification of the substance.
   - Mixture
     - The chemical identity and concentration or concentration ranges of all ingredients which are hazardous within the meaning of the GHS and are present at or above their cutoff levels.

4. **First aid measures**
   - Description of necessary measures subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion.
   - Most important symptoms/effects, acute and delayed.
   - Indication of immediate medical attention and special treatment needed, if necessary.

5. **Firefighting measures**
   - Suitable (and unsuitable) extinguishing media.
   - Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products).
   - Special protective equipment and precautions for firefighters.

6. **Accidental release measures**
   - Personal precautions, protective equipment and emergency procedures.
   - Environmental precautions.
   - Methods and materials for containment and cleaning up.

7. **Handling and storage**
   - Precautions for safe handling.
   - Conditions for safe storage, including any incompatibilities.

8. **Exposure controls/personal protection**
   - Control parameters, e.g. occupational exposure limit values or biological limit values.
   - Appropriate engineering controls.
   - Individual protection measures, such a personal protective equipment.

9. **Physical and chemical properties**
   - Appearance (physical state, color, etc.)
   - Odor
   - Odor threshold
   - pH
   - Melting point/freezing point
   - Initial boiling point and boiling range
   - Flash point
   - Evaporation rate
   - Flammability (solid, gas)
   - Upper/lower flammability or explosive limits
   - Vapor pressure
   - Vapor density
   - Relative density
   - Solubility(ies)
   - Partition coefficient: n-octanol/water
   - Auto-ignition temperature

- Decomposition temperature

10. Stability and reactivity

- Chemical stability
- Possibility of hazardous reactions
- Conditions to avoid (e.g., static discharge, shock or vibration)
- Incompatible materials
- Hazardous decomposition products

11. Toxicological information

- Concise but complete and comprehensible description of the various toxicological (health) effects and the available data used to identify those effects, including:
  - Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact);
  - Symptoms related to the physical, chemical and toxicological characteristics;
  - Delayed and immediate effects and chronic effects from short- and long-term exposure;
  - Numerical measures of toxicity (such as acute toxicity estimates)

12. Ecological information

- Eco-toxicity (aquatic and terrestrial, where available)
- Persistence and degradability
- Bio-accumulative potential
- Mobility in soil
- Other adverse effects

13. Disposal considerations

- Description of waste residues and information on their safe handling and methods of disposal, including the disposal of any contaminated packaging.

14. Transport Information

- UN Number
- UN Proper shipping name
- Transport hazard class(es)
- Packing group, if applicable
- Marine pollutant (Yes/No)
- Special precautions which a user needs to be aware of or needs to comply with in connection with transport or conveyance either within or outside their premises.

15. Regulatory Information

- Safety, health and environmental regulations specific for the product in question.

16. Other information including information on preparation and revision of the SDS

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Labels, Signs and Other Forms of Warning

Labeling requirements for all hazardous substances are summarized as follows:

- All containers of purchased hazardous materials or materials intended for distribution must be labeled with the identity of the hazardous substance;
- The label must contain all applicable hazard warning statements;
- The name and address of the chemical manufacturer or other responsible party must be present;
- Manufacturer's product labels must remain on all containers and must not be defaced in any way. Appropriate hazard warning statements and Proposition 65 warming must be present, if not that information must be added;
- Labels must be legible, in English, and prominently displayed;
- Symbols and/or other languages are required for non-English speaking employees;
- Secondary containers (such as spray bottles) must be labeled with the appropriate hazard warnings based on the knowledge of the chemicals and physical properties of that substance;
- New synthesized compounds must be labeled with employee's information and chemical name or structure if known or at a minimum a chemical identification number derived from the employee's lab notebook;
- Global Harmonization System symbols should be used when labeling containers

Additional information on container labelling is provided in Appendix B

Global Harmonization System (Hazard Communication Standard Pictograms)

Employee Information and Training

Employee training on specific workplace hazards must be provided at the time of initial assignment, whenever a new hazard is introduced into the workplace, and whenever employees may be exposed to

hazards in other work areas. General Hazard Communication Training is available through EH&S. Additional employee training is required whenever a new hazard is introduced into the work environment and must be provided when receiving the **SDS** or other safety information and before the employee starts with said new hazard. All training must be in the appropriate language, educational level, vocabulary for the personnel and employees must be given the opportunity to ask questions.

Hazard Assessment

The Hazard Assessment Tool, accessed through Risk and Safety Solutions CSU Portal using your Bronco login credentials, was developed to broadly identify activities involving chemical and other types of hazards and is an effective method of hazard communication. The Assessment application captures information on the specific type of hazard(s), the location of the hazard(s), the name of the PI/Laboratory Supervisor who oversees the facility and provides guidance for the proper exposure controls (Engineering, Administrative and Personal Protective Equipment (PPE)), that should be used by the laboratory personnel to protect themselves against these hazards. Once the PPE selection is made, the laboratory is required to conduct and document training for laboratory personnel on the use of PPE.

Additional Resources

1. "Occupational Exposure to Hazardous Chemicals in Laboratories." California Code of Regulations (CCR) Title 8, §5191.
2. Standard Operating Procedures (SOPs) for handling toxic chemicals (laboratory specific).
3. General information on the signs and symptoms associated with exposure to hazardous substances used in the laboratory or facility (laboratory specific SOPs or SDS)
    a. Identity labels, showing contents of containers (including waste receptacles) and associated hazards.
    b. Label hazardous waste containers. See the EH&S website for hazardous waste management information.
    c. Warnings at areas or equipment where special or unusual hazards exist (e.g., particularly hazardous substances).
4. Procedures to follow in case of an emergency; including the posting of campus Emergency Procedures
    a. Emergency telephone numbers of emergency personnel/facilities, supervisors, and laboratory workers.
    b. Location signs for safety showers, eyewash stations, other safety and first aid equipment, exits and areas where food and beverage consumption and storage are permitted.
    c. Emergency Procedure poster
    d. Report injury, illness, or safety concerns through University Strategic Enterprise Risk Management
    e. Work related injury and illness information available online: https://www.cpp.edu/~workers-comp/index.shtml

3. CLASSES OF HAZARDOUS CHEMICALS

Regulatory Requirements

Implementation of the necessary work practices, procedures, and policies outlined in this chapter is required by the following:

- *Title 8, California Code of Regulations (CCR), §5194, "Hazard Communication"*
- *Title 8, CCR §5209, "Carcinogens"*

Other applicable regulations include those promulgated by the U.S. Department of Labor including Title 29 CFR §1910.1450 "Occupational Exposure to Hazardous Chemicals in Laboratories" (the "Laboratory Standard").

Identification & Classification of Hazardous Chemicals

Chemicals can be divided into several different hazard classes. The hazard class will determine how a chemical should be stored and handled and what special equipment and procedures are needed to use them safely.

Each chemical container, whether supplied by a vendor or produced in the laboratory, must include labels that clearly identify the hazards associated with that chemical. In addition to specific chemical labels, hazard information for specific chemicals can be found by referencing the Safety Data Sheet (SDS) for that chemical.

It is essential that all laboratory workers understand the types of hazards, recognize the routes of exposure, and are familiar with the major hazard classes of chemicals. In many cases, the specific hazards associated with new compounds and mixtures will not be known, so it is recommended that all chemical compounds be treated as if they were potentially harmful and to use appropriate eye, inhalation and body protection equipment.

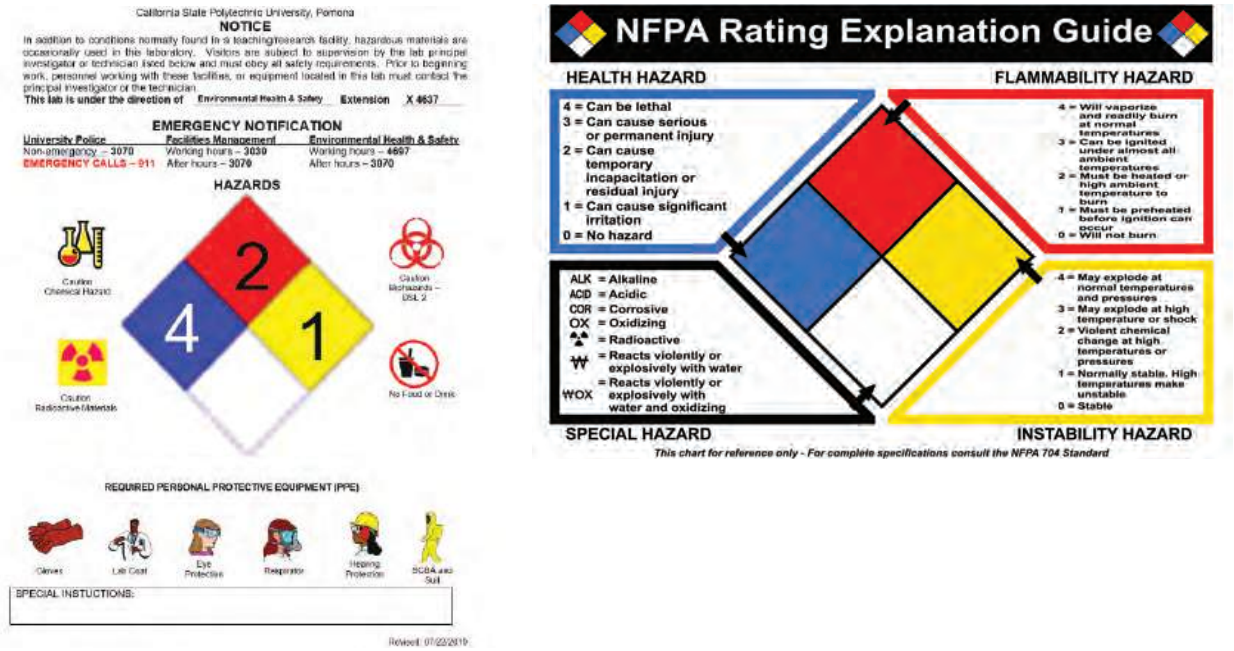
Rooms containing hazardous chemicals are labeled with a door placard that gives an overview of the key chemical hazards contained within that room. The door placard lists the following information:

- List the name of the PI as well as the building and room number.
- Contains emergency contact information
- Contains personal protection and physical hazards
- Contains specific hazards (chemical, biological, radiological).

Based on the hazards, the NFPA 704 placard may contain the familiar four color, 1-4 number rating symbol that quickly supplies the hazard information broken down into four hazard classes, with 1 indicating a low level of hazard and 4 indicating a high hazard level. The four chemical hazard types correspond to the four-color areas:

- Red indicates a flammability hazard
- Yellow indicates a reactive hazard
- Blue indicates a health hazard
- White area is reserved for special hazards that are identified by hazard symbols or labels to indicate hazards such as radioactivity, biohazard, water reactive chemicals, etc.

Each of these hazards has a different set of safety precautions associated with them. The figure below is an example of a CPP placard along with an explanation of the NFPA 704 Rating System



Example of a CPP Door Placard

FLAMMABILITY HAZARDS

Several highly flammable substances are in common use in campus laboratories. Flammable liquids include those chemicals that have a flashpoint of less than 199.4 degrees Fahrenheit (93 degrees Celsius).

- These materials must be stored in **self-closing** flammable storage cabinets in aggregate quantities of 10 gallons or more per room.
- If less than 10 gallons, flammables can be stored in regular cabinets.
- **No more than 60 gallons** of flammable liquids may be stored inside of an approved flammable liquid storage cabinet.
- Flame-resistant laboratory coats must be worn when working with large quantities (4 liters or more) of flammable materials and/or with procedures where a significant fire risk is present (e.g., when working with open flame or near ignition sources).
- Store only compatible materials inside flammable cabinets.
- Particular attention should be given to preventing static electricity and sparks when handling flammable liquids by using electrical grounding and bonding techniques whenever required in accordance to Title 29 CFR §1910.106 and NFPA 45 [Fire Protection for Laboratories Using Chemicals] – Chapter 9, NFPA 77 [Recommended Practice on Static Electricity] – Chapter 11.

REACTIVITY HAZARDS

Reactive and explosive substances are materials that decompose under conditions of mechanical shock, elevated temperature, or chemical action, and release large volumes of gases and heat. Some materials, such as peroxide formers, may not be explosive, but may form explosive substances over time. These

substances pose an immediate potential hazard and procedures which use them must be carefully reviewed. These materials must also be stored in a separate flame-resistant storage cabinet or, in many cases, in a separate laboratory grade (fire rated) refrigerator or freezer that is designed for flammable/ reactive chemicals.

Peroxide formers (Appendix G) can only be stored in refrigerators when unopened. Once used, they must be stored in a dry environment. **Pyrophoric chemicals** are a special classification of reactive materials that spontaneously combust when in contact with air and require laboratory-specific training. Flame-resistant laboratory coats or other appropriate flame-resistant protection must always be worn when working with pyrophoric chemicals. Following the UCLA Procedures for Safe use of Pyrophoric Liquid Reagents and Procedures for Safe Use of Pyrophoric Solids when utilizing such materials.

HEALTH HAZARDS

Cal/OSHA uses the following definition for health hazards:

> The term 'health hazard' includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.

The major classes of "hazardous" and "particularly hazardous substances" and their related health and safety risks detailed below:

Corrosive Substances

As a health hazard, corrosive substances cause destruction of, or alterations in, living tissue by chemical action at the site of contact.

Major classes of corrosive substances include:

- Strong acids – e.g., sulfuric, nitric, hydrochloric acids and hydrofluoric acids
- Strong bases – e.g., sodium hydroxide, potassium hydroxide and ammonium hydroxide
- Dehydrating agents – e.g., sulfuric acid, sodium hydroxide, phosphorus pentoxide and calcium oxide
- Oxidizing agents – e.g., hydrogen peroxide, chlorine and bromine.

Symptoms of exposure for inhalation include a burning sensation, coughing, wheezing, laryngitis, shortness of breath, nausea, and vomiting. For eyes, symptoms include pain, blood shot eyes, tearing, and blurring of vision. For skin, symptoms may include reddening, pain, inflammation, bleeding, blistering and burns.

As a physical hazard, corrosive substances may corrode materials they come in contact with and may be highly reactive with other substances. It is important to review information regarding the materials they may corrode, and their reactivity with other substances, as well as information on health effects. In most cases, these materials should be segregated from other chemicals and require secondary containment when in storage.

Irritants

Irritants are defined as non-corrosive chemicals that cause reversible inflammatory effects on living tissue by chemical action at the site of contact. A wide variety of organic and inorganic compounds, including many chemicals that are in a powder or crystalline form, are irritants. The most common example of an irritant may be ordinary smoke which can irritate the nasal passages and respiratory system. Consequently, eye and skin contact with all laboratory chemicals should always be avoided. Symptoms of exposure can include reddening or discomfort of the skin and irritation to respiratory systems.

Sensitizer

A sensitizer (allergen) is a substance that causes exposed people to develop an allergic reaction in normal tissue after repeated exposure to the substance. Examples of sensitizers include diazomethane, chromium, nickel, formaldehyde, isocyanates, arylhydrazines, benzylic and allylic halides, and many phenol derivatives. Sensitizer exposure can lead to all the symptoms associated with allergic reactions or can increase an individual's existing allergies.

Hazardous Substances with Toxic Effects on Specific Organs

Substances included in this category include:

- Hepatotoxins – i.e., substances that produce liver damage, such as nitrosamines and carbon tetrachloride
- Nephrotoxins – i.e., agents causing damage to the kidneys, such as certain halogenated hydrocarbons
- Neurotoxins – i.e., substances which produce their primary toxic effects on the nervous system, such as mercury, acrylamide and carbon disulfide
- Agents which act on the hematopoietic system – e.g., carbon monoxide and cyanides which decrease hemoglobin function and deprive the body tissues of oxygen
- Agents which damage lung tissue – e.g., asbestos and silica.

Symptoms of exposure to these materials vary. Personnel working with these materials should review the SDS for the specific material being used, take special note of the associated symptoms of exposure and contact EH&S for assistance.

Particularly Hazardous Substances

OSHA recognizes that some classes of chemical substances pose a greater health and safety risk than others. To differentiate this different risk characteristic, OSHA identifies two categories of hazardous chemicals:

1. **Hazardous chemicals**; and
2. **Particularly hazardous substances**.

Substances that pose such significant threats to human health are classified as "particularly hazardous substances" (PHSs). The OSHA Laboratory Standard and Cal/OSHA regulation require that special provisions be established to prevent the harmful exposure of researchers to PHSs, including the establishment of designated areas for their use.

1. Use of containment devices such as fume hoods or glove boxes;
2. Procedures for safe removal of contaminated waste; and
3. Decontamination procedures.

Particularly hazardous substances are divided into three primary types:

1. Acute Toxic Chemicals
2. Reproductive Toxins
3. Carcinogens

Acute Toxins

Substances that have a high degree of acute toxicity are interpreted by OSHA as being substances that "may be fatal or cause damage to target organs as the result of a single exposure or exposures of short duration." These chemicals associated chemical waste, and storage containers must be handled with care to prevent cross contamination of work areas and unexpected contact. These chemicals must be labeled as "Toxic." Empty containers of these substances must be packaged and disposed of as hazardous waste without rinsing trace amounts into the sanitary sewer system.

Reproductive Toxins

Reproductive toxins include any chemical that may affect the reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

Reproductive toxins can affect the reproductive health of both men and women if proper procedures and controls are not used. For women, exposure to reproductive toxins during pregnancy can cause adverse effects on the fetus; these effects include embryolethality (death of the fertilized egg, embryo or fetus), malformations (teratogenic effects), and postnatal functional defects. For men, exposure can lead to sterility.

Examples of embryotoxins include thalidomide and certain antibiotics such as tetracycline. Women of childbearing potential should note that embryotoxins have the greatest impact during the first trimester of pregnancy. Because a woman often does not know that she is pregnant during this period of high susceptibility, special caution is advised when working with all chemicals, especially those rapidly absorbed through the skin (e.g., formamide). Pregnant women and women intending to become pregnant should consult with their laboratory supervisor and EH&S before working with substances that are suspected to be reproductive toxins.

Carcinogens

Carcinogens are chemical or physical agents that cause cancer. Generally, they are chronically toxic substances; that is, they cause damage after repeated or long-duration exposure, and their effects may only become evident after a long latency period. Chronic toxins are particularly insidious because they may have no immediately apparent harmful effects. These materials are separated into two classes:

1. **Select Carcinogens;** and

2. Regulated Carcinogens

Select carcinogens are materials which have met certain criteria established by the National Toxicology Program (NTP) or the International Agency for Research on Cancer (IARC) regarding the risk of cancer via certain exposure routes. It is important to recognize that some substances involved in research laboratories are new compounds and have not been subjected to testing for carcinogenicity. The following references (links provided) are used to determine which substances are select carcinogens by Cal/OSHA's classification:

- OSHA Carcinogen List
- Annual Report on Carcinogens published by the National Toxicology Program (NTP), including all of the substances listed as "known to be carcinogens" and some substances listed as "reasonably anticipated to be carcinogens"
- International Agency for Research on Cancer (IARC), including:
  - All of Group 1 "carcinogen to humans" by the International Agency for Research on Cancer Monographs (IARC) (Volumes 1-48 and Supplements 1-8)
  - Some in Group 2A or 2B, "reasonably anticipated to be carcinogens" by the National Toxicology Program (NTP), and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
    - After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m^3
    - After repeated skin application of less than 300 mg/kg of body weight per week;
    - After oral dosages of less than 50 mg/kg of body weight per day.

Regulated Carcinogens fall into a higher hazard class and have extensive additional requirements associated with them. The use of these agents may require personal exposure sampling based on usage. When working with Regulated Carcinogens, it is particularly important to review and effectively apply engineering and administrative safety controls as the regulatory requirements for laboratories that may exceed long term (8 hour) or short term (15 minutes) threshold values for these chemicals are very extensive.

Chemicals Known to the State of California to Cause Cancer or Reproductive Toxicity
The Safe Drinking Water and Toxic Enforcement Act of 1986, also known as **Proposition 65**, requires the State to publish a list of chemicals known to cause cancer or reproductive toxicity. The list is updated regularly and reviewed by two committees that are a part of the Office of Environmental Health Hazard Assessment's Science Advisory Board. The two committees are the Carcinogen Identification Committee (CIC) and Developmental and Reproductive Toxicant (DART) Identification Committee.

4. HOW TO REDUCE EXPOSURES TO HAZARDOUS CHEMICALS

Regulatory Requirements to Hazardous Chemicals

Implementation of the necessary work practices, procedures, and policies outlined in this chapter is required by the following:

- *Title 8, CCR, §5191,"Occupational Exposures to Hazardous Chemicals in Laboratories"*
- *Title 8, CCR, §5209, "Carcinogens"*
- *Title 8, CCR, §5154.1, "Ventilation Requirements for Laboratory-Type Hood Operations"*

Other applicable regulations include those promulgated by the U.S. Department of Labor including Title 29 CFR §1910.1450 "Occupational Exposure to Hazardous Chemicals in Laboratories" (the "Laboratory Standard").

Introduction

Hazardous chemicals require a carefully considered, multi-tiered approach to ensure safety. There are four primary routes of exposure for chemicals which have associated health hazards:

- Inhalation
- Absorption (through the skin or eyes)
- Ingestion
- Injection (skin being punctured by a contaminated sharp object or uptake through an existing open wound)

Of these, the most likely route of exposure in the laboratory is by inhalation. Many hazardous chemicals may affect people through more than one of these exposure modes, so it is critical that protective measures are in place for each of these uptake mechanisms.

Safety Controls

Safety controls are divided into three main classifications:

(1) Engineering Controls
(2) Administrative Controls
(3) Personal Protective Equipment

Elements of these three classes are used in a layered approach to create a safe working environment. The principles of each of these elements are detailed below.

Engineering Controls

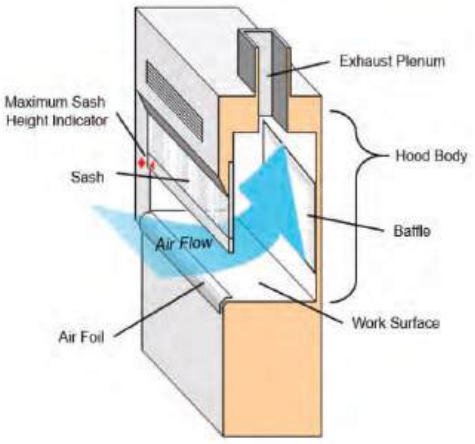
Engineering controls include all "built in" safety systems. These controls offer the first line of protection and are highly effective in that they generally require minimal special procedures or actions on the part of the user except in emergency situations. A fundamental and very common example is the laboratory fume hood which is very effective at containing chemical hazards and protecting users from inhalation hazards. Other examples of engineering controls include general room ventilation, flammable material storage units, and secondary containment.

General Laboratory Ventilation

All laboratory rooms in which hazardous materials are used must have fresh air ventilation with 100% of the exhaust venting to the outside; laboratory rooms should not be part of recycled air systems. In cases where this is not feasible, a formal hazard evaluation will be made by EH&S to determine what work can be done in the space and under what special conditions or limitations. Laboratory rooms should be kept at negative pressure compared to public areas to prevent the spread of hazardous vapors.

Fume Hoods

Laboratory fume hoods are one of the most important pieces of equipment used to protect laboratory and other workers from exposure to hazardous chemicals. Other methods include vented enclosures for large pieces of equipment or chemical storage, and portable exhaust systems for capturing contaminants near the point of release. Some systems are equipped with air cleaning devices (HEPA filters or carbon absorbers).



Use a laboratory fume hood when working with all hazardous substances. In addition, a laboratory hood or other suitable containment device must be used for all work with "particularly hazardous substances." A properly operating and correctly used laboratory hood can reduce or eliminate volatile liquids, dusts and mists.

- Fume hoods are evaluated for operation and certified by EH&S on an annual basis. These annual evaluations check the fume hood air flow velocity to ensure that the unit will contain hazardous vapors. Data on annual fume hood monitoring will be maintained by EH&S.
- Each fume hood should have a current calibration sticker and a marker indicating the highest sash height to be used when working with hazardous materials. Contact EH&S for a fume hood evaluation if these labels are missing.
- Air flow for fume hood ventilation is measured at nine points. The average of the nine readings must be at least 100 linear feet per minute (fpm) with a minimum of 70 fpm for any measurement. The average face velocity should not exceed 160 fpm.
- Each fume hood must be equipped with at least one type of continuous quantitative monitoring device designed to provide the user with current information on the operational status of the hood. Many hoods also have motion sensors to determine when they are not in active use. These sensors will reduce the fume hood's air flow as part of the campus' energy savings effort.
- When hazardous materials are in a fume hood, but it is not under active use (e.g., during an unattended reaction or experiment), the sash should be closed. Fume hoods are not designed for storage of hazardous materials.

Routine maintenance and repairs of fume hoods are conducted by Facilities Management through submitting a work order form. EH&S does not initiate maintenance but will coordinate with Facilities Management to ensure its completion. An outside vendor may need to be consulted dependent on the service requested.

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General Rules for Fume Hood Use

The following general rules should be followed when using laboratory hoods:

1. Fume hoods must provide an average linear face velocity of 100 feet per minute with a minimum of 70 feet per minute at any one location. If the hood is unable to attain the required face velocity, the sash will be lowered until a satisfactory velocity is achieved. The hood shall be marked indicating the maximum sash height.
2. Fume hoods **should not** be used for work involving hazardous substances unless they have a certification label that confirms certification has occurred within the past year. Immediately contact EH&S for fume hood certification.
3. Always keep hazardous chemicals more than **6 inches behind the plane of the sash**.
4. **Never** put your head inside a laboratory hood containing hazardous materials. The plane of the sash is the barrier between contaminated and uncontaminated air.
5. Work with the hood sash in the **lowest practical position.** The sash acts as a physical barrier in the event of an accident. Keep the sash closed when not conducting work in the hood.
6. Do not make any modifications to hoods, duct work, or the exhaust system without first contacting EH&S.
7. Fume hoods **should not** be used as storage areas for chemicals, apparatus, or other materials. Keep it clean and clear. Only materials actively in use should be in the hood. Excessive storage reduces the ability of the fume hood to operate effectively.
8. Fume hood sashes should be closed except when necessary to adjust the apparatus inside the hood or conducting a chemical procedure. Fume hood sashes should be closed when fire alarm sounds and for energy efficiency.

Chemical fume hoods should be inspected upon installation, renovation, when a deficiency is reported, or a change has been made to the operating characteristics of the hood. Since fume hoods used for regulated carcinogens have additional requirements, such as increased face velocity, contact the EH&S if the intended use changes for further evaluation.

Glove Boxes and Ventilation Devices

In addition to fume hoods, some laboratories use contained glove box units for working with reactive chemicals under an inert environment, working with very toxic substances in a completely closed system, or for creating a stable, breeze free, system for weighing hazardous or reactive materials. These units can be very effective because they offer complete containment.

Another type of ventilation device is the elephant trunk, or snorkel, which is connected to the exhaust system. This device is effective for capturing discharges from instruments such as gas chromatographs. The intake of the snorkel must be placed very close to the source to be effective. There are newer designs that are mounted on articulating arms, which make the systems more convenient to use.

Other Engineering Controls

In addition to the elements listed above, consideration must be given to providing sufficient engineering controls for the storage and handling of hazardous materials.

- **No more than 10 gallons of flammable** chemicals may be stored outside of an approved flammable storage cabinet.
- For refrigerated or frozen storage, flammable and explosive materials must be kept in refrigeration units specifically designed for storing these materials. Generally, these units do not have internal lights or electronic systems that could spark and trigger an ignition; additionally, the cooling elements are external to the unit. These units should be labeled with a rating from Underwriters Laboratory or other certifying organization.
- Secondary containment must be provided for corrosive and reactive chemicals and is recommended for all other hazardous chemicals. Secondary containment should be made of chemically resistant materials and should be sufficient to hold at least 110% the volume of at least the largest single bottle stored in the container.
- Laboratories that use hazardous materials must contain a sink, kept clear for hand washing to remove any final residual contamination.
- Hand washing is required whenever a staff member who has been working with hazardous materials plans to exit the laboratory or work on a project that does not involve hazardous materials.

Administrative Controls

The next layer of safety controls is Administrative Controls. These controls consist of policies and procedures; they are not generally as reliable as engineering controls in that the user must carefully follow the appropriate procedures and must be fully trained and aware in order to do so.

Laboratory groups should also review their operations to minimize the amounts of hazardous substances in use or to replace them with less hazardous alternatives. Attention must also be paid to the appropriate segregation of incompatible materials.

Standard Operating Procedures

Standard operating procedures (SOPs) that are relevant to safety and health considerations must be developed and followed when laboratory work involves the use of hazardous chemicals (Title 8, CCR, §5191 (e)(3)(A)), especially for "particularly hazardous substances" (PHS). SOPs are written instructions that detail the steps that will be performed during a given experimental procedure and include information about potential hazards and how these hazards will be mitigated. SOPs should be written by laboratory personnel who are most knowledgeable and involved with the experimental process. The development and implementation of SOPs is a core component of promoting a strong safety culture in the laboratory and helps ensure a safe work environment.

While general guidance regarding laboratory work with chemicals is contained in this plan, Faculty/ Laboratory Supervisors are required to develop and implement laboratory-specific SOPs for certain hazardous chemicals and PHS that are used in their laboratories. These SOPs must be submitted and reviewed by the Primary Investigator prior to implementation. For certain hazardous chemicals, PHS, or specialized practices, consideration must be given to whether additional consultation with safety professionals is warranted or required.

Circumstances requiring prior approval from the PI/Laboratory Supervisor must also be addressed in laboratory specific SOPs. These circumstances are based on the inherent hazards of the material being used, the hazards associated with the experimental process, the experience level of the worker, and the scale of the experiment. Some examples of circumstances that may require prior approval include working alone in a laboratory, unattended or overnight operations, the use of highly toxic gas of any amount, the use of large quantities of toxic or corrosive gases, the use of extremely reactive chemicals (e.g., pyrophorics, water reactive chemicals), or the use of carcinogens.

EH&S maintains a website with tools and resources that may be referenced while developing SOPs. EH&S is also available to assist with the development of SOPs. SOPs must be developed prior to initiating any experiments with hazardous chemicals or particularly hazardous substances and are to be reviewed, approved by PI signature, filed and maintained in the Laboratory Safety Manual where they are accessible to all laboratory personnel.

When drafting an SOP, consider the type and quantity of the chemical being used, along with the frequency of use. The Safety Data Sheet (SDS) for each hazardous chemical or particularly hazardous substance that will be addressed in the SOP should be referenced during SOP development. The SDS lists important information that will need to be considered, such as exposure limits, type of toxicity, warning properties, and symptoms of exposure. If a new chemical will be produced during the experiment, an SDS will not necessarily be available. In these cases, the toxicity is unknown, and it must be assumed that the substance is particularly hazardous, as a mixture of chemicals will generally be more toxic than its most toxic component.

Personal Protective Equipment

Personal protective equipment (PPE) serves as a researcher's last line of defense against chemical exposures and is required by everyone entering a laboratory containing hazardous chemicals.
The PPE policy outlines the basic PPE requirements, which include but are not limited to:

- Full length pants and close-toed shoes, or equivalent
- Protective gloves, laboratory coats, & eye protection when working with, or adjacent to, hazardous chemicals
- Flame resistant laboratory coats for high hazard materials, pyrophorics, and ≥4 liters of flammables

The primary goal of basic PPE is to mitigate, at a minimum, the hazard associated with exposure to hazardous substances. In some cases, additional, or more protective, equipment must be used.

- If a project involves a chemical splash hazard, chemical goggles are required; face shields may also be required when working with chemicals that may cause immediate skin damage.
- Safety goggles differ from safety glasses in that they form a seal with the face, which completely isolates the eyes from the hazard.
- If a significant splash hazard exists, heavy gloves, protective aprons and sleeves may also be needed.

- Gloves should only be used under the specific condition for which they are designed, as no glove is impervious to all chemicals. It is also important to note that gloves degrade over time, so they should be replaced as necessary to ensure adequate protection.

EH&S requires each laboratory to complete a "Hazard Assessment" prior to beginning work and to provide annual updates thereafter, of which, PPE can be selected based on this hazard assessment. Access the online hazard Assessment tool through the Risk and Safety Solutions platform.

How to Use and Maintain PPE

Personal protective equipment should be kept clean and stored in an area where it will not become contaminated. Personal protective equipment should be inspected prior to use to ensure it is in good condition. It should fit properly and be worn properly. If it becomes contaminated or damaged, it should be cleaned or repaired when possible, or discarded and replaced.

Contaminated Clothing/PPE

In cases where spills or splashes of hazardous chemicals on clothing or PPE occur, the clothing/PPE should immediately be removed and placed in a closed container that prevents release of the chemical. Heavily contaminated clothing/PPE resulting from an accidental spill should be disposed of as hazardous waste. Lightly contaminated laboratory coats should be cleaned and properly laundered, as appropriate. Laboratory personnel should never take contaminated items home for cleaning or laundering. Persons or companies hired to clean contaminated items should be provided with hazard communication and personal protective equipment.

Respiratory Protection (state "in alignment with the Respiratory Protection Program")

Typically, respiratory protection is not needed in a laboratory. Under most circumstances, safe work practices, small scale usage, and engineering controls (fume hoods, biosafety cabinets, and general ventilation) adequately protect laboratory workers from chemical and biological hazards. Under certain circumstances however, dedicated respiratory protection may be needed. These situations can include:

- An accidental spill such as:
  - a chemical spill outside the fume hood
  - a spill of bio-hazardous material outside a biosafety cabinet
- Performance of an unusual operation that cannot be conducted under the fume hood or biosafety cabinet.
- When weighing powdered chemicals or microbiological media outside a glove box or other protective enclosure. Disposable filtering face-piece respirators are generally recommended for nuisance dusts. If the chemicals are toxic, contact EH&S for additional evaluation.
- When exposure monitoring indicates that exposures exist that cannot be controlled by engineering or administrative controls.
- As required by a specific laboratory protocol or as defined by applicable regulations.

To ensure employees receive the proper type of respiratory protection when existing controls may not be adequate, employees must be enrolled in the Respiratory Protection Program. Because there are numerous types of respirators available, and each has specific limitations and applications, respirator

selection and use ultimately requires pre-approval by EH&S. Respirators can be used on a voluntary basis in alignment with the provisions outlined in the Respiratory Protection Program.

Processes with potential airborne hazards that cannot be eliminated by engineering or administrative controls will not be authorized by EH&S until affected employees can be enrolled into CPP's Respiratory Protection Program.

Because wearing respiratory equipment places a physical burden on the user, laboratory workers must be medically evaluated prior to wearing respiratory equipment. Certain individuals (e.g., persons with severe asthma, heart conditions, or claustrophobia) may not be medically qualified to wear a respirator.

Upon enrollment in Respirator Training and Fit Testing, the employee will be sent the appropriate medical questionnaire. The completed medical questionnaire will be evaluated before the employee proceeds with the training. **NOTE: This medical questionnaire is confidential.** The employee will be provided additional information on who to contact for follow up questions.
After successful completion of the medical evaluation, the employee will be trained and fit tested by EH&S. Training topics include:

- Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator
- What the limitations and capabilities of the respirator are
- How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions
- How to inspect, put on and remove, use, and check the seals of the respirator
- What the procedures are for maintenance and storage of the respirator
- How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators
- The general requirements of the respiratory program

Finally, a qualitative or quantitative fit test is conducted by EH&S for each respirator user. The fit test ensures a proper face to face piece seal for each individual and his/her mask. Fit testing is done in accordance with Cal/OSHA regulations (Title 8, CCR, §5144).

An annual refresher is required for the medical evaluation, respirator training, and fit testing. In addition to the annual training refresher, a more frequent re-training, fit testing or medical evaluation must be performed when any of the following occur:

- Changes in the workplace or the type of respirator render previous training obsolete
- Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill
- Any other situation arises in which reevaluation appears necessary to ensure safe respirator use
- Facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight
- An employee reports medical signs or symptoms related to their ability to use a respirator

Laboratory Safety and Emergency Response Equipment

New personnel must be instructed in the location of fire extinguishers, safety showers, and other safety equipment before they begin work in the laboratory. This training is considered part of the laboratory specific training that all staff members must attend.

Fire Extinguishers

All laboratories working with combustible chemicals, flammable chemicals, or other potential ignition sources (e.g. lasers) must be outfitted with appropriate fire extinguishers. All extinguishers should be mounted on a wall in an area free of clutter or stored in a fire extinguisher cabinet. Research personnel should be familiar with the location, use and classification of the extinguishers in their laboratory.

Laboratory personnel are not required to extinguish fires that occur in their work areas and should not attempt to do so unless:

- It is a small fire (i.e., small trash can size fire); and
- Appropriate training has been received; and
- It is safe to do so

Per Title 29, CFR, §1910.157(e)(2), fire extinguishers in the vicinity of the assigned responsible party is subject to monthly visual inspections by the any individual associated to the respective area (i.e., PI/Laboratory Supervisor, Department Safety Coordinator, Staff, Laboratory Students/Volunteers, EH&S etc.)

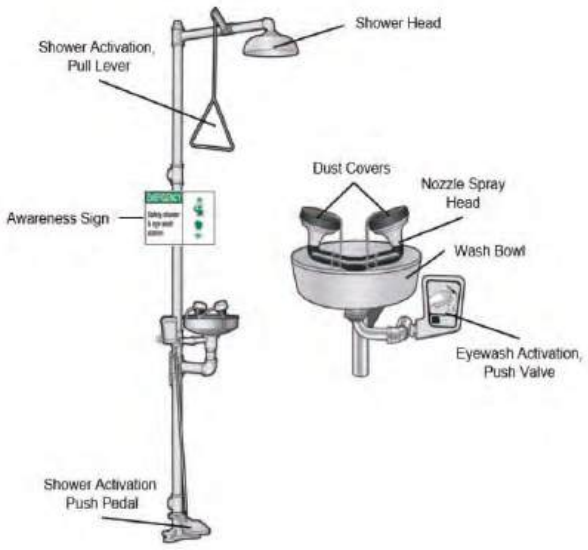
- Confirm the extinguisher is visible, unobstructed, and in its designated location.
- Verify the locking pin is intact and the tamper seal is unbroken. Examine the extinguisher for obvious physical damage, corrosion, leakage, or clogged nozzle.
- Confirm the pressure gauge or indicator is in the operable range or position and lift the extinguisher to ensure it is still full.
- Make sure the operating instructions on the nameplate are legible and facing outward.
- Check the last professional service date on the tag. (A licensed fire extinguisher maintenance contractor must have inspected the extinguisher within the past 12 months.)
- Initial and date the back of the tag upon concluding monthly visual inspection.

Any time a fire extinguisher is used, no matter for how brief a period, the PI/ Laboratory Supervisor, or most senior laboratory personnel present at the time of the incident, must immediately report the incident to EH&S at (909) 869-**4697** or ehs@cpp.edu, as well as, if your extinguisher is missing or needs service.

Safety Showers and Eyewash Stations

All laboratories using hazardous chemicals must have immediate access to safety showers with eye wash stations.

- Access must be available in an unlocked location **within 10 seconds or less** for a potentially injured individual and access routes must be kept clear.
- This requirement applies to all areas where, during routine operations or emergencies, the eyes or body of an employee may encounter a substance that could cause corrosion, sever irritation, or permanent tissue damage, or is toxic by absorption.
- Safety showers must always have a minimum clearance of 16 inches from the centerline of the spray pattern in all directions; this means that no objects should be stored or left within this distance of the safety shower.



- In the event of an emergency, individuals using the safety shower should be assisted by an uninjured person to aid in decontamination and should be encouraged to stay in the safety shower for **15 minutes** to remove all hazardous material.

Safety shower/eyewash stations are required to be tested monthly by individual departments and/or EH&S. Any units which a testing date is not listed on the corresponding tag should be reported immediately to EH&S at (909) 869-**4697** or ehs@cpp.edu.

Fire Doors

Many areas of research buildings may contain critical fire doors as part of the building design. These doors are an important element of the fire containment system and should remain closed unless they are on a magnetic self-closing or other automated self-closing system.

Safe Laboratory Habits

As detailed above, a safety program must include layers of policies and protective equipment to allow for a safe working environment, but to achieve effectiveness, several fundamental elements must become basic working habits for the research community (Appendix A)

Chemical Exposure Assessment

Regulatory Requirements

It is University policy to comply with all applicable health, safety and environmental protection laws, regulations and requirements. Cal/OSHA requires that all employers "measure an employee's exposure to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance exceed the action level (or in the absence of an action level, the

exposure limit).” Repeated monitoring may be required if initial monitoring identifies employee exposure over the action level or exposure limit.

Cal/OSHA regulates Permissible Exposure Limits (PELs) for airborne contaminants to which “nearly all workers may be exposed daily during a 40-hour workweek for a working lifetime (of 40 years) without adverse effect”, are based upon an 8-hour Time-Weighted Average (TWA) exposure. Thus, the PELs are the maximum permitted 8-hour TWA concentration of an airborne contaminant without the use of respiratory protection. Cal/OSHA has also defined Short Term Exposure Limits (STELs) as the maximum TWA exposure during any 15-minute period, provided the daily PEL is not exceeded and Ceiling (C) exposures that shall not be exceeded at any time.

Cal/OSHA has listed established PELs, STELs and Ceiling exposures for chemical contaminants identified in Title 8, CCR, §5155 (Airborne Contaminants) Table AC-1. In the absence of a published Ceiling limit, Cal/OSHA requires employee exposure to concentrations above the PEL be controlled to prevent harmful effects. Further, Cal/OSHA has promulgated specific standards covering several regulated carcinogens, which may include an Action Level (AL), triggering medical surveillance requirements or the imposition of a specific Excursion Limit (such as for asbestos) with a unique measurement of the duration of an exposure.

Additionally, the Safety Drinking Water and Toxic Enforcement Act of 1986 requires Cal/EPA to publish annually a list of Proposition 65 chemicals known to the State to cause cancer or other reproductive toxicity.

Exposure Assessment Overview

All employees require protection from exposure to hazardous chemicals above PELs, STELs and Ceiling concentrations. The profession with expertise in exposure assessment monitoring is Industrial Hygiene. At CPP, the person supervising, directing or evaluating the exposure assessment monitoring must be competent in the practice of industrial hygiene. General questions regarding exposure assessment or the can be directed to EH&S at (909) 869-**4697** or ehs@cpp.edu.

Minimizing an exposure may be accomplished using a combination of engineering controls, administrative controls and personal protective equipment, respectively. Assessing exposure to hazardous chemicals may be accomplished through several methods performed by EH&S, including employee interviews, visual observation of chemical use, evaluation of engineering controls, use of direct reading instrumentation, or the collection of analytical samples from the employee’s breathing zone.

Personal exposure assessment will be performed under either of the following situations:

- Based on chemical inventories, review of Standard Operating Procedures (SOPs), types of engineering controls present, laboratory inspection results and/or review of the annual CPP Assessment tool, EH&S determines whether an exposure assessment is warranted; or
- User of a hazardous chemical has concern or reason to believe exposure is not minimized or eliminated through use of engineering controls or administrative practices (such as transfer of chemical through double needle performed entirely in a fume hood) and the potential for exposure exists. The user should then inform his or her PI/ Laboratory Supervisor, who will in

turn contact the EH&S at (909) 869-**4697** or ehs@cpp.edu. EH&S will then determine the best course of action in assessing employee exposure, including visual assessment, air monitoring, medical evaluation, examination, or medical surveillance.

In event of any serious injury or exposure, including chemical splash involving dermal or eye contact, **immediately call 911** from a campus phone or call CPP Campus Police at (909) 869-**3070** from an off-campus location or cell phone and obtain medical treatment immediately. Do not wait for an exposure assessment to be performed before seeking medical care.

Exposure Assessment Protocol

EH&S conducts and/or contracts exposure assessments for members of the campus community. Employees have a right to observe testing, sampling, monitoring or measuring of employee exposure. They are also allowed access to the records and reports related to the exposure assessment. Exposure assessments may be performed for hazardous chemicals, as well as for physical hazards including noise and heat stress to determine if exposures are within PELs or other appropriate exposure limits that are considered safe for routine occupational exposure. The costs of exposure monitoring are the responsibility of the lab, department and organization where the personnel are employed. General protocol in conducting an exposure assessment may include any of the following:

- Employee interviews;
- Visual observation of chemical usage and/or laboratory operations;
- Evaluation of simultaneous exposure to multiple chemicals;
- Evaluation of potential for absorption through the skin, mucus membranes or eyes;
- Evaluating existing engineering controls (such as measuring face velocity of a fume hood);
- Use of direct reading instrumentation; and
- Collection of analytical samples of concentrations of hazardous chemicals taken from the employees breathing zone, or noise dosimetry collected from an employee's shirt collar or various forms of radiation dosimetry.

If exposure monitoring determines an employee exposure to be over the action level (or the PEL) for a hazard for which OSHA has developed a specific standard (e.g., lead), the medical surveillance provisions of that standard shall be followed. It is the responsibility of the PI/Laboratory Supervisor to ensure that any necessary medical surveillance requirements are met. When necessary, EH&S will make recommendations regarding adjustments to engineering controls or administrative procedures to maintain exposure below any applicable PEL. Where the use of respirators is necessary to maintain exposure below permissible exposure limits, CPP will recommend the proper respiratory equipment and training. Respirators will be selected and used in accordance with the requirements of Title 8, CCR, §5144 and the University's Respiratory Protection Program.

In assessing exposure to hazardous chemicals for which Cal/OSHA has not published a PEL, STEL or Ceiling exposure, EH&S defers to the Threshold Limit Values (TLVs) established by the American Conference of Governmental Industrial Hygienists (ACGIH) or the Recommended Exposure Limits (RELs) established by the National Institute of Occupational Safety & Health (NIOSH). Please contact EH&S at (909) 869-**4697** for more information regarding these chemicals.

Notification

EH&S will promptly notify the employee and his/her PI/Laboratory Supervisor of the results in writing after the receipt of any monitoring results. EH&S will establish and maintain an accurate record of any measurements taken to monitor exposures for each employee. Records, including monitoring provided by qualified vendors, will be managed in accordance with CCR Title 8, §3204 "Access to Employee Exposure and Medical Records".

Exposure Assessment Use to Determine and Implement Controls

EH&S will use any of the following criteria to determine required control measures to reduce employee's occupational exposure:

- Verbal information obtained from employees regarding chemical usage;
- Visual observations of chemical use or laboratory operations;
- Evaluation of existing engineering control measures or administrative practices;
- Recommendations expressed in Safety Data Sheets;
- Regulatory requirements of Cal/OSHA;
- Recommendations from professional industrial hygiene organizations;
- Direct reading instrumentation results;
- Employee exposure monitoring results; and/or
- Medical evaluation, examination and/or surveillance findings.

Particular attention shall be given to the selection of safety control measures for chemicals that are known to be extremely hazardous. Per Cal/OSHA CCR Title 8 §5141 "Control of Harmful Exposure to Employees", the control of harmful exposures shall be prevented by implementation of control measures in the following order:

- Engineering controls, whenever feasible;
- Administrative controls whenever engineering controls are not feasible or do not achieve full compliance and administrative controls are practical; and
- Personal protective equipment, including respiratory protection, during:
    a. the time period necessary to install or implement feasible engineering controls
    b. when engineering and administrative controls fail to achieve full compliance
    c. in emergencies
    d. As an extra precaution/option for employees

Medical Evaluation

All employees, student workers, medical health services volunteers, or laboratory personnel who work with hazardous chemicals shall have an opportunity to receive a free medical evaluation, including supplemental examinations which the evaluating physician determines necessary, under the following circumstances:

1. Whenever an employee develops signs or symptoms associated with a hazardous chemical to which an employee may have been exposed in a laboratory;
2. Where personal monitoring indicates exposure to a hazardous chemical is above a Cal/OSHA Action Level (AL) or Permissible Exposure Limit (PEL) or recommended exposure levels established by the National Institute for Occupational Safety & Health (NIOSH) or the American Conference of

Governmental Industrial Hygienists (ACGIH) in the event Cal/OSHA has not established an AL or PEL for a particular hazardous chemical;
3. Whenever an uncontrolled event takes place in the work area such as a spill, leak, explosion, fire, etc., resulting in the likelihood of exposure to a hazardous chemical; or
4. Upon reasonable request of the employee to discuss medical issues and health concerns regarding work-related exposure to hazardous chemicals.

All work-related medical evaluations and examinations will be performed by a licensed medical facility. Evaluations and examinations will be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

Information to Provide to the Clinician

At the time of the medical evaluation, the following information shall be provided:

1. Personal information such as age, weight and University employee ID number;
2. Common and/or IUPAC name of the hazardous chemicals to which the individual may have been exposed;
3. A description of the conditions under which the exposure occurred;
4. Quantitative exposure data, if available;
5. A description of the signs and symptoms of exposure that the employee is experiencing, if any;
6. A copy of the Safety Data Sheet (SDS) of the hazardous chemical in question;
7. History of exposure including previous employment and non-occupational (recreational) hobbies; and
8. Any additional information helpful in assessing or treating an exposure or injury such as a biological component of exposure or existence of an antitoxin.
9. Pay Status at time of exposure/injury

Physician's Written Opinion

For evaluation or examinations required by Cal/OSHA, the employer shall receive a written opinion from the examining physician which shall include the following:

1. Recommendation for further medical follow-up;
2. Results of the medical examination and any associated tests, if requested by the employee;
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; and
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.

Confidentiality & Individual's Access to Personal Medical Records

All patient medical information is protected by California and federal law and is considered strictly confidential. The medical facility is prohibited from disclosing any patient medical information that is not directly related to the work-related exposure under evaluation and should not reveal any diagnosis unrelated to exposure.

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Any patient information disclosed by the medical facility to the employee's supervisor will be limited to information necessary in assessing an employee's return to work, including recommended restrictions in work activities, if any.

Any patient information disclosed by the medical facility to EH&S will be limited to information necessary to develop a course of exposure monitoring, or perform hazard assessments and incident investigations, if appropriate, the medical facility will otherwise disclose patient medical information only as required by California and Federal law, such as for Worker's Compensation Insurance claims. Each employee has the right to access his/her own personal medical and exposure records. The medical facility will provide an employee with a copy of his/her medical records upon written request.

Medical Surveillance

Medical surveillance is the process of using medical examinations, questionnaires and/or biological monitoring to determine potential changes in health as a result of exposure to a hazardous chemical or other hazard. Certain Cal/OSHA standards require clinical examination as part of medical surveillance when exposure monitoring exceeds an established Action Level or PEL.

CPP uses outside vendors for medical surveillance services. Medical surveillance is required of employees who are routinely exposed to certain hazards as part of their job description (such as asbestos) and may be offered to other employees based upon quantifiable or measured exposure. Examples of hazards that are monitored through the medical surveillance program may include: Asbestos, Beryllium, Formaldehyde, Lead, Methylene Chloride, Noise (Hearing Conservation Program), Radioactive Chemicals, Respirator Use (Respirator Protection Program), and other particularly hazardous substances. Individuals with questions regarding work-related medical surveillance are encouraged to contact EH&S at (909) 869-**4697** or ehs@cpp.edu for more information.

5. PROCUREMENT, CHEMICAL INVENTORY, LABELING, STORAGE AND TRANSPORTATION

Regulatory Requirements

Implementation of the necessary work practices, procedures, and policies outlined in this chapter is required by the following:

- *Title 8, CCR, § 5164, "Storage of Hazardous Substances"*
- *Title 8, CCR, § 5191, "Occupational Exposures to Hazardous Chemicals in Laboratories"*
- *Title 8, CCR, § 5194, "Hazard Communication"*
- *Title 8, CCR, § 5209, "Carcinogens"*
- *Title 8, CCR, § 5154.1, "Ventilation Requirements for Laboratory-Type Hood Operations"*
- *Assembly Bill 2286*

Procurement and Donations

The Office of Environmental Health and Safety is tasked under Executive Order 1039 to review and approve materials and equipment that may result in an occupational injury or illness or items that are regulated under an EH&S program. Currently this list of items includes, hazardous materials (chemical, biological, radiological), radiation generating equipment, lasers, and Unmanned Aerial Vehicles (drones).

Purchasers must receive **pre-approval prior** to purchasing items listed on the procurement webpage. Please follow instructions for P-Card and Purchase Order transactions and complete the **EH&S Order Approval Form** prior to placing an order. The order form should have an approval by EH&S that is dated before the date of the transaction on the P-Card statement.

The PI/Laboratory Supervisor shall ensure that appropriate storage and/or controls are in place, in accordance the University's Chemical Hygiene Plan prior to the purchase, loan, or receipt of a donation of a chemical. Chemical or material donations or gifts originating from off-campus shall not be permitted without the written consent of the EH&S Director/Manager.

Special Cases

Radionuclides

In alignment with the University's radioactive materials license, all radionuclides shall be procured, handled, stored, and disposed of in accordance with the University Radiation Safety Manual. Copies of the University Radiation Safety Manual are available from the Office of Environmental Health & Safety upon request.

DEA Controlled Substances and Controlled Precursors

All DEA controlled substances will be procured, handled, stored and disposed of in accordance with all federal, state, and local laws. Contact the Environmental Health and Safety for guidance on compliance with the applicable laws.

Explosives

In the planning phase before starting any work involving explosives, EH&S and the Chemical Hygiene Committee will be informed. Materials shall not be purchased until written approval has been obtained from the Dean, Department Chair, and EH&S Director/Manager. It should be noted that the Federal Alcohol, Tobacco, and Firearms Agency; Department of Transportation; and state and local fire codes may regulate the use of some explosive materials. EH&S will review the chemical inventory for potentially explosive materials and explicitly address the safe storage, handling, and use of these materials as necessary.

Chemical Inventories

Chemical inventories are used to provide the required information to the fire department, ensure compliance with fire code storage limits, and homeland security reporting thresholds. The chemical inventory can also be used in an emergency to identify potential hazards for emergency response operations and more.

Faculty members and other supervisors with chemicals are required to use the campus chemical inventory system (Chemicals) to maintain a current, accurate and complete chemical inventory that includes the materials that are toxic, oxidizing, corrosive, reactive, carcinogenic, or flammable, as well as any liquids and gases under pressure including liquid nitrogen tanks and compressed air cylinders stored in the rooms to which they are assigned or allowed to be used. At a minimum, each chemical inventory owner or EH&S will conduct an annual inventory reconciliation. Additionally, if your inventory changes by >10%, or is moved into a new room, an inventory update needs to be completed by the responsible party.

The information maintained in the inventory includes the name of the chemical, the concentration, the chemical abstracts number, the size of the container, the number of identical containers, the amount on hand, the physical state, the type of the container, whether it is pure or a mixture and both the storage pressure and temperature.

The chemical inventory list should be reviewed prior to ordering new chemicals and only the minimum quantities of chemicals necessary for the research should be purchased. As new chemicals are added to the inventory, each laboratory group can confirm that they have access to the Safety Data Sheet (SDS) for that chemical. Where practical, each chemical should be dated so that expired chemicals can be easily identified for disposal.

The Department of Homeland Security (DHS) requires a report to be submitted within 60 days of specific chemicals that exceed set threshold aggregate amounts. As a result, everyone who has chemicals at CPP must update the on-line inventory for each of 325 chemicals within 60 days of when they are received or consumed/disposed.

Many materials should not be entered in the chemical inventory, per the table below (not all inclusive). If you are unsure what to include, please contact EH&S.

WHAT TO INCLUDE IN YOUR INVENTORY	WHAT NOT TO INCLUDE
All chemicals and chemical products (except those listed to the right)	Retail products used and stored in amounts and frequencies typical to ordinary household usage.
All compressed and liquefied gases	Etiologic agents (bacteria, viruses, select agents, and toxins)
Lubricants, fuels, and oils (motor oil, gasoline, diesel, vacuum pump oil)	Biological culture media, agar, serum proteins, albumin
Aerosol lubricants	Enzyme preparations
Paints including spray-paints	Non-hazardous buffers
Pesticides and biocides	Radioactive materials (unless mixed with hazardous chemicals)
	Pre-packed test kits for medical labs

Chemical Inventory Maintenance

Chemical storage areas should be periodically evaluated to ensure that the chemical inventory is maintained. **All unneeded Title 8 §339 listed hazardous substances, aged (>5-6 years)/expired, compromised chemical containers with visible damage or deterioration should be discarded as hazardous waste through WASTe.**

Attributes that may indicate the materials need to be disposed are:

- Cloudiness in liquids
- A change in color
- Evidence of liquids in solids, or solids in liquids
- Evidence of “puddling" material around outside of containers
- Pressure build-up within containers
- Obvious deterioration of containers
- Exceeding a manufacturer’s expiration date

Access to hazardous chemicals, including toxic and corrosive substances, should always be restricted. These materials must be stored in laboratories or storerooms that are kept locked when laboratory personnel are not present. Locked storage cabinets or other precautions are always recommended, and in some cases may be required in the case of unusually toxic or hazardous chemicals. Unusually toxic chemicals may include those that are immediately dangerous to life or health (IDLH). For guidance on storage requirements, please contact EH&S at (909) 869-**4697**.

On termination or transfer of laboratory personnel, all related hazardous materials should be properly disposed of, or transferred to the laboratory supervisor or a designee.

To facilitate improved inventory management and reporting, CPP has implemented the systemwide Risk and Safety Solutions Chemicals application. Information on how to use Chemicals is available through Risk and Safety Solutions and further guidance can be requested from EH&S. This program will allow CPP

to more easily comply with both long standing and new regulation requiring chemical inventory maintenance and reporting.

Cal/OSHA Title 8, §5194(e)(1) requires that employers develop and maintain a list of hazardous chemicals known to the workplace. This is a long-standing regulatory requirement and is an important component of our lab safety evaluations. New regulation in the form of Assembly Bill 2286 mandates the development of the California Environmental Reporting System (CERS) and requires all regulated businesses to use the internet to electronically submit chemical inventories.

In order to facilitate compliance with the new electronic reporting requirement, each lab group is always required to maintain an up-to-date chemical inventory through the Chemicals online application.

Chemical Labeling

All containers (including diluted chemical solutions and those with abbreviations) of hazardous materials must be labeled with the identity of the hazardous substance and all applicable hazard warning statements or abbreviations. If abbreviations are used, a list of the abbreviations used, the full chemical names and the hazards warning statement associated with each, must be prominently displayed in each room.

- In either case, all containers not actively being used in transfer or a reaction must be labeled.
- New synthesized compounds must be labeled with the appropriate hazard warnings based on the knowledge of the chemical and physical properties of that substance.
- Labels must be legible, in English, and clearly displayed; Lewis structures alone are inadequate.
- Secondary containers (such as spray bottles) must be labeled with the identity of the substance and appropriate hazard warnings.
- Symbols and/or other languages may be provided for non-English speaking employees
- Use the symbols in the Globally Harmonized System of Classification and Labeling of Chemicals
- Peroxide forming chemicals (e.g., ethers) must be labeled with a date on receipt and the date when the bottle is first opened. For the containers without a manufacturer supplied expiration date, these chemicals are only allowed a one-year shelf life and must be disposed of as waste within one year of receipt or six months of opening. These chemicals can degrade to form shock sensitive, highly reactive compounds and should be stored and labeled very carefully.
- Particularly Hazardous Substances require additional labeling to identify the specific hazard associated with each of these chemicals (carcinogen, reproductive toxin, acutely toxicant). In addition, the storage area where they are kept must be labeled with the type of hazard. These chemicals should be segregated from less hazardous chemicals to help with proper access control and hazard identification.

Chemical Storage & Segregation

Establish and follow safe chemical storage & segregation procedures for your laboratory

Storage guidelines are included for materials that are flammable, oxidizers, corrosive, and water reactive, explosive and highly toxic. The specific Safety Data Sheet (SDS) should always be consulted when doubts arise concerning chemical properties and associated hazards. All procedures employed must comply with Cal/OSHA, Fire Code and building code regulations. Always wear appropriate personal protective equipment (e.g., laboratory coat, safety glasses, gloves, safety goggles, apron) when handling hazardous chemicals. Be aware of the locations of the safety showers and emergency eyewash stations. Each laboratory is required to provide appropriate laboratory-specific training on how to use this equipment prior to working with hazardous chemicals. The table below lists chemical safety storage priorities

Safe Chemical Storage Priorities

Keep in mind that most chemicals have multiple hazards and a decision must be made as to which storage area would be most appropriate for each specific chemical. First you must determine your priorities:

1. **Flammability**: When establishing a storage scheme, the number one consideration should be the flammability characteristics of the material. If the material is flammable, it should be stored in a flammable cabinet.
2. **Isolation:** If the material will contribute significantly to a fire (e.g., oxidizers), it should be isolated from the flammables. If there were a fire in the laboratory and response to the fire with water would exaggerate the situation, isolate the water reactive material away from contact with water.
3. **Corrosivity**: Next look at the corrosivity of the material, and store accordingly.
4. **Toxicity**: Finally, consider the toxicity of the material, with attention paid to regulated materials. In some cases, this may mean that certain chemicals will be isolated within a storage area. For example, a material that is an extreme poison but is also flammable, should be locked away in the flammable storage cabinet to protect it against accidental release.

There will always be some chemicals that will not fit neatly in one category or another, but with careful consideration of the hazards involved, most of these cases can be handled in a reasonable fashion. Reference the Flinn Scientific Shelf Storage Pattern guidelines

General Recommendations for Safe Storage of Chemicals

Each chemical in the laboratory should be stored in a specific location and returned there after each use. Acceptable chemical storage locations may include corrosive cabinets, flammable cabinets, laboratory shelves, or appropriate refrigerators or freezers. Fume hoods should not be used as general storage areas for chemicals, as this may seriously impair the ventilating capacity of the hood.

The image to the right depicts improper fume hood storage.

- Chemicals should not be routinely stored on bench tops or stored on the floor.
- Additionally, bulk quantities of chemicals (i.e., larger than one-gallon) should be stored in a separate storage area, such as a stockroom or supply room.
- Laboratory shelves should have a raised lip along the outer edge to prevent containers from falling.
- Hazardous liquids, toxic or corrosive chemicals should not be stored on shelves above eye-level and chemicals which are highly toxic, or corrosive should be in unbreakable secondary containers.
- Chemicals must be stored at an appropriate temperature and humidity level and should never be stored in direct sunlight or near heat sources, such as laboratory ovens.
- Incompatible materials should be stored in separate cabinets, whenever possible. If these chemicals must be stored in one cabinet, due to space limitations, adequate segregation and secondary containment must be ensured to prevent adverse reactions.
- All stored containers and research samples must be appropriately labeled and tightly capped to prevent vapor interactions and to alleviate nuisance odors. Flasks with only septa, cork, rubber or glass stoppers should be avoided because of the potential for leaking.

Laboratory refrigerators and freezers must be labeled appropriately with **"No Food/Drink"** and must **never** be used for the storage of food or drinks intended for human consumption. Freezers should be defrosted periodically so that chemicals do not become trapped in ice formations. **Never** store peroxide formers (e.g., ether) in a refrigerator not specifically designed for storage of flammable liquids.

Flammable and Combustible Liquids

In general, flammables should not be stored alongside combustible materials like paper and packaging nylon bags. Large quantities of flammable or combustible materials should not be stored in the laboratory. The Fire Code limits specific volume of flammable materials or other classes of hazardous chemicals depending on the original design and construction of the facility and varies from building to building at CPP.

- In most **B occupancy labs**, the maximum total quantity of class 1A, 1B and 1C flammable liquids must not exceed **60 gallons**, which must all be stored in a flammable storage cabinet.
- The maximum quantity allowed to be kept outside a flammable storage cabinet, safety can, or approved refrigerator/freezer is **10 gallons per room.**
- **Class 1A solvents**, such as ethyl ether, should be purchased only in **one gallon (4 liter) or smaller** containers. Because of the extreme flammability of the Class 1 liquids, only quantities needed for immediate use should be stored.
- Examples of equipment that can be used for storage include: flammable storage cabinets, flammable storage refrigerators or freezers that are designed and UL approved for the storage of flammable substances, or approved safety cans or drums that are grounded.
- **Always segregate flammable or combustible liquids from oxidizing acids and oxidizers.**
- Flammable materials must never be stored in domestic-type refrigerators/freezers and should not be stored in a refrigerator/freezer if the chemical has a flash point below the temperature of

the equipment. Flammable or combustible liquids must not be stored on the floor or in any exit access.

- Handle flammable and combustible substances only in areas free of ignition sources and use the chemical in a fume hood whenever practical.
- Only the amount of material required for the experiment or procedure should be stored in the work area.
- Always transfer flammable and combustible chemicals from glass containers to glassware or from glass container/glassware to plastic. Transferring these types of chemicals between plastic containers may lead to a fire hazard due to static electricity. The transfer of flammable liquid from 5 gallon or larger metal containers should not be done in the laboratory.
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HAZARD CLASSIFICATION FOR FLAMMABLE LIQUIDS			
Class	**Flash point**	**Boiling point**	**Examples**
I-A	below 73°F (23°C)	below 100°F (38°C)	diethyl ether, pentane, ligroin, petroleum ether
I-B	below 73°F (23°C)	at or above 100°F (38°C)	acetone, benzene, cyclohexane, ethanol
I-C	73-100°F (24-38°C)	----	p-xylene
HAZARD CLASSIFICATION FOR COMBUSTIBLE LIQUIDS			
II	101-140°F (39-60°C)	----	diesel fuel, motor oil, kerosene, cleaning solvents
III-A	141-199°F (61-93°C)	----	paints (oil base), linseed oil, mineral oil
III-B	200°F (93°C) or above	----	paints (oil base), neatsfoot oil

Pyrophoric & Water Reactive Substances

Because pyrophoric substances can spontaneously ignite on contact with air and/or water, they must be handled under an inert atmosphere and in such a way that rigorously excludes air and moisture. Some pyrophoric materials are also toxic, and many are dissolved or immersed in a flammable solvent. Other common hazards include corrosivity, teratogenicity, or peroxide formation.

Only minimal amounts of reactive chemicals should be used in experiments or stored in the laboratory. These chemicals must be stored as recommended in the SDS. Reactive materials containers must be clearly labeled with the correct chemical name, in English, along with a hazard warning.

Suitable storage locations may include inert gas-filled desiccators or glove boxes; however, some pyrophoric materials must be stored in a flammable substance approved freezer. If pyrophoric or water reactive reagents are received in a specially designed shipping, storage or dispensing container (such as the Aldrich Sure/Seal packaging system), ensure that the integrity of that container is maintained. Ensure that sufficient protective solvent, oil, kerosene, or inert gas remains in the container while pyrophoric materials are stored. **Never store reactive chemicals with flammable materials or in a flammable liquid's storage cabinet.**

Storage of pyrophoric gases is described in the California Fire Code, Chapter 41. Gas cabinets, with remote sensors and fire suppression equipment, are required. Gas flow, purge and exhaust systems should have redundant controls to prevent pyrophoric gas from igniting or exploding. Emergency back-up power should be provided for all electrical controls, alarms and safeguards associated with the pyrophoric gas storage and process systems.

Never return excess reactive chemical to the original container. Small amounts of impurities introduced into the container may cause a fire or explosion. For storage of excess chemical, prepare a storage vessel in the following manner:

- Dry any new empty containers thoroughly;
- Insert the septum into the neck in a way that prevents atmosphere from entering the clean dry (or reagent filled) flask;
- Insert a needle to vent the flask and quickly inject inert gas through a second needle to maintain a blanket of dry inert gas above the reagent;
- Once the vessel is fully purged with inert gas, remove the vent needle then the gas line. To introduce the excess chemical, use the procedure described in the handling section of the SOP;
- For long-term storage, the septum should be secured with a copper wire or hose clamp
- For extra protection a second same-sized septa (sans holes) can be placed over the first; and
- Use "Parafilm M®" or equivalent around the outer septa and remove the Parafilm M® and outer septum before accessing the reagent through the primary septum.

Oxidizers

Oxidizers should be stored in a cool, dry place and kept away from flammable and combustible materials, such as wood, paper, Styrofoam™, most plastics, flammable organic chemicals, and away from reducing agents, such as zinc, alkaline metals, and formic acid.

Examples of oxidizers: (e.g., oxygen, ozone, hydrogen peroxide, and other **inorganic peroxides**; fluorine, chlorine, and other **halogens**; nitric acid and **nitrate compounds**; persulfuric acids; chlorite, chlorate, perchlorate, and other **analogous halogen compounds**; hypochlorite and other **hypohalite compounds**, including household bleach; **hexavalent chromium compounds** such as chromic and dichromic acids and chromium trioxide, pyridinium chlorochromate, and chromate/dichromate compounds; **permanganate compounds**; sodium perborate; nitrous oxide; silver oxide; osmium tetroxide; Tollens' reagent; 2,2'-dipyridyldisulfide)

Peroxide Forming Chemicals

Peroxide forming chemicals (Appendix G) should be stored in airtight containers in a dark, cool, and dry place and must be segregated from other classes of chemicals that could create a serious hazard to life or property should an accident occur (e.g., acids, bases, oxidizers). The containers should be **labeled with the date received** and the date opened. This information, along with the chemical identity should face forward to minimize container handling during inspection. These chemicals must also be tested and documented for the presence of peroxides periodically. Minimize the quantity of peroxide forming chemicals stored in the laboratory and dispose of peroxide forming chemicals before peroxide formation.

Carefully review all cautionary material supplied by the manufacturer prior to use. Avoid evaporation or distillation, as distillation defeats the stabilizer added to the solvents. Ensure that containers are tightly sealed to avoid evaporation and that they are free of exterior contamination or crystallization. **Never return unused quantities back to the original container and clean all spills immediately.**

If old containers of peroxide forming chemicals are discovered in the laboratory, (greater than two years past the expiration date or if the date of the container is unknown), **do not handle the container**. If crystallization is present in or on the exterior of a container, **do not handle the container**. Secure it and contact EH&S at (909) 869-**4697** or ehs@cpp.edu to arrange the appropriate pick-up and disposal.

Corrosives

Store corrosive chemicals (i.e., acids, bases) below eye level and in secondary containers that are large enough to contain at least 110% of the total volume of liquid stored or the volume of the largest container, whichever is greater. Acids must always be segregated from bases and from active metals (e.g., sodium, potassium, magnesium) at all times and must also be segregated from chemicals which could generate toxic gases upon contact (e.g., sodium cyanide, iron sulfide).

Specific types of acids require additional segregation. Mineral acids must be kept away from organic acids and oxidizing acids must be segregated from flammable and combustible substances. Perchloric acid should be stored by itself, away from other chemicals. Picric acid is reactive with metals or metal salts and explosive when dry and must contain at least 10% water to inhibit explosion.

Special Storage Requirements

Compressed Gas Cylinders

Cylinders stored and chained correctly

- Compressed gas cylinders that are stored in the laboratory must be chained or strapped to the wall or other stable building member, with the safety cap in place to prevent failing caused by contact, vibration, or seismic activity.
- Single non-combustible straps or the use of chains are acceptable given that when tightly secured at minimum two-thirds the height of the cylinder – above the midpoint, but below the shoulder, with the cylinder having less than one inch of lateral movement in any direction.
- Else, the cylinders is preferred to be restrained by two chains or non-combustible straps; one chain/strap must be placed at one third from the top of the cylinder, and the other placed at one third from the bottom of the cylinder.
- Bolted “clam shells” may be used in instances where gas cylinders must be stored or used away from the wall. Store liquefied fuel-gas cylinders securely in the

upright position. **Cylinders are not to be stored in a horizontal position**. Do not expose cylinders to excessive dampness, corrosive chemicals or fumes.

Certain gas cylinders require additional precautions. Flammable gas cylinders must use only flame-resistant gas lines and hoses which carry flammable or toxic gases from cylinders and must have all connections wired. **Compressed oxygen gas cylinders must be stored at least 20 feet away from combustible materials and flammable gases.**

Gas cylinder connections must be inspected frequently for deterioration and must never be used without a regulator. **Never** use a leaking, corroded or damaged cylinder and never refill compressed gas cylinders. When stopping a leak between cylinder and regulator, always close the valve before tightening the union nut. The regulator must be replaced with a safety cap when the cylinder is not in use. Move gas cylinders with the safety cap in place using carts designed for this purpose.

Liquid Nitrogen

Because liquid nitrogen containers are at low pressure and have protective rings mounted around the regulator, they need to be affixed to a permanent fixture such as a wall to prevent them from walking or rolling into the egress path in an earthquake.

Additional protection considerations should be addressed when storing liquid nitrogen in a laboratory.

- The primary risk to laboratory personnel from liquid nitrogen is skin or eye thermal damage caused by contact with the material.
- Nitrogen expands 696:1 when changing from a cryogenic liquid to a room temperature gas.
- The gases usually are not toxic, but if too much oxygen is displaced, asphyxiation is a possibility.
- Always use appropriate PPE to include thermally insulated gloves when handling liquid nitrogen. Face shields may be needed in cases where splashing may occur.

Laboratory Security

Recently regulatory agencies have been implementing rules to ensure chemical security. While many of these rules are for large manufacturing facilities, it is critical that chemicals be secured to prevent theft from campus laboratories. Numerous federal agencies are involved in the maintenance of laboratory security, including the Drug Enforcement Agency, Federal Bureau of Investigations, and Department of Homeland Security. It is each laboratory's responsibility to prevent and report any theft of chemicals from their laboratory.

Aspects that should be considered when evaluating laboratory security should include:

- Existing threats, based on the history of the institution (e.g., theft of laboratory materials, sabotage, data security breaches, protests)
- The attractiveness of the institution as a target, and the potential impact of an incident
- Chemicals, biological agents, radioactive materials, or other laboratory equipment or materials with dual-use potential
- Sensitive data or computerized systems
- Animal care facilities

- Infrastructure vulnerabilities (e.g., accessible power lines, poor lighting)
- Security systems in place (e.g., access control, cameras, intrusion detection)
- Access controls for laboratory personnel (e.g., background checks, authorization procedures, badges, key controls, escorted access)
- Institutional procedures and culture (e.g., tailgating, open laboratories, no questioning of visitors)
- Security plans in place
- Training and awareness of laboratory personnel

Labs can increase their security by simply keeping lab doors closed and locked when unoccupied, maintaining a current and accurate chemical inventory, training personnel on security procedures, and controlling access to keys. Labs should report any suspicious activity to CPP Campus Police at (909) 869-**3070** and EH&S at (909) 869-**4697**.

On-Campus Distribution of Hazardous Chemicals

Precautions must be taken when transporting hazardous substances between laboratories.

- Chemicals must be transported between stockrooms and laboratories in break-resistant, secondary containers such as commercially available bottle carriers made of rubber, metal, or plastic, that include carrying handle(s) and which are large enough to hold the contents of the chemical container in the event of breakage.
- When transporting cylinders of compressed gases, always secure the cylinder with straps or chains onto a suitable hand truck and protect the valve with a cover cap.
- Avoid dragging, sliding, or rolling cylinders and use a freight elevator when possible. The figure illustrates correct cylinder transport.

Correct cylinder transport

Off-Campus Distribution of Hazardous Chemicals

The transportation of hazardous chemicals and compressed gases over public roads, or by air, is strictly governed by international, federal, and state regulatory agencies, including the U.S. Department of Transportation (DOT) and the International Air Transport Association (IATA). Any person who prepares and/or ships these types of materials must ensure compliance with pertinent regulations regarding training, quantity, packaging, and labeling. **Without proper training and packaging, it is illegal to ship hazardous materials.** Those who violate the hazardous materials shipment regulations are subject to criminal investigation and penalties.

Individuals who wish to ship or transport hazardous chemicals, compressed gases or biological materials off-campus, must contact EH&S at (909) 869-**4697** for review and approval.

6. TRAINING

Regulatory Requirements

Environmental Health and Safety training shall conform to the requirements defined in CSU Executive Order No. 1039. Implementation of the necessary work practices, procedures, and policies outlined in this chapter is also required by the following:

- *Title 8, CCR, §5191, "Occupational Exposures to Hazardous Chemicals in Laboratories"*
- *Title 8, CCR, § 5194, "Hazard Communication"*
- *Title 8, CCR, § 5209, "Carcinogens"*

Other applicable regulations include those promulgated by the U.S. Department of Labor including Title 29 CFR §1910.1450 "Occupational Exposure to Hazardous Chemicals in Laboratories" (the "Laboratory Standard").

Introduction

Effective training is critical to facilitate a safe and healthy work environment and prevent laboratory accidents. All Faculty/Laboratory Supervisors must participate in formal safety training and ensure that all their employees have appropriate safety training before working in a laboratory. Contact EH&S for further consultation on training requirements.

Types of Training

All laboratory personnel must complete general laboratory safety training and lab specific training before:

1. Beginning work in the laboratory;
2. Prior to new exposure situations; and
3. As work conditions change.

Annual refresher on specific trainings is also required for all laboratory personnel. EH&S offers online training and resource materials to assist laboratories in implementing laboratory-specific training. Appendix C outlines training requirements for Faculty, Staff, and Students.

Student Training Plans

Training plans are categorized based on hazard assessments and hazard exposure to implement supplemental training topics based on exposure. All training plans are based on a base plan and a supplemental plan.

Base Plan- general safety training that applies to all learning plans

Topic	Frequency
CSU - Injury and Illness Prevention Program	Annual
Hazard Communication	Annual
Emergency and Disaster Preparedness	Annual
Fire Safety and Prevention	Annual
Heat Illness Training	Annual

Supplemental Plan- covers hazard-specific training more relevant to the work being performed. Additional site-specific training on standard operating procedures (SOP's) or unique equipment can vary from one area to another and must be identified by the PI. Custom plans may be developed as needed. Reference the Student Training Plan document for further information.

The following topics should be assigned to any students working in lab environments involving the use of chemicals and/or hazardous materials.

Topic	Frequency
CSU - Laboratory Safety Fundamentals	Annual
Hazardous Waste Generator	Annual
Compressed Gas Safety	Annual
Safety Data Sheets	Annual

Laboratory-Specific Training

Faculty/ Laboratory Supervisors must also provide laboratory-specific training. Topics that require specific training include:

- Location and use of the Chemical Hygiene Plan, IIPP, SDS(s) and other regulatory information
- Review of IIPP and Emergency Management Plan, including location of emergency equipment and exit routes
- Specialized equipment
- Standard Operating Procedures
- Personal Protective Equipment
- Specialized procedures and protocols
- Particularly Hazardous Substances including physical and health hazards, potential exposure, medical surveillance, and emergency procedures
- Each person working in a laboratory or technical area receives a site-specific orientation.

Documentation of Training

Accurate recordkeeping is a critical component of health and safety training. Per OSHA regulations, departments or laboratories are responsible for documenting health and safety training, including safety meetings, one-on-one training, and classroom and online training. Documentation should be maintained in the Laboratory Safety Manual.

Student training records shall be maintained by the hosting College and/or department as applicable, determined by the Dean or department head. Training records shall be maintained for a period of three (3) years with the exception to hazardous waste training shall be maintained for three (3) years following departure from the campus.

A training history for all laboratory employees is available to Faculty/Laboratory Supervisors upon request. This document can serve as an official record of laboratory safety training conducted by EH&S and others.

7. LAB EVALUATIONS AND COMPLIANCE

Regulatory Requirements

Implementation of the necessary work practices, procedures, and policies outlined in this chapter is required by the following:

- *Title 8, California Code of Regulations (CCR), §5191, "Occupational Exposures to Hazardous Chemicals in Laboratories"*

Other applicable regulations include those promulgated by the U.S. Department of Labor including 29 CFR §1910.1450 "Occupational Exposure to Hazardous Chemicals in Laboratories" (the "Laboratory Standard").

Laboratory Safety Evaluations

EH&S has a comprehensive laboratory safety evaluation program to assist laboratories and other facilities that use, handle or store hazardous chemicals to maintain a safe work environment. This program helps to ensure compliance with regulations and to fulfill CPP's commitment to protecting the health and safety of the campus community.

As part of this laboratory safety program, EH&S conducts periodic inspections of laboratories and other facilities with hazardous chemicals to ensure the laboratory is operating in a safe manner and to ensure compliance with all federal, state and university safety requirements. The primary goal of lab evaluations is to identify both existing and potential accident-causing hazards, actions, faulty operations and procedures that can be corrected **before** an accident occurs. **EH&S has the authority to suspend or restrict any operation that presents a significant (real or potential) imminent hazard associated with life safety, or the health and welfare of campus personnel or the public until that hazardous condition or activity is abated.**

The laboratory safety evaluation is comprehensive in nature and investigates all key aspects of working with hazardous chemicals. While inspections are a snapshot in time and cannot identify every accident-causing mistake, they do provide important information on the overall operation of a laboratory. They can also help to identify weaknesses that may require more systematic action across a broader spectrum of laboratories, and strengths that should be fostered in other laboratories. Laboratory evaluations categories include:

- Documentation and Training;
- Emergency and Safety Information;
- Fire Safety;
- General Safety;
- Use of personal protective equipment (PPE);
- Housekeeping;
- Chemical Storage;
- Fume Hoods;
- Chemical Waste Disposal and Transport;
- Seismic Safety; and

- Mechanical and Electrical Safety.

Planned, focused assessments are also conducted. Examples of these include industrial hygiene assessments and unannounced PPE inspections. Once the evaluations are completed, EH&S issues a Laboratory Evaluation Report via RSS Inspect application. The report identifies deficiencies in the laboratory, both critical and non-critical. Critical deficiencies are those that have the potential to lead to serious injuries or be of critical importance in the event of an emergency. These deficiencies must be immediately corrected. Non-critical deficiencies must be corrected within 30-days. A copy of the most recent Laboratory Evaluation Report should be maintained as part of the records inside the Laboratory Safety Manual.

Notification and Accountability

The annual laboratory inspections require faculty, laboratory supervisors, and other responsible parties take appropriate and effective corrective action upon receipt of written notification of evaluation findings.

- Critical deficiencies are required to be corrected within 48 hours
- Non-critical deficiencies must be corrected within 30 days

Failure to take corrective actions within the required timeframe will result in an escalation of the notification to the EH&S Director/Manager, Department Chair, Associate Dean, Dean and Provost. Depending on the severity of the deficiency, the EH&S Director/Manager, in consultation with the Department Chair, Associate Deans, Deans, and Provost, may temporarily suspend research activities until the violation is corrected. In some cases, the PI may be required to provide a corrective action plan to EH&S prior to recommencement of research activities.

RECORDKEEPING REQUIREMENTS

Accurate recordkeeping demonstrates a commitment to the safety and health of the CPP community, integrity of research, and protection of the environment. EH&S is responsible for maintaining records of inspections, accident investigations, equipment calibration, and training conducted by EH&S staff. Documentation of training conducted by EH&S staff can be accessed via the Learning Management System (LMS). Per OSHA regulations, departments or laboratories must document health and safety training, including safety meetings, one-on-one training, and classroom and online training. Additionally, the following records must be retained in accordance with the requirements of state and federal regulations:

- Accident records – 5 years
- Measurements taken to monitor employee exposures – 30 years
- Chemical Hygiene Plan records should document that the facilities and precautions were compatible with current knowledge and regulations
- Inventory and usage records for high-risk substances should be kept
- Any medical consultation and examinations, including tests or written opinions required by Title 8, CCR, §5191 – duration of employment plus 30 years
- Medical records must be retained in accordance with the requirements of state and federal regulations – duration of employment plus 30 years

8. HAZARDOUS CHEMICAL WASTE MANAGEMENT

Regulatory Requirements

In California, hazardous waste is regulated by the Department of Toxic Substance Control (DTSC), a division within the California Environmental Protection Agency (Cal/EPA). Federal EPA regulations also govern certain aspects of hazardous waste management, since most of our waste is treated and disposed out of state. These hazardous waste regulations are part of the Resource Conservation and Recovery Act (RCRA). Local enforcement authority is administered by Los Angeles County Department of Environmental Health.

Hazardous Waste Program

The EH&S Hazardous Waste Program manages the shipment and disposal of all hazardous waste generated on campus. Each laboratory employee must comply with the campus Hazardous Waste Management Program requirements and all applicable regulations. Hazardous waste weekly pick-up service is provided to all CPP hazardous waste generators in research buildings on campus. Laboratory personnel are responsible for identifying hazardous waste, segregating, labeling, and storing it properly in the laboratory. Laboratory clean-outs and disposal of high hazard compounds must be scheduled at well in advance. The PI/Laboratory Supervisor is responsible for coordinating the disposal of all chemicals from his/her laboratories prior to closing laboratory operations.

DEFINITION OF HAZARDOUS WASTE

Federal and State regulations define hazardous wastes as a substance which poses a hazard to human health or the environment when improperly managed. A chemical waste is considered hazardous if it is either listed on one of the lists found in Federal or State regulations or if it exhibits one or more of the four following characteristics (T.R.I.C):

1. **Toxic** - a chemical that poses a hazard to health or the environment
    a. Has an acute oral LD_{50} less than 2,500 mg/kg
    b. Has an acute dermal LD_{50} less than 4,300 mg/kg
    c. Has an acute inhalation LC_{50} less than 10,000 ppm as a gas or vapor
    d. Has an acute aquatic 96-hour LC_{50} less than 500 mg/l
    e. Has been shown through experience or testing to pose a hazard to human health or environment because of its ability to cause cancer or mutation (carcinogen, mutagen, teratogen), acute toxicity, chronic toxicity, bio-accumulative properties, or persistence in the environment
2. **Reactive** - reactive wastes are those wastes that are unstable, explosive, and capable of detonation or react violently with water.
3. **Ignitable** - ignitable wastes generally are liquids with a flash point below 60°C or 140°F (however, just because a material has a higher flash point, it still cannot be drain disposed).
4. **Corrosive** - corrosive wastes are generally aqueous wastes with a pH less than or equal to two (2) or greater than or equal to 12.5

The EPA definition of hazardous waste also extends to the following items:

- Abandoned chemicals
- Unused or unwanted chemicals

- Chemicals in deteriorating containers
- Empty containers that have visible residues
- Containers with conflicting labels
- Unlabeled or unknown chemicals

Chemicals not in frequent use must be carefully managed to prevent them from being considered a hazardous waste. This is especially true for certain compounds that degrade and destabilize over time and require careful management so that they do not become a safety hazard (review "Wastes that Require Special Handling").

Extremely Hazardous Waste

Certain compounds meet an additional definition known as "extremely hazardous waste". This list of compounds includes carcinogens, pesticides, and reactive compounds, among others (e.g., formaldehyde, chloroform, and hydrofluoric acid). The Federal EPA refers to this waste as "acutely hazardous waste", but Cal/EPA has published a more detailed list of extremely hazardous waste. NOTE: While there is some overlap with the list of Particularly Hazardous Substances, the extremely hazardous waste list is specific to hazardous waste management.

Proper Hazardous Waste Management

Training

All personnel who handle, manage or dispose of hazardous waste must complete training **prior** to working with these materials. The EH&S online Hazardous Waste Management training course covers the hazardous waste program requirements and includes training on container labeling.

Waste Identification

All the chemical constituents in each hazardous waste stream must be accurately identified by knowledgeable laboratory personnel. This is a critical safety issue for both laboratory employees and the waste technicians that handle the waste once it is turned over to EH&S. Mixing of incompatible waste streams has the potential to create violent reactions and is a common cause of laboratory accidents.

If there is uncertainty about the composition of a waste stream resulting from an experimental process, laboratory workers must consult the PI/Laboratory Supervisor, the Chemical Hygiene Officer, or EH&S. In most cases, careful documentation and review of all chemical products used in the experimental protocol will result in accurate waste stream characterization.

The manufacturer's SDS provides detailed information on each hazardous ingredient in laboratory reagents and other chemical products, and includes the chemical, physical, and toxicological properties of that ingredient. The CSU SDS library provides an extensive library of research chemicals. Waste streams that have a large percentage of ingredients listed as proprietary information should be discussed with the Hazardous Waste Supervisor.

Labeling

Hazardous waste labels must be placed on the hazardous waste container upon the **start** of accumulation. CPP uses the CSU system-wide Waste Accumulation Storage Tracking electronically (WASTe). Each label must be completed accurately and updated as the contents of the waste container change. Product names or abbreviations for waste container constituents should not be used. Information and tutorials on how to use WASTe is available through Risk and Safety Solutions. Additional on-site guidance and support from EH&S is available upon request.

Waste Accumulation Storage Tracking electronically (WASTe)

How to Create an Account

Waste Accumulation Storage Tracking electronically (WASTe) accounts are integrated with the hazard Assessment Tool. Users of Assessment can establish a WASTe account for the laboratory group in which one is assigned. Employees should ascertain if an account has already been established for their PI and associated laboratory(s).

How to Use WASTe

Once a user profile has been established, employees can print labels from their laboratory's printer, and affix the tag to the waste container by sliding it into the plastic envelope provided by EH&S (based on availability). Each label must be completed accurately, and the tag must be updated as the contents of the waste container change. Product names or abbreviations for waste container constituents should not be used.

WASTe tags **cannot be photocopied**, as each tag has a unique bar code that is used to track that individual container. Employees may save a WASTe tag templates in the program for waste streams that are frequently generated but must print a new tag for each container.

When waste containers approach the maximum allowable storage period in the laboratory accumulation area, all contacts for that WASTe account are emailed a reminder to bring their waste to a scheduled pick-up location or to request a pick-up from EH&S through the WASTe application. When EH&S collects the waste, the tags are scanned, and the containers are entered into the inventory for the campus waste accumulation area and removed from the laboratory inventory.

Storage

The hazardous waste storage area in each laboratory is considered a Satellite Accumulation Area (SAA). According to EPA requirements, this area must remain under the control of the persons producing the waste. This means that it should be located within an area that is supervised and is not accessible to the public. Other SAA requirements include:

- Hazardous waste containers must always be labeled with a WASTe tag
- Waste must be collected and stored at or near the point of generation
- The maximum amount of waste that can be stored in a SAA is 55 gallons of a hazardous waste or 1 quart of **acutely/extremely hazardous waste**. If you reach these volumes for acutely/extremely hazardous waste, you must have the waste removed within 3 days of reaching these set volumes
- All hazardous waste containers in the laboratory must be kept closed when not in use

- Hazardous waste streams must have compatible constituents, and must be compatible with the containers in which they are stored
- Hazardous waste containers must always be stored in secondary containment
- Containers must be in good condition with leak proof lids
- Containers must be less than 80% full
- Dry wastes must be double-bagged in clear, 3-mil plastic bags
- Do not dispose of chemicals by pouring them down the drain or placing them in the trash

Segregation

All hazardous materials must be managed in a manner that prevents spills and uncontrolled reactions. Stored chemicals and waste should be segregated by hazard class. Examples of proper segregation are:

- Segregate acids from bases
- Segregate oxidizers from organics
- Segregate cyanides from acids

Segregation of waste streams should be conducted in a similar manner to segregation of chemical products (Appendix F).

Incompatible Waste Streams

Mixing incompatible waste streams or selecting a container that is not compatible with its contents, is a common cause of accidents in laboratories and waste storage facilities. Reactive mixtures can rupture containers and explode, resulting in serious injury and property damage. All chemical constituents and their waste byproducts must be compatible for each waste container generated (Appendix F). WASTe tags must be immediately updated when a new constituent is added to a mixed waste container, so that others in the laboratory will be aware and manage it accordingly.

Some common incompatible waste streams include:

- Oxidizers added to any fuel can create an exothermic reaction and explode. The most frequent is acids oxidizing flammable liquids. For this reason, all flammable liquids are pH tested before they are consolidated
- Piranha etch solution is a specific waste stream that contains sulfuric acid and hydrogen peroxide, which form a reactive mixture that is often still fuming during disposal. For this waste stream, and other reactive mixtures like it, vented caps are mandatory

Wastes That Require Special Handling

Unknowns

Unlabeled chemical containers and unknown/unlabeled wastes are considered unknowns, and additional fees must be paid to have these materials analyzed and identified. These containers must be labeled with the word “unknown”.

Peroxide Forming Chemicals

Peroxide forming chemicals, or PFCs, include several substances that can react with air, moisture or product impurities, and undergo a change in their chemical composition during normal storage.

- The peroxides that form is highly reactive and can explode upon shock or spark. Peroxides are not particularly volatile and thus tend to precipitate out of liquid solutions.
- It is particularly dangerous to allow a container of these materials to evaporate to dryness, leaving the crystals of peroxide on the surfaces of the container.
- Each container of peroxide forming chemicals **should be dated with the date received and the date first opened.**

There are three classes of peroxide forming chemicals, with each class having different management guidelines. A review of the safety information provided by the manufacturer can be used as a guide to manage PFCs.

- Ensure containers of PFCs are kept tightly sealed to avoid unnecessary evaporation, as this inhibits the stabilizers that are sometimes added.
- Visually inspect containers periodically to ensure that they are free of exterior contamination or crystallization. PFC containers must be disposed of prior to expiration date.
- If old containers of peroxide forming chemicals are discovered in the laboratory, (greater than two years past the expiration date or if the date of the container is unknown), **do not handle the container**. Secure the area and contact the EH&S at (909) 869-**4697**.
- If **crystallization is present** in or on the exterior of a container, **do not handle the container**. Secure the area and contact the EH&S at (909) 869-**4697**.

Dry Picric Acid

Picric acid (also known as trinitrophenol) must always be kept hydrated, as it becomes increasingly unstable as it loses water content. When dehydrated, it is not only explosive but also sensitive to shock, heat and friction. Picric acid is highly reactive with a wide variety of compounds (including many metals) and is extremely susceptible to the formation of picrate salts.

- Be sure to label all containers that contain picric acid with the date received, and then monitor the water content every 6 months.
- Add distilled water as needed to maintain a consistent liquid volume.
- If old or previously unaccounted for bottles of picric acid are discovered, **do not touch the container**.
- Depending on how long the bottle has been abandoned and the state of the product inside, even a minor disturbance could be dangerous.
- Visually inspect the contents of the bottle without moving it to evaluate its water content and look for signs of crystallization inside the bottle and around the lid. If there is even the slightest indication of crystallization, signs of evaporation, or the formation of solids in the bottle, **do not handle the container** and contact EH&S at (909) 869-**4697** immediately.
- Secure the area and restrict access to the container until it can be evaluated by EH&S personnel.

Explosives and Compounds with Shipping Restrictions

A variety of other compounds that are classified as explosives or are water or air reactive are used in research laboratories. These compounds often have shipping restrictions and special packaging requirements.

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- When disposing of these compounds, employees must ensure that they are stored appropriately for transport.
- Flammable metals must be completely submerged in oil before they are brought to a waste pick-up.
- Many pyrophoric and reactive compounds can be stabilized using a quenching procedure prior to disposal. Chemicals classified by the Department of Transportation (DOT) as explosives (e.g., many nitro- and azo- compounds) will require special packaging, shipping, and may require stabilization prior to disposal.
- Consult with EH&S for disposal considerations of these compounds.

Managing Empty Containers

Empty containers that held **Extremely Hazardous waste** must be managed as hazardous waste. Do not rinse or reuse these containers.

All other hazardous waste containers, if they are less than 5 gallons in size, should either be reused for hazardous waste collection, or should be cleaned and discarded or recycled. Contact EH&S for guidance on rinsing and repurposing empty containers.

- Proper cleaning involves triple rinsing the container, with the first rinse collected as hazardous waste.
- Then the labels should be completely defaced (remove it or mark it out completely).
- Empty containers 5 gallons in size or more should be disposed of through WASTe.

Transportation

It is a violation of DOT regulations to transport hazardous waste in personal vehicles, or to carry hazardous waste across campus streets that are open to the public. As a result, EH&S contracts with Stericycle to provide weekly pick-up services for all hazardous waste generators. These routine waste pick-ups are for routinely generated teaching laboratory and research wastes. Special pick-ups and laboratory clean-outs are available upon request through EH&S.

Accumulation and Disposal

Frequent disposal will ensure that hazardous waste accumulation areas in labs are managed properly, and that accumulation limits are not exceeded. CPP EH&S Hazardous Waste Manual states that hazardous chemical waste can be stored in a laboratory for up to 90 days. Once a waste container is 80% full or it is near the 90-day time limit, it should be requested for pick-up through WASTe. The Waste Accumulation Storage Tracking electronically (WASTe) should be used to prepare compliant hazardous chemical waste labels, and to request pickup of hazardous waste.

Drain Disposal

CPP does not permit drain disposal of chemical wastes, unless a specific dilution and/or neutralization method for a consistent waste stream has been reviewed and approved by EH&S. This applies to weak acid and base solutions. Hazardous waste regulations specify that materials with a pH between 2.0 and 12.5 are not hazardous wastes. However, drain disposal of these materials is still **not permitted**, because

local waste water discharge requirements have more restrictive pH thresholds. In addition, acid and base neutralization is considered waste treatment, a process that is strictly regulated by the Cal/EPA.

Drain disposal of properly disinfected infectious or biohazardous liquids is acceptable, if disinfection is conducted as specified by the EH&S Bloodborne Pathogen Program Manual, and the liquids disposed **contain no other hazardous constituents**.

9. ACCIDENTS, EMERGENCIES, AND CHEMICAL SPILLS

Overview and Responsibilities

This section provides the information needed to respond to accidents and spills in University locations, including laboratories and classrooms where chemicals are used or stored.

Faculty, and any other University employee, graduate student or designee who supervises students have the responsibility to respond to a situation involving students; employees who do not supervise students in a classroom or laboratory do not have responsibility to respond to injury or spill incidents involving students.

Faculty, and any other University employee, graduate student or designee, who supervises students where chemicals are used or stored, or is conducting research in a University laboratory have the following responsibilities:

1. Understand and exercise the information in this section
2. Using the chemical inventory, know exactly which chemicals are being used as teaching and research materials and stored where you work, where you do research, and for the classes you teach, and how to safely use those chemicals, use personal protective equipment (PPE) as necessary, know what to do in the event of a spill or accident, and know how to properly dispose of any chemical or hazardous waste generated by the instructional or research activity.
3. Be aware that to the best of your ability, you may need to distinguish between a basic first aid situation and one that requires medical attention beyond first aid.
4. Be aware that to the best of your ability, you may need to distinguish between a simple chemical spill and a complex chemical spill using the information in this section.
5. Know how to respond to a simple spill or a complex spill using the information in this section.
6. Know whom to call, what numbers to use, and where the campus emergency phones are.
7. Maintain familiarity with emergency procedures and locations of exits in the event the area needs to be evacuated.
8. Know the locations for closest eye wash fountains and emergency showers and know the procedures for when and how to use them.
9. Know when and how to contact the University's Environment Health and Safety (EH&S) Department in advance of any incident to answer any questions about these responsibilities, or other questions related to chemical inventory, chemical use, chemical hazards, personal protective equipment (PPE), emergency response procedures or hazardous waste.
10. Provide detailed information and training to all students for whom you have teaching responsibility about how to properly identify chemicals being used as teaching or research materials in each and every laboratory or classroom you teach, know and understand the hazards of those chemicals, the exact personal protective equipment (PPE) that must be used when these chemicals are present, how to respond in the event of an injury, or either simple or complex accident spill, and how to properly dispose of used and unwanted hazardous chemicals as hazardous waste.
11. Before beginning any laboratory task where you teach students as faculty or instructor, or conduct research as investigator, know what to do in the event of an emergency, including the location of first aid kits, eye washes, emergency showers, fire extinguishers, fire alarm pull stations, and spill kits.

12. Follow instructions in section to ensure that in the event of a student injury or chemical exposure, appropriate medical attention is received.
13. Know how to report to the EH&S injuries requiring medical treatment or complex chemical spills or chemical exposures to any employee or student as soon as possible.

University employees who work with chemicals that are stored, used, or disposed have the following responsibilities:

1. Understand and exercise the information in this section
2. Using the chemical inventory, know exactly which chemicals are present and being used and stored where you work, and how to safely use hazardous chemicals, use personal protective equipment as necessary, know what to do in the event of a spill or accident, and know how to properly dispose of any chemical or hazardous waste generated by your work activity.
3. Be aware that to the best of your ability, you may need to distinguish between a basic first aid situation and one that requires medical attention beyond first aid for all incidents that occur in your workplace, except for those that involve students who are already under direct supervision of faculty.
4. Be aware that to the best of your ability, you may need to distinguish between a simple chemical spill and a complex chemical spill using the information in this section for all incidents that occur in your workplace, except for those that involve students who are already under direct supervision of faculty.
5. Know how to respond to a simple spill or a complex spill using the information in this section.
6. Know who to call, what numbers to use, and where the campus emergency phones are.
7. Know the procedures and locations of exits in the event the area needs to be evacuated.
8. Know the locations for closest eye wash fountains and emergency showers and know the procedures for when and how to use them.
9. Know when and how to contact the University's Environment Health and Safety (EH&S) Department in advance of any incident to answer any questions about these responsibilities, or other questions related to chemical inventory, use, personal protective equipment, emergency response procedures or hazardous waste.
10. Before beginning any work, task involving chemicals, know what to do in the event of an emergency, including the location of first aid kits, eye washes, emergency showers, fire extinguishers, fire alarm pull stations, and spill kits.
11. Follow instructions in section to ensure that in the event of any injury or chemical exposure appropriate medical attention is received for incidents that involve persons who are not under the direct supervision of faculty.
12. Know how to report to EH&S and Workers Compensation any injuries requiring medical treatment or complex chemical spills or hazardous chemical exposures to any employee as soon as possible.

Students who are in classrooms, laboratories, or other campus facilities where chemicals are used have the following responsibilities:

1. Understand and exercise the information in this section
2. Using the chemical inventory and information provided by your faculty instructor, graduate assistant, or room supervisor, know exactly which chemicals you are using, know how to safely

handle those chemicals, how to use personal protective equipment as necessary, and know what to do in the event of a spill or accident.

3. Know and understand the specific chemical safety and emergency response information and training provided by your faculty or other university instructor or supervisor.
4. Know how to report any incident that requires first aid or medical treatment to your faculty or other university instructor or supervisor.
5. Know how to report any chemical spill using the information in this section to your faculty or other university instructor or supervisor.

Resources are available on the Emergency Management website

- Emergency Operations Plan (EOP)
- Emergency Procedures Pamphlet
- Emergency Procedures Poster

Accidents – Sharps injury involving non-infectious materials

Injuries from needles, scalpel blades and glass pipettes injuries pose a potential threat to an individual's health due to the potential nature of materials being worked with. For sharps related injury involving infectious materials, consult the Bloodborne Pathogen Exposure Control Manual for guidance.

In the event you sustain a sharps injury in a university facility where chemicals are present or being used, but the incident does not involve using biohazardous materials:

1. Notify the person supervising the location immediately, if possible. If the injured person is the location supervisor, the Department leadership must be notified. In the event the injured person cannot initiate this notification, another person close to the situation must make that immediate notification.
2. To the best of the ability of the injured person and the location's faculty or supervisor, determine if the situation requires basic first aid or will require medical treatment. If a determination cannot be immediately made, the immediate response is to assume the situation requires medical treatment.
3. **For all cases that require medical treatment, the faculty or supervisor or other witness must immediately call 911** from a campus phone and indicate an event has occurred that requires immediate medical attention.
4. If a **cell phone** is used, **call CPP Campus Police Dispatch directly (909) 869-3070** - the caller must provide exact location information (Building-Floor-Room) and indicate that there is a need for immediate emergency medical response.
5. Faculty or supervisors are to assist the injured as possible and remain with the injured person until campus police and professional emergency medical technicians (EMTs) arrive.
6. Witnesses should remain at a safe distance until University Police has released them.
7. For simple first aid cases, the faculty or location supervisor may choose to assist the injured person with first aid, using materials found in the first aid kit.
8. In the event a student believes additional medical observation and advice is needed after the simple first aid is rendered, he or she may choose to visit Student Health Services.

9. If the student decides to visit Student Health Services, the faculty or supervisor may choose to accompany the student to building 46 depending on circumstances however, faculty/staff should not transport students to Student Health Services or any medical facility for treatment.
10. Immediately after calling for medical assistance or providing first aid, the Department Chair is to be notified.
11. If any person receives medical attention beyond basic first aid or is transferred off campus for medical treatment, whether or not it involves chemical exposure, **EH&S must be notified as soon as possible but not more than 8 hours after the incident at (909) 869-4697. EH&S will report the event to Cal-OSHA if necessary.**
12. For medical treatment cases involving employees (faculty, staff, and student assistants), **Worker's Compensation: (909) 869-3725** must be contacted as soon as possible and a Workers Compensation case initiated.
13. Obtain and complete a Sharps Injury Log (Appendix I) and return to EH&S.

Accidents – No chemicals involved

In the event you sustain an injury or illness in a university facility where chemicals are present or being used, but the incident does not involve a chemical spill or any chemical exposure:

14. Notify the person supervising the location immediately, if possible. If the injured person is the location supervisor, the Department leadership must be notified. In the event the injured person cannot initiate this notification, another person close to the situation must make that immediate notification.
15. To the best of the ability of the injured person and the location's faculty or supervisor, determine if the situation requires basic first aid or will require medical treatment. If a determination cannot be immediately made, the immediate response is to assume the situation requires medical treatment.
16. **For all cases that require medical treatment, the faculty or supervisor or other witness must immediately call 911** from a campus phone and indicate an event has occurred that requires immediate medical attention.
17. If a **cell phone** is used, **call CPP Campus Police Dispatch directly (909) 869-3070** - the caller must provide exact location information (Building-Floor-Room) and indicate that there is a need for immediate emergency medical response.
18. Faculty or supervisors are to assist the injured as possible and remain with the injured person until campus police and professional emergency medical technicians (EMTs) arrive.
19. Witnesses should remain at a safe distance until University Police has released them.
20. For simple first aid cases, the faculty or location supervisor may choose to assist the injured person with first aid, using materials found in the first aid kit.
21. In the event a student believes additional medical observation and advice is needed after the simple first aid is rendered, he or she may choose to visit Student Health Services.
22. If the student decides to visit Student Health Services, the faculty or supervisor may choose to accompany the student to building 46 depending on circumstances however, faculty/staff should not transport students to Student Health Services or any medical facility for treatment.
23. Immediately after calling for medical assistance or providing first aid, the Department Chair is to be notified.

24. If any person receives medical attention beyond basic first aid or is transferred off campus for medical treatment, whether or not it involves chemical exposure, **EH&S must be notified as soon as possible but not more than 8 hours after the incident at (909) 869-4697. EH&S will report the event to Cal-OSHA if necessary.**
25. For medical treatment cases involving employees (faculty, staff, and student assistants), **Worker's Compensation: (909) 869-3725** must be contacted as soon as possible and a Workers Compensation case initiated.

Accidents – Chemical Spill

In the event there is a chemical spill, or you sustain an injury or illness or chemical exposure in a university facility where chemicals are present or being used:

1. Notify the person supervising the location immediately, if possible
2. If the injured or chemically exposed person is the location supervisor, the Department leadership must be notified.
3. In the event the injured or chemically exposed person cannot initiate this notification, another person close to the situation must make that immediate notification.
4. To the best of the ability of the location's faculty or supervisor, use the information in this section to determine if the situation is a simple chemical spill or a complex chemical spill. If a determination cannot be immediately made, the immediate response is to assume the situation is a complex chemical spill. How to respond both types of spills is below.
5. For cases where a hazardous chemical exposure has occurred that requires medical treatment, the faculty or supervisor or other witness must immediately **call 911 on the campus emergency phone** and indicate a chemical exposure event has occurred that requires immediate medical attention.
6. If a **cell phone** is used, **call CPP Campus Police Dispatch (909) 869-3070** - the caller must provide exact location information (Building-Floor-Room) and indicate that there is a need for immediate emergency medical response.
7. Faculty or supervisors are to assist the injured person if possible and remain with the injured person until campus police arrives. Faculty or supervisors as well as witnesses should remain at the scene and at a safe distance until being released by University Police and EH&S.
8. Faculty, instructors, or other University personnel with supervisory responsibility for the location where the incident has occurred make the determination whether to use the showers or eye washes.
9. For hazardous chemical exposures, this assistance may involve immediately using the eyewash fountain, or the emergency shower.
10. Eyewash fountain and showers are to be used for 15 minutes. Contaminated clothing and lab coats must be removed to the extent possible.
11. Washing off a minor exposure to a non-hazardous chemical or using only the eyewash fountain is first aid, not medical treatment, and may not require calling 911.
12. Assisting personnel are advised to limit contamination of the building with a hazardous chemical by **NOT** taking the exposed person outside the lab and into hallways and bathrooms, unless immediate evacuation from the location is warranted, based on significant hazards of the spilled or released chemical.

13. Faculty, staff and supervisors, and any other assisting personnel must use appropriate Personal Protective Equipment to limit their own exposure while assisting the person exposed to a hazardous chemical, so that only those with proper PPE may assist.
14. For first aid cases and simple spills only, the faculty or location supervisor may assist the injured person by providing first aid, or for minor or non- hazardous chemical exposure, in ensuring that the person can appropriately remove contaminated clothing or PPE and ensuring the chemically exposed body parts are washed.
15. For students who have a minor or non-hazardous exposure, after washing or first aid as appropriate, the student may choose to have additional medical observation and advice. In these cases, he or she may choose to visit the Student Health Services (Building 46).
16. If the student decides to visit Student Health Services, the faculty or supervisor may choose to accompany the student to **Building 46** depending on circumstances but must not transport the student to Student Health Services. If the student is not ambulatory, emergency medical may be needed to ambulate for medical care.
17. Immediately after medical assistance has been called or first aid rendered, the Department Chair is to be notified.
18. If any person receives medical attention beyond basic first aid or is transported off-campus for medical care, whether or not it involves chemical exposure, **EH&S must be notified as soon as possible but not more than 8 hours after the incident at (909) 869-4697. EH&S will report the event to Cal-OSHA if necessary.**
19. For medical treatment cases involving employees (faculty, staff, student assistants), **Worker's Compensation: (909) 869-3725** must be contacted as soon as possible and a Workers Compensation case initiated.

DETERMINING A SIMPLE CHEMICAL SPILL:

All of the following criteria must be met to define a simple chemical spill.

- The material released must be known to the faculty, employee, graduate student or supervisory designee in charge of the location where the release occurs.
- This knowledge of the chemical teaching/research material enables the faculty, employee, graduate student or supervisory designee to immediately determine if the volume, toxicity, flammability or environmental effects of the material can be safely managed and cleaned up using the standard personal protective equipment (PPE) already being worn in the location.
- Standard PPE (fresh gloves, lab coat, goggles/glasses) are used to safely work with the chemical
- A fume hood is NOT needed to work with material (see fume hood spill below)
- The spill has NOT occurred in a public space (ex. hallway, elevator, etc.)

ADDITIONAL SIMPLE SPILL DEFINITIONS

- Low volume incidental release, splash, or drip of chemical teaching/research materials which are known to the faculty, staff, and graduate students responsible for the specific classroom, laboratories, countertops, measuring/weighing locations and fume hoods is not a spill, if it can be managed safely with standard PPE.
- Safe housekeeping of these incidental releases while wearing standard PPE is not a spill clean-up.

- Spills in a functioning fume hood that are in secondary containment may be defined as a simple spill by the faculty or supervisor in that location, based on exact knowledge of the spilled chemical and the certainty that it presents no hazard to the location in which the fume hood is located.
- Solid chemical spills are generally a simple spill. Unless the faculty, employee, graduate student or supervisory designee in charge of the location has determined that the substance cannot be managed with standard PPE in use, use damp paper towels to transfer it into plastic bags to prevent causing an airborne hazard by dry sweeping.

SIMPLE Chemical Spill Response

1. Determine that all criteria are met for a Simple Spill.
2. Immediately notify the Faculty or supervisor where the spill occurred.
3. Because it is a simple spill, the people cleaning the spill are knowledgeable about the spilled material, are current on all required EH&S training, and are approved to do so by the faculty, employee, graduate student or supervisory designee.
4. Ensure all personnel or students who are non-essential for the clean-up process are not in the immediate area of the spill.
5. Limit contamination of other areas by anyone from walking through the spill.
6. Use appropriate clean up techniques and the local spill response kit if needed. Call EH&S at (909) 869-**4697** for guidance if necessary.
7. If a person is involved in a simple spill incident where the chemical has contacted skin, eye or mouth despite wearing PPE, that person must wash off the material as soon as possible.
8. Faculty or supervisor may assist those who need to have the chemical washed off by directing them to the appropriate location to do so. Simple spills are low volume, low hazard chemicals and a sink, rest room, or eye wash fountain may be all that is needed to provide the individual with the ability to wash the chemical off. The full body emergency shower is likely not necessary for a simple spill.
9. Work with another person to clean-up the spill. **Do not clean-up a simple spill alone.**
10. Use an appropriate chemical spill kit to neutralize and absorb inorganic acids and bases.
11. For other chemicals, use the appropriate spill kit or absorb the chemical with sorbent pads, paper towels, vermiculite, dry sand, or diatomaceous earth.
12. Collect the clean-up materials and residue and place it in a clear plastic bag. Double bag the waste and label the bag with a properly completed Hazardous Waste label.

COMPLEX CHEMICAL SPILLS:

- **Any spill that is NOT a simple spill is a complex chemical spill.**
- These are spills of larger quantities than 1 gal, known toxic substances for which standard PPE may not be sufficient, a spill of an unknown chemical, a spill of a toxic substance in a public area where people are not wearing PPE, or spills into or adjacent to drains.
- Uncontrolled leaks from compressed gas cylinders can be considered a complex spill requiring an emergency response depending on the hazard of the gas.

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COMPLEX Chemical Spill Response

1. Complex spills require an emergency response from the EH&S Department.
2. Faculty, Staff, and students do not respond directly to a complex chemical spill.
3. Unless you have been contaminated by the spilled material, when the faculty or location supervisor has declared a spill emergency, evacuate from the immediate area and leave the room where it occurred.
4. **Call 911 on a campus phone** and indicate the room location where a chemical spill has occurred that requires EH&S response.
5. **If a cell phone is used, call CPP Campus Police Dispatch (909) 869-3070** - the caller must provide exact location information (Building-Floor-Room) and indicate that there is a need for immediate EH&S response.
6. If the spill presents a situation that is immediately dangerous to life, activate the fire alarm and clear the entire building.
7. Anyone who has been directly exposed to a significantly hazardous chemical should not evacuate the building unless the situation is immediately dangerous to life and health and prioritize immediately washing the contamination off.
8. Faculty, instructors, or other University personnel with supervisory responsibility for students at the location where the incident has occurred make the determination whether to use the showers, eye washes, or restrooms for decontamination; not the students or supervised staff.
9. Faculty or supervisors are to assist those who have been exposed to a significantly hazardous chemical by directing them to the nearest location outside the immediate spill area that has appropriate means to wash off the chemical, such as eye wash fountains, emergency showers, or rest rooms if appropriate.
10. For significantly hazardous chemicals, washing off the chemical must be immediate and continue for 15 minutes, unless trained EMTs and Hazmat responders arrive on the scene and require other procedures. Contaminated clothing and lab coats must be removed to the extent possible before washing and appropriately bagged and labeled as hazardous waste.
11. Faculty, staff and supervisors, and any other assisting personnel must use appropriate Personal Protective Equipment to limit their own exposure to a hazardous chemical while assisting the person exposed, so that only those with proper PPE may assist.
12. Assisting personnel are advised to limit contamination of the building with a significantly hazardous chemical by **NOT** taking the exposed person into hallways, stairways, and elevators, unless immediate evacuation from the location is warranted, based on significant hazards of the spilled or released chemical.
13. Be sure to notify EH&S at (909) 869-**4697** as soon as possible **after calling the police/dispatch** of any complex chemical spills. EH&S will handle further notifications to regulatory authorities as needed. EH&S will report the event to Cal-OSHA if necessary and investigate further.
14. For medical treatment cases involving employees (faculty, staff, student assistants), **Worker's Compensation: (909) 869-3725** must be contacted as soon as possible and a Workers Compensation case initiated.
15. **No re-entry of any evacuated space where a complex emergency chemical spill has occurred is permitted until approval is provided by the Office of Environmental Health & Safety.**

Highly Toxic Chemical Spills

Do not clean up by yourself! All spills of these chemicals require emergency response,

- Aromatic amines
- Hydrazine
- Bromines
- Nitriles
- Carbon disulfide
- Nitro-compounds
- Cyanides
- Organic halides

1. Notify EH&S at (909) 869-**4697** as soon as possible **after calling the police/dispatch** of any toxic chemical spills.
2. For medical treatment cases involving employees (faculty, staff, student assistants), **Worker's Compensation: (909) 869-3725** must be contacted as soon as possible and a Workers Compensation case initiated.
3. **No re-entry of any evacuated space where a toxic emergency chemical spill has occurred is permitted until approval is provided by the Office of Environmental Health & Safety.**

Accidents – Fire

1. If a fire or smoke is detected in a laboratory or other University facility, the faculty or supervisor of that location must be alerted immediately.
2. Faculty, staff or supervisors in a location are **not required** to extinguish fires that occur in their work areas and should not attempt to do so **unless**:
    a. It is a small fire (i.e., small trash can size fire);
    b. Appropriate fire extinguisher training has been received;
    c. The person wishes to do so and is capable.
3. The immediate location must be evacuated, and a fire alarm pulled.
4. If the clothing of an individual catches on fire, the most immediate location where drenching water can be applied must be used.
5. Any time a fire occurs, or a fire extinguisher is used, no matter for how brief a period, the incident must be reported to CPP Campus Police dispatch - (909) 869-**3070**) and then afterwards to EH&S (909) 869-**4697 (during normal business hours)**.

10. APPENDIX

APPENDIX A: General Rules for Laboratory Work

Prudent Laboratory Practices

It is prudent to minimize all chemical exposures. Few laboratory chemicals are without hazards. General precautions for handling all laboratory chemicals should be adopted, as well as specific guidelines for particular chemicals.

Exposure should be minimized even for substances of no known significant hazard, and special precautions should be taken for work with substances that present special hazards. One should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic. Avoid inadvertent exposures to hazardous chemicals by developing and encouraging safe habits and thereby promoting a strong safety culture.

Safe Laboratory Practices:

- Never work alone while working on procedures involving hazardous chemicals, biological agents, or other physical hazards.
- Wear closed-toe shoes with an enclosed heel and full-length pants, or equivalent, at all times when in the laboratory.
- Ensure that appropriate PPE is worn by all persons, including visitors, where hazardous chemicals or materials are stored or handled.
- Utilize appropriate PPE while in the laboratory and while performing procedures that involve the use of hazardous chemicals or materials. These items may include but not limited to laboratory coats, gloves, and safety glasses or goggles.
- Wear appropriate gloves when the potential for contact with toxic materials exists; inspect the gloves before each use and replace them often.
- Remove laboratory coats or gloves immediately on significant contamination, as well as before leaving the laboratory. Wash hands thoroughly before leaving lab or upon completion of an experiment to further remain any remaining contamination.
- Avoid use of contact lenses in the laboratory unless necessary; if they are used, inform supervisor so special precautions can be taken.
- Confine long hair and loose clothing and accessories.
- Use appropriate respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls.
- Inspect the respirator before use. Use of respirators requires a respirator hazard assessment, successful completion of the EH&S respirator training and fit test in alignment with CPP's Respiratory Protection Program.
- Be aware of the locations of first aid kits, emergency eyewash and shower stations, and other emergency or first aid equipment.

Chemical Handling:

- Use only those chemicals for which the quality of the available ventilation system is appropriate.
- Vent apparatus which may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into local exhaust devices.

- Properly label and store all chemicals. Always Use secondary containment.
- Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the Chemical Hygiene Plan.
- In the case of an accident or spill, refer to the emergency response procedures for the specific material. These procedures should be readily available to all personnel.
- Do not smell or taste chemicals.
- Do not allow release of toxic substances or fumes into cold or warm rooms, as these types of areas typically involve re-circulated atmospheres.
- Never use mouth suction for pipetting or starting a siphon.
- Do not dispose of any hazardous chemicals through the sewer system. These substances might interfere with the biological activity of waste water treatment plants, create fire or explosion hazards, cause structural damage or obstruct flow.

Information on chemical spill mitigation may also be referenced in Section 9 of the chemical hygiene plan and Appendix H for general spill clean-up procedures.

Equipment Storage and Handling:

- Use equipment only for its designed purpose.
- Do not use uncertified fume hoods or glove boxes for hazardous chemical handling.
- Avoid storing materials in hoods and do not allow them to block vents or air flow.
- Keep hood closed at all times, except when adjustments within the hood are being made or when the hood is actively being used by a researcher.
- Leave the fume hood "on" even when it is not in active use if toxic substances are in the fume hood or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off."
- Do not use damaged glassware or other equipment, under any circumstances. The use of damaged glassware increases the risks of implosion, explosion, spills, and other accidents.

Laboratory Operations:

- Keep the work area clean and uncluttered.
- Seek information and advice about hazards, plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation.
- If unattended operations are unavoidable and have been approved by the PI/Laboratory Supervisor, place an appropriate sign on the door, leave lights on, and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water).
- Be alert to unsafe conditions and ensure that they are corrected when detected
- Receive both CSU Laboratory Safety Fundamentals and lab specific training prior to starting work in a lab.

Food/Drink:

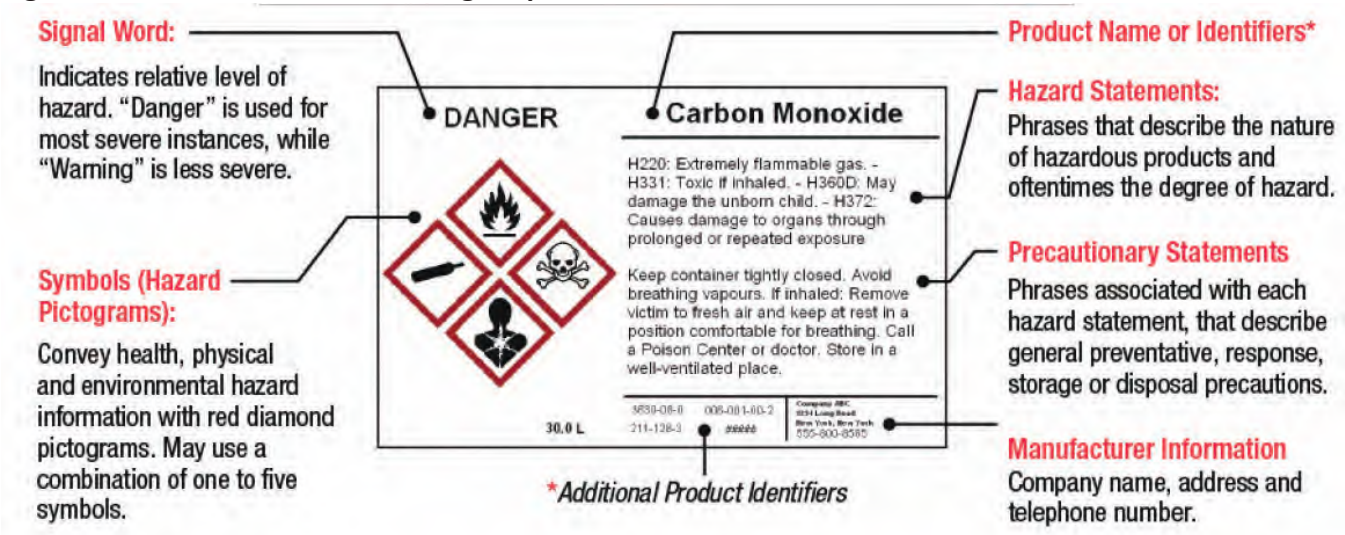
- Do not eat, drink, smoke, chew gum, or apply cosmetics (including Chapstick) in areas where laboratory chemicals are present; wash hands before conducting these activities.

- Do not store, handle, or consume food or beverages in storage areas, refrigerators, glassware or utensils which are also used for laboratory operations.
- Wash areas of exposed skin well before leaving the laboratory.

APPENDIX B: Container Labeling

Chemical container labels are a good resource for information on chemical hazards. All containers of hazardous chemicals must have labels attached. Figure B.1 displays the label requirements.

Figure B.1 – GHS Container Labeling Requirements



The warning may be a single word (e.g. Danger, Caution, Warning) or may identify the primary hazards, including both physical (e.g. water reactive, flammable, or explosive) and health (e.g. carcinogen, corrosive or irritant), such as what is found on the hazard warnings from the label or SDS. The label will also have hazard pictograms associated with the degree of hazard.

Most labels provide additional safety information to help workers protect themselves from the substance. This information may include protective measures and/or protective clothing to be used, first aid instructions, storage information and emergency procedures. For further information on the product, please consult the manufacturer's SDS. Table B.2 gives guidelines for laboratory personnel and proper chemical labeling use.

Table B.2 – Chemical Labeling: What are Laboratory Personnel Responsible for?

- Inspecting incoming containers to be sure that labels are attached and are in good condition and contain the information outlined above;
- Reading the container label each time a newly purchased chemical is used. It is possible that the manufacturer may have added new hazard information or reformulated the product since the last purchase;
- Ensuring that chemical container labels are not removed or defaced, except when containers are empty;
- Labeling any secondary containers used in the laboratory, to prevent unknown chemicals or inadvertent reaction;
- Verifying that chemical waste containers have complete and accurate chemical waste labels.

Labeling is important for the safe management of chemicals, preventing accidental misuse, inadvertent mixing of incompatible chemicals, and facilitating proper chemical storage. Proper labeling helps ensure quick response in the event of an accident, such as a chemical spill or chemical exposure incident. Finally, proper labeling prevents the high costs associated with disposal of "unknown" chemicals.

Except for transient containers that will contain chemicals for immediate use, **all containers of chemicals** being used or generated in CPP's research laboratories must be labeled sufficiently to indicate the contents of the container. On original containers, the label must not be removed or defaced in any way until the container is emptied of its original contents. Incoming containers must be inspected to make sure the label is in good condition. It is also advisable to put a date on new chemicals when they are received in the laboratory, and to put a date on containers of chemicals generated in the laboratory, as well as the initials of the responsible person.

Abbreviations or other acronyms may be used to label containers of chemicals generated in the laboratory as long as all personnel working in the laboratory understand the meaning of the label, or know the location of information, such as a laboratory notebook or log sheet that contains the code associated with content information. In addition, small containers, such as vials and test tubes, can be labeled as a group by labeling the outer container (e.g., rack or box). Alternatively, a placard can be used to label the storage location for small containers (e.g., shelf, refrigerator, etc.). This information must be provided to janitorial and maintenance staff as part of their hazard communication training.

Containers of practically non-toxic and relatively harmless chemicals must also be labeled with content information, **including containers such as squirt bottles containing water**.

With respect to chemical labeling, all potentially chemicals transferred from their original container to a second container must be labeled with a compliant GHS chemical name and the principal hazards found on the primary container label or SDS. For more information on labeling, reference the section on labeling, Storage, Inventory and Transport.

APPENDIX C: Training Access Links

Training Links	**Student**	**Employee**
Training Portal Log-in	CSU Skill Soft Log In	CSU Sum Total Log In
Base Learning Plan		
CSU - Injury and Illness Prevention Program *(25 mins)*	Injury Illness Prevention	Injury Illness Prevention
Hazard Communication – Cal/OSHA *(45 mins)*	Hazard Communication	Hazard Communication
Emergency and Disaster Preparedness – Cal/OSHA *(46 mins)*	Emergency Procedures Overview	Emergency Procedures Overview
Fire Safety and Prevention *(36 mins)*	Fire Safety	Fire Safety and Prevention
Bio Medical		
Bloodborne Pathogen Awareness *(49 mins)*	Bloodborne Pathogens (Awareness)	Bloodborne Pathogens (Awareness)
Biosafety Hazardous Waste Handling and Disposal *(34 mins)*	Medical Waste	Medical Waste
Biosafety Level 1 *(60 mins)*	Biosafety Level 1 (BSL1)	Biosafety Level 1 (BSL1)
Biosafety Cabinets *(NA)*	Biosafety Cabinets	Biosafety Cabinets
CSU - Laboratory Safety Fundamentals *(150 mins)*	CSU Lab Safety	CSU Lab Safety
Driving		
Defensive Driving Fundamentals *(54 mins)*	Defensive Driving Fundamentals	Defensive Driving Fundamentals
CSU Powered Carts *(NA)*	Powered Carts	Powered Carts
Distracted Driving *(30 mins)*	Distracted Driving	Distracted Driving
CSU - Utility Trailer Towing Safety *(15 mins)*	Utility Trailer Training	Utility Trailer Training
Fall Protection		
Fall Protection – Cal/OSHA *(35 mins)*	Fall Protection	Fall Protection
Slips, Trips, and Falls – Cal/OSHA *(18 mins)*	Slips, Trips and Falls	Slips, Trips, and Falls
Scaffolding and Ladder Safety *(41 mins)*	Scaffolding and Ladder Safety	Scaffolding and Ladder Safety
Scissor Lifts *(30 mins)*	Scissor Lifts	Scissor Lifts
Laboratory Safety		
CSU - Laboratory Safety Fundamentals *(150 mins)*	CSU Lab Safety	CSU Lab Safety

Hazardous Waste Generator (RCRA) *(30 mins)*	Hazardous Waste Generator	Hazardous Waste Generator
Compressed Gas Safety *(30 mins)*	Compressed Gas Safety	Compressed Gas Safety
Safety Data Sheets *(60 mins)*	Safety Data Sheets	Safety Data Sheets
Laser Safety		
Fundamentals of Laser Safety *(60 mins)*	Laser Safety	Laser Safety
Radiation Generating Equipment (Ionzing Radiation)		
Radiation Safety *(60 mins)*	Radiation Safety	Radiation Safety
Non-Ionizing Radiation Safety *(NA)*	Non-Ionizing Radiation Safety	Not Available
CSU - Laboratory Safety Fundamentals *(150 mins)*	CSU Lab Safety	CSU Lab Safety
Radioactive Materials		
Radiation Safety *(60 mins)*	Radiation Safety	Radiation Safety
For Users of Radioactive Materials *(60 mins)*	Radioactive Material Users	Radioactive Material Users
CSU - Laboratory Safety Fundamentals *(150 mins)*	CSU Lab Safety	CSU Lab Safety
Shop Safety		
CSU - Shop Safety *(15 mins)*	CSU Shop Safety	CSU Shop Safety
Hazardous Waste Generator (RCRA) *(30 mins)*	Hazardous Waste Generator	Hazardous Waste Generator
Machine Guarding *(30 mins)*	Machine Guarding	Machine Guarding
Compressed Gas Safety *(30 mins)*	Compressed Gas Safety	Compressed Gas Safety
Welding, Cutting, and Brazing *(29 mins)*	Welding	Welding
Hand and Power Tool Safety *(18 mins)*	Hand and Power Tools	Hand and Power Tools
Safety Data Sheets *(60 mins)*	Safety Data Sheets	Safety Data Sheets
Respiratory Protection – Cal/OSHA *(48 mins)*	Respiratory Protection	Respiratory Protection

APPENDIX D: Regulated Carcinogens

The term "regulated carcinogen" means a recognized cancer-causing substance, compound, mixture, or product regulated by Cal/OSHA sections 1529, 1532, 1532.2, 1535, 8358, 8359 or Article 110, sections 5200-5220.

- Acrylonitrile
- Arsenic metal and inorganic arsenic compounds
- Asbestos
- Benzene
- 1,3-butadiene
- Cadmium metal and cadmium compounds
- Chromium (VI) compounds
- Coke Oven Emissions
- 1,2-Dibromo-3-chloropropane (DBCP)
- Ethylene Dibromide (EDB)
- Ethylene Oxide (EtO)
- Formaldehyde gas and formaldehyde solutions
- Lead metal and inorganic lead compounds
- Methylene Chloride
- 4,4'-Methylene bis(2-chloroaniline) (MBOCA)
- Methylenedianiline (MDA)
- Vinyl Chloride
- 2-Acetylaminofluorene
- 4-Aminodiphenyl
- Benzidine (and its salts)
- 3,3'-Dichlorobenzidine (and its salts)
- 4-Dimethylaminoazobenzene
- alpha-Naphthylamine
- beta-Naphthylamine
- 4-Nitrobiphenyl
- N-Nitrosodimethylamine
- beta-Propiolactone
- bis-Chloromethyl ether
- Methyl chloromethyl ether
- Ethyleneimine

APPENDIX E: Listed Carcinogens

The term "listed carcinogen" refers to a specific list of 13 chemicals regulated by Cal/OSHA and Federal OSHA and has specific use and handling requirements. *Title 8, CCR, §5209*, "Carcinogens"

- 2-Acetylaminofluorene
- 4-Aminodiphenyl
- Benzidine (and its salts)
- 3,3'-Dichlorobenzidine (and its salts)
- 4-Dimethylaminoazobenzene
- alpha-Naphthylamine
- beta-Naphthylamine
- 4-Nitrobiphenyl
- N-Nitrosodimethylamine
- beta-Propiolactone
- bis-Chloromethyl ether
- Methyl chloromethyl ether
- Ethyleneimine

APPENDIX F: Chemical Compatibility Chart

Below is a chart adapted from the CRC Laboratory Handbook which groups various chemicals into 23 groups with examples and incompatible chemical groups. This chart is by no means complete but it will aid in making decisions about storage. For more complete information please refer to the SDS for the specific chemical.

Group	Name	Example	Incompatible Groups
Group 1:	Inorganic Acids	Hydrochloric acid Hydrofluoric acid Nitric acid Sulfuric acid	**2,3,4,5,6,7,8,10,13,14,16,17,18,19,21,22,23**
Group 2:	Organic acids	Acetic acid Butyric acid Formic acid Propionic acid	**1,3,4,7,14,16,17,18,19,22**
Group 3:	Caustics	Sodium hydroxide Ammonium hydroxide solution	**1,2,6,7,8,13,14,15,16,17,18,20,23**
Group 4:	Amines and Alkanolamines	Aminoethylethanolamine Aniline Diethanolamine Diethylamine Ethylenediamine Monoethanolamine Triethanolamine Triethylamine Triethylenetetramine	**1,2,5,7,8,13,14,15,16,17,18,23**
Group 5:	Halogenated Compounds	Carbon tetrachloride Chlorobenzene Chloroform Methylene chloride Carbon Tetrachloride 1,2,4-Trichlorobenzene 1,1,1-Trichloroethane Trichloroethylene Trichlorofluoromethane	**1,3,4,11,14,17**
Group 6:	Alcohols Glycols Glycol Ether	1,4-Butanediol Butanol (iso, n, sec, tert) Diethylene glycol Ethyl alcohol Ethyl butanol Ethylene glycol Furfuryl alcohol Isoamyl alcohol Methyl alcohol Propylene glycol	**1,7,14,16,20,23**
Group 7:	Aldehydes Acetaldehyde	Acrolein Butyraldehyde Formaldehyde Paraformaldehyde Propionaldehyde	**1,2,3,4,6,8,15,16,17,19,20,23**

Group 8:	Ketones		Acetone Acetophenone Diisobutyl ketone Methyl ethyl ketone	**1,3,4,7,19,20**
Group 9:	Saturated Hydrocarbons		Cyclohexane Heptane Paraffins Pentane Petroleum ether	**20**
Group 10:	Aromatic Hydrocarbons		Benzene Ethyl benzene Naphtha Toluene Xylene	**1,20**
Group 11:	Olefins		Butylene 1-Decene 1-Dodecene Ethylene Turpentine	**1,5,20**
Group 12:	Petroleum Oils		Asphalt Gasolines Mineral Oil	**20**
Group 13:	Esters		Amyl acetate Butyl acetates Ethyl acetate	**1,3,4,19,20**
Group 14:	Monomers Polymerizable Esters		Acrylic acid Acrylonitrile Butadiene Acrylates	**1,2,3,4,5,6,15,16,19,20,21,23**
Group 15:	Phenols		Cresote Cresols Phenol	**3,4,7,14,16,19,20**
Group 16:	Alkylene Oxides		Ethylene oxide Propylene oxide	**1,2,3,4,6,7,14,15,17,18,19,23**
Group 17:	Cyanohydrins		Acetone cyanohydrin Ethylene cyanohydrin	**1,2,3,4,5,7,16,19,23**
Group 18:	Nitriles		Acetonitrile Adiponitrile	**1,2,3,4,16,23**

Group 19:	Ammonia	Ammonia gas Ammonium Hydroxide	**1,2,7,8,13,14,15,16,17,20,23**
Group 20:	Halogens	Chlorine Fluorine	**3,6,7,8,9,10,11,12,13,14,15,19,21,22**
Group 21:	Ethers	Diethyl Ether THF	**1,14,20**
Group 22:	Phosphorus	Phosphorus, Elemental	**1,2,3,20**
Group 23:	**Acid Anhydrides**	**Acetic anhydride Propionic anhydride**	**1,3,4,6,7,14,16,17,18,19**

APPENDIX G: Peroxide Forming Chemicals Common to Research

Peroxide-Forming Chemicals

TABLE 1. COMMON PEROXIDE-FORMING COMPOUNDS Group A- Chemicals that form explosive levels of peroxides without concentration (Safe storage time after opening - 3 months)		
Chemical Name	**CAS Number**	Synonym(s)
1,1-Dichloroethylene	75-35-4	**Vinylidene Chloride**
2-Chloro-1,3-Butadiene[1,3]	126-99-8	**Chloroprene**
Butadiene[1,3]	106-99-0	
Divinyl Acetylene	821-08-9	
Isopropyl Ether	108-20-3	
Tetrafluoroethylene	116-14-3	
Vinyl Ether	109-93-3	**Divinyl ether**
Group B-Chemicals that form explosive levels of peroxides on concentration (Safe storage time after opening - 12 months)		
Chemical Name	**CAS Number**	Synonym(s)
2-Butanol	78-92-2	
2-Cyclohexan-1-ol	822-67-3	
2-Hexanol	626-93-7	
2-Pentanol	6032-29-7	
3-Methyl-1-Butanol	123-51-3	**Isoamyl alcohol**
4-Heptanol	589-55-9	
4-Methyl-2-Pentanol	108-11-2	
Acetal	105-57-7	
Acetaldehyde	75-07-0	
alpha-Methyl-Benzyl Alcohol	98-85-1	**Phenyl Ethanol**
Benzyl Alcohol	100-51-6	
Cyclohexanol	108-93-0	
Cyclohexene	110-83-8	
Cyclooctene	931-87-3	
Cyclopentene	42-29-0	
Decahydronaphthalene	91-17-8	
Diacetylene	460-12-8	
Dicyclopentadiene	77-73-6	
Dioxane	123-91-1	**1,4 Dioxane**
Ethylene Glycol Dimethyl Ether	110-71-4	**Diethylene Glycol Dimethyl Ether and Glyme**
Ethyl Ether	60-29-7	**Diethyl Ether**
Furan	110-71-4	
Isopropyl Benzene	98-82-8	**Cumene**
Methylcyclopentane	96-37-7	
Methyl Isobutyl Ketone	108-10-1	
Penten-1-ol	821-09-0	

Propyne	74-99-7	**Methyl Acetylene**
Tetrahydrofuran	109-99-9	
Tetrahydronaphthalene	119-64-2	
Group C- Chemicals which may autopolymerize as a result of peroxide accumulation (Safe storage time after opening: inhibited chemicals- 12 months; uninhibited chemicals: - 24 hours) Note: Do not store inhibited chemicals in this group under inert atmospheres		
Chemical Name	**CAS Number**	Synonym(s)
1,1-Dichloroethylene	75-35-4	**Vinylidene Chloride**
2-Chloro-1,3-Butadiene[1,3]	126-99-8	**Chloroprene**
Acrylic Acid [2]	79-10-7	
Acrylonitrile [2]	107-13-1	
Butadiene[1,3]	106-99-0	
Buten-3-yne	689-97-4	**Vinyl acetylene & Butenyne**
Chlorotrifluoroethylene	79-38-9	
Methyl Methracrylate[2]	80-62-6	
Phenethyl Alcohol	60-12-8	**Phenyl Ethanol**
Styrene	100-42-5	
Tetrafluoroethylene	116-14-3	
Vinyl Acetate	108-05-4	
Vinyl Chloride	75-01-4	**Monochloroethylene**
1. When stored as a liquid monomer **2. Although these form peroxides, no explosions involving these monomers have been reported** **3. Also stored as a gas in gas cylinders.**		

APPENDIX H: Spill-Clean Up Procedures

Laboratory personnel can clean up small spills if trained and competent to do so. Small spills include chemical spills that are up to 1 liter in size and of limited toxicity, flammability and volatility, and mercury spills from broken thermometers (about 1.5 grams). If respiratory protection is needed for spill clean-up, the spill is too large to be handled by laboratory personnel – **dial 911 or call CPP Police Dispatch (909) 869-3070 and notify EH&S at (909) 869-4697**. Commercial chemical and mercury spill kits are available, which include protective equipment such as goggles and gloves, neutralizing and absorbing materials, bags, and scoops. You can also make your own spill kits to include the materials described below.

Chemical Spills:

- Sodium Bicarbonate;
- Citric Acid;
- Vermiculite or other diking material;
- pH paper;
- 1 pair neoprene or nitrile gloves;
- 1 pair goggles;
- 1 scoop;
- Spill pillows, sorbent pads;
- Disposable shoe covers (plastic bags may work).

Mercury Spills:

- Disposable gloves;
- Disposable shoe covers (plastic bags will work);
- Index card or rubber squeegee;
- Disposable syringe or a vacuum trap flask fitted with tubing or Pasteur pipette;
- Inactivating solutions and/or powders

Weak Inorganic Acid or Base Spill Clean Up Procedure

1. Wear gloves, goggles, laboratory coat and shoe covers.
2. To clean-up a spill of weak inorganic acid or base, neutralize the spilled liquid to pH 5 to 8 using a Neutralizing Agent such as:
    - Sodium bicarbonate;
    - Soda ash;
    - Sodium bisulfate;
    - Citric acid.
3. Absorb the neutralized liquid with an Absorbent such as:
    - Sorbent pads;
    - Diatomaceous earth;
    - Dry sand;
    - Sponges;
    - Paper towels;
    - Vermiculite.

Rinse the absorbent pads or sponges in a sink with water if chemicals involved do not include any other high hazard substances like acutely toxicants or carcinogens. Scoop or place the other absorbent materials into a clear plastic bag. Double bag and tag the bag with a chemical waste label. Fill out the "Hazardous Waste Disposal Request" form to request a disposal via the EH&S website at

Solvent Spill Clean Up Procedure

- Absorb the spill with a non-reactive material such as:
- Vermiculite;
- Dry sand;
- Paper towels;
- Sponges.
- Package as described above.
- Do not rinse or dispose of any chemicals down the sink or into any drain.

Broken Mercury Thermometer Clean Up Procedure

1. Clean up the spill immediately after it has occurred.
2. Prevent the spread of the spilled mercury. Do not allow people to walk through spill area.
3. Wear disposable gloves and shoe covers or place plastic bags over your shoes during the cleanup.
4. Push the mercury droplets together into a bead using an index card or rubber squeegee.
5. Aspirate the beaded mercury into a disposable syringe or use a disposable Pasteur Pipette attached with tubing to a vacuum flask to aspirate the mercury into the flask. The flask should contain water. Always have a second vacuum flask between the mercury flask and the house vacuum.
6. Chemically inactivate any residual mercury. There are several methods to inactivate the residual mercury including:
    a. Use a commercial inactivating powder following its directions for use
    b. Sprinkle zinc powder over the spill area. Then moisten the zinc with a 5 to 10 percent sulfuric acid solution until a paste is formed. Scour the contaminated surface and allow the paste to dry. Sweep up the dried paste.
    c. Wash the contaminated area with a detergent solution. Rinse and then swab the area with a calcium polysulfide solution containing two to four tablespoons of calcium polysulfide per gallon of water.

Place the collected mercury and materials used in the clean-up into a clear plastic bag. Double bag and label the waste. Affix a WASTe tag to the bag and request a pickup through the Risk and Safety Solutions platform.

If a large spill occurs, call 911 from a campus phone or from a cell phone call CPP Campus Police (909) 869-3070 and notify EH&S at (909) 869-4697

APPENDIX I: Sharps Injury Log

CalPolyPomona

SHARPS INJURY LOG

Please complete a Log for **each employee** exposure incident involving a sharp
Fill in the one circle corresponding to the most appropriate answer

California State Polytechnic Univ., Pomona	Department:	
3801 W. Temple Ave.		
City: Pomona	State: CA	Zip Code: 91768
Date filled out:	By:	Phone Number:

Date of injury: ___ / ___ / ___ (month / day / year)

Time of injury: ___ : ___ ○ a.m. ○ p.m.

Optional
Gender ○ Male ○ Female

Description of the exposure incident:

In what location did this injury occur?
- ☐ Student Health Center
- ☐ Academic Laboratory
- ☐ FM Trades
- ☐ FM Custodial
- ☐ Institutional Research

Procedure: (Medically or Occupationally Related)
- ☐ Draw venous blood
- ☐ Injection, through skin
- ☐ Start IV/set up heparin lock
- ☐ Unknown/not applicable
- ☐ Cutting
- ☐ Suturing
- ☐ Industrial use of Sharps
- ☐ Occupational encounter with Sharp
- ☐ Other _____

Did the exposure incident occur:
- ☐ During use of sharp
- ☐ Between steps of a multistep procedure
- ☐ After use and before disposal of sharp
- ☐ While putting sharp into disposal container
- ☐ Sharp left, inappropriate place (table, bed, etc.)
- ☐ Disassembling
- ☐ Other _____

Body Part:
(Check all that apply)
- ☐ Finger
- ☐ Hand
- ☐ Arm
- ☐ Face/head
- ☐ Torso
- ☐ Leg
- ☐ Other _____

Identify sharp involved:
(if known)

Type: _____
Brand: _____
Model: _____
e.g., 18g "Medical" no shield/safety

Did the device being used have engineered sharps injury protection?
☐ Yes ☐ No ☐ Don't know

Was the protective mechanism activated?
☐ Yes – fully ☐ Yes - partially ☐ No

Did the exposure incident occur:
☐ Before ☐ During ☐ After activation

Exposed employee: If sharp had no engineered sharps injury protection, do you have an opinion that such a mechanism could have prevented the injury? ○ Yes ○ No

Explain:

Exposed employee: Do you have an opinion that any other engineering, administrative or work practice control could have prevented the injury? ○ Yes ○ No

Explain:

California State Polytechnic University, Pomona
Office of Environmental Health and Safety – v1.0 2019

APPENDIX J: Glossary

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 (TLVs) for hundreds of chemicals, physical agents, and biological exposure indices.

ACTION LEVEL -A concentration designated in Title 8, California Code of Regulations for a specific substance, calculated as an eight (8)-hour time weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

AEROSOL - Liquid droplets or solid particles dispersed in air that are of fine enough size (less than 100 micrometers) to remain dispersed for a period of time.

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.

"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 cancer-producing substance or physical agent in animals or humans. A chemical is considered a carcinogen or potential carcinogen if it is so identified in any of the following:

- National Toxicology Program, "Annual Report of Carcinogens" (latest edition)
- International Agency for Research on Cancer, "Monographs" (latest edition)
- OSHA, Title 29 CFR §1910, Subpart Z, Toxic and Hazardous Substances

CHEMICAL HYGIENE PLAN - A written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment, and work practices that (1) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (2) meets the requirements of OSHA regulation Title 29 CFR §1910.1450.

COMBUSTIBLE LIQUID - Any liquid having a flashpoint at or above 100°F (37.8°C) but below 200°F (93.3°C) except any mixture having components with flashpoints of 200°F or higher, the total volume of which make up 99% or more of the total volume of the mixture.

COMPRESSED GAS - A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70°F (21.1°C), or; a gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F (54.4°C) regardless of the pressure at 70°F (21.1°C), or; a liquid having a vapor pressure exceeding 40 psi at 100°F (37.8°C) as determined by ASTM D-32372.

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.

DESIGNATED AREA - An area which has been established and posted with signage for work involving hazards (e.g., "select carcinogens," reproductive toxins, or substances which have a high degree of acute toxicity). A designated area may be the entire laboratory, an area of a laboratory, or a device such as a laboratory hood.

EMERGENCY -Any potential occurrence, such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which could result in an uncontrolled release of a hazardous chemical into the workplace.

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

FLAMMABLE - A chemical that falls into one of the following categories:

1. Flammable aerosol - an aerosol that, when tested by the method described in Title 16 CFR §1500.45, yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;
2. Flammable gas - a gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13% by volume or less; or a gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12% by volume, regardless of the lower limit;
3. Flammable liquid - any liquid having a flashpoint below 100°F (37.8°C), except any mixture having components with flashpoints of 100°F (37.8°C) or higher, the total of which make up 99% or more of the total volume of the mixture;
4. Flammable solid - a solid, other than a blasting agent or explosive as defined in §1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and, when ignited, burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered a flammable solid if, when tested by the method described in Title 16 CFR §1500.44, it ignites and burns with a self-sustained flame at a greater than one-tenth of an inch per second along its major axis.

FLASHPOINT - The minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite in the presence of an ignition source or when tested as follows:

1. **Tagliabue Closed Tester** (See American National Standard Method of Test for Flashpoint by Tag Closed Tested, Z11.24-1979 (ASTM D-56-79) for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100oF (37.8°C) or that contain suspended solids and do not tend to form a surface film under test;
2. **Pensky-Martens Closed Tester** (See American National Standard Method of Test for Flashpoint by Pensky-Martens Closed Tester, Z11.7-1979 (ASTM D-73-79) for liquids with a viscosity equal to or greater than 45 SUS at 100oF (37.8°C), or that contain suspended solids, or that have a tendency to form a surface film under test; or,
3. **Setaflash Closed Tester** (See American National Standard Method of Test for Flashpoint of Setaflash Closed Tester (ASTM D-3278-78)). Organic peroxides, which undergo auto accelerating thermal decomposition, are excluded from any flashpoint determination methods specified above.

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)

HAZARD ASSESSMENT - A formal procedure undertaken by the supervisor in which occupational hazards for all employees are described per procedure or task, and by affected body part(s) or organ(s), and which is documented and posted in the workplace with all personal protective equipment requirements.

HAZARD WARNING - Any words, pictures, symbols or combination thereof appearing on a label or other appropriate form of warning which convey the hazards of the chemical(s) in the container(s).

HAZARDOUS MATERIAL - Any material which is a potential/actual physical or health hazard to humans.

HAZARDOUS MATERIAL (DOT) - A substance or material capable of posing an unreasonable risk to health, safety, and property when transported including, but not limited to, compressed gas, combustible liquid, corrosive material, cryogenic liquid, flammable solid, irritating material, material poisonous by inhalation, magnetic material, organic peroxide, oxidizer, poisonous material, pyrophoric liquid, radioactive material, spontaneously combustible material, an water-reactive material.

HAZARDOUS CHEMICAL - A chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, and neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes or mucous membranes. A chemical is also considered hazardous if it is listed in any of the following:

1. OSHA, Title 29 CFR §1910, Subpart Z, Toxic and Hazardous Substances;
2. "Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment," ACGIH (latest edition);
3. "The Registry of Toxic Effects of Chemical Substances," NIOSH (latest edition)

HIGHLY TOXIC -A substance falling within any of the following categories:

1. A substance that has a median lethal dose (LD50) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each;
2. A substance that has a median lethal dose (LD50) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each; or
3. A substance that has a median lethal concentration (LC50) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

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

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

IRRITANT -A substance which, by contact in sufficient concentration for a sufficient period of time, will cause an inflammatory response or reaction of the eye, skin, nose or respiratory system. The contact may be a single exposure or multiple exposures. Some primary irritants: Chromic acid, nitric acid, sodium hydroxide, calcium chloride, amines, metallic salts, chlorinated hydrocarbons, ketones and alcohols.

LABEL - Any written, printed or graphic material displayed on or affixed to containers of chemicals, both hazardous and non-hazardous.

LABORATORY TYPE HOOD -A device located in a laboratory, enclosed on five sides with a movable sash or fixed partial enclosure on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms.

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LABORATORY USE OF HAZARDOUS CHEMICALS - Handling or use of such chemicals in which all of the following conditions are met:

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

LOCAL EXHAUST VENTILATION (Also known as exhaust ventilation) – A ventilation system that captures and removes the 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: It removes the contaminant rather than dilutes it, requires less airflow and, thus, is more economical over the long term; and the system can be used to conserve or reclaim valuable materials; however, the system must be properly designed with the correctly shaped and placed hoods, and correctly sized fans and ductwork.

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 appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

MIXTURE - Any combination of two or more chemicals if the combination is not, in whole or in part, the result of a chemical reaction.

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

NFPA - The National Fire Protection Association; 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. 705, "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; a federal agency that among its various responsibility's trains occupational health and safety professionals, conducts research on health and safety concerns, and tests and certifies respirators for workplace use.

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

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

PERMISSIBLE EXPOSURE LIMIT (PEL) - An exposure, inhalation or dermal permissible exposure limit specified in 8CCR5155. PELs may be either a time-weighted average (TWA) exposure limit (8hour), a 15-minute short-term limit (STEL), or a ceiling (C).

PERSONAL PROTECTIVE EQUIPMENT - Any devices or clothing worn by the worker to protect against hazards in the environment. Examples are lab coats, respirators, gloves, and chemical splash goggles.

PHYSICAL HAZARD - A chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive), or water-reactive.

PYROPHORIC - A chemical that will spontaneously ignite in the air at a temperature of 130^{o}F (54.4^{o}C) or below.

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 an SDS.

REPRODUCTIVE TOXINS - Chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

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 body function impairment.

SAFETY DATA SHEET (SDS) - Written or printed material concerning a hazardous chemical which is prepared in accordance with paragraph (g) of Title 29 CFR §1910.1200. (Formerly material safety data sheet, MSDS)

SELECT CARCINOGENS - Any substance which meets one of the following:

1. It is regulated by OSHA as a carcinogen; or
2. It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition);or
3. It is listed under Group 1 ("carcinogen to humans") by the International Agency for Research on Cancer Monographs (IARC)(latest editions); or
4. It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP.

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.

SOLVENT - A substance, commonly water, but in industry or the laboratory often an organic compound, which dissolves another substance.

THRESHOLD LIMIT VALUE (TLV) -Airborne concentration of substances devised by the ACGIH that represents 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, which 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).

TOXICITY -A relative property of a material to exert a poisonous effect on humans or animals and a description of the effect and the conditions or concentration under which the effect takes place.

VAPOR - The gaseous form 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 lower boiling points will evaporate faster.