Santa Clara
UNIVERSITY

Chemical Hygiene Plan

Santa Clara University (SCU)

500 El Camino Real
Santa Clara, CA 95053

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1. Purpose

The Chemical Hygiene Plan describes procedures, equipment, personal protective equipment, and work practices for protecting employees from the potential health hazards in Santa Clara University (SCU) laboratories. This Plan is primarily intended to meet the requirements of the California Occupational Safety and Health Administration (Cal/OSHA), California Code of Regulations, Title 8, Section 5191, "Occupational Exposure to Hazardous Chemicals in Laboratories."

A significant goal of this Chemical Hygiene Plan is to safely limit employees' exposure to Cal/OSHA-regulated substances through inhalation, ingestion, or dermal exposure[1]. The Plan is also designed to meet the following requirements:

- Fire Prevention Programs (8 CCR 3221), as the regulation applies to laboratories;
- Injury and Illness Prevention Plan inspection requirements (8 CCR 3203(a)(4)), as they apply to laboratories.
- Qualification of laboratory managers and employees to use laboratory chemical hoods and biological hoods and cabinets, per 8 CCR 5154.1 and 5154.2.
- Workplace Chemical Protection Program (WCPP) for laboratory use of dichloromethane, per 40 CFR 751.109, issued by the Environmental Protection Agency under section 6(a) of the Toxic Substances Control Act

2. Applicability

Employees. This plan applies to employees, including faculty, instructors, and student employees, who work where "laboratory use" of hazardous chemicals occurs. Laboratory use of hazardous chemicals means handling or use of such chemicals in which all of the following conditions are met:

- The handling or use of chemicals occurs on a "laboratory scale," that is, the work involves containers that can easily and safely be manipulated by one person.
- Multiple chemical procedures or chemical substances are used, and
- Protective laboratory practices and equipment are available and in common use to minimize the potential for lab employee exposures to hazardous chemicals.

Students. Students working in a laboratory where laboratory use of hazardous chemicals occurs should be informed of and are required to follow the General Laboratory

[1]Specifically, Employees must not be exposed to substances in excess of the limits established by the California Code of Regulations, Title 8, Article 109, "Hazardous Substances and Processes" and the Permissible Exposure Limits (PEL) specified by 8 CCR 5155 "Toxic and Hazardous Substances." Permissible Exposure Limits refer to airborne concentrations of substances and are averaged over an eight-hour day. A few substances also have "action levels" that, if exceeded, trigger air monitoring and/or additional control measures. The potential for these levels to be exceeded are assessed through a Risk and Hazard Assessment process, which is used to evaluate the effectiveness of engineering controls (such as fume hoods) and/or to determine the need for additional protective measures. In addition, employees must use proper Personal Protective Equipment (PPE) to prevent short-term exposure of skin or eye to chemicals. PPE equipment requirements are determined through an assessment process and are discussed in 8 CCR 3203 and 8 CCR 3380 – 3400.

Standards (Appendix 1) and any laboratory-specific operating procedures.

Non-Santa Clara University Employees. The SCU Office of Risk Management has policies concerning non-Santa Clara University employees working in SCU laboratories. Before persons from other universities, outreach programs, or similar operations are permitted to work in SCU laboratories, Risk Management must be contacted to determine under what conditions such work is to be allowed. Any non-SCU employees working in a laboratory where the laboratory use of hazardous chemicals occurs should be informed of and are required to follow the General Laboratory Standards (Appendix 1) and any laboratory-specific operating procedures. Visitors are also required to follow the General Laboratory Standards (Appendix 1) and must not be left unattended in the laboratories.

3. Definitions

The most pertinent definitions are contained in Appendix 2. Review and use as necessary.

4. Roles and Responsibilities

The following are the SCU Roles and Responsibilities in regards to personnel working in laboratories subject to the Chemical Hygiene Standard:

Group	Responsibilities
Employees and Student Employees	Plan and conduct each operation in accordance with SCU's Chemical Hygiene Plan. Particularly, ensure that: ▪ Chemicals are stored, used, and disposed of as per standard operating procedures ▪ Appropriate handling and control measures are employed, in accordance with the results of the Risk and Hazard Assessment ▪ PPE, from the results of the PPE Assessment, is available and is worn ▪ Potential sources of ignition and fuel are controlled as per this plan
Supervisors (The direct supervisor of an employee who works where there is the use of hazardous chemicals. A supervisor cannot be a student employee.)	▪ Ensure that students and employees know and follow the procedures in the chemical hygiene plan. ▪ Train employees in the specific work practices and procedures of their laboratory (as a good practice, keep records of this training) ▪ Ensure that PPE and other protective equipment defined in the PPE assessment and Risk and Hazard Assessment is available, in working order, and is used when required ▪ Identify clearly to employees the circumstances and procedures that require prior approval of the supervisor ▪ Approve student employees working alone in the laboratory

Laboratory Supervisors (The individual who is in charge of a laboratory. It may be a Principal Investigator (PI), laboratory instructor, laboratory manager, laboratory associate, or other designated personnel. The laboratory supervisor is appointed by the Department Chair or the laboratory director.)	▪ Ensure that any necessary **PPE Assessments** and **Risk and Hazard Assessments** have been conducted and any changes defined in the assessment have been implemented ▪ Conduct periodic inspections of the laboratory and equipment ▪ Participate in annual inspections with the Chemical Hygiene Officer ▪ Ensure that all identified issues from these inspections are corrected expeditiously and that a record is kept of the identified issue and follow up actions ▪ Provide custom **Standard Operating Procedures (SOP)** for any procedures not covered by the SOPs in this plan (Model SOP and SOP Template is provided in Appendices 5 and 6) ▪ Ensure that signage installed in the laboratory is visible and maintained ▪ Ensure that there is effective fire prevention procedures and equipment in their laboratory as identified by EHS ▪ Review with the CHO for use of Restricted Substances as described in Appendix 8
Academic Department Chairs	▪ Designate Laboratory Supervisors as needed for each laboratory under their jurisdiction ▪ Ensure that laboratories within their department meet the standards specified in this plan ▪ Coordinate with CHO to determine appropriate actions if a Laboratory Supervisor does not complete corrective and preventive actions in a timely manner
Facilities Department	▪ Maintains laboratory facilities and infrastructure, as per regulation and manufacturer specifications (lab hoods, electrical outlets, eyewashes and safety showers, fire extinguishers, sprinklers) ▪ Responds to identified deficiencies in facilities and infrastructure and services in a timely manner ▪ Installs signage as directed by Chemical Hygiene Officer
Chemical Hygiene Officer (CHO)	▪ Conducts inspections of laboratories governed by this standard (jointly with Laboratory Supervisor) ▪ Conducts Risk and Hazard Assessments and PPE Assessments upon lab setup, any significant change in lab practices, every three years, or as requested by the Laboratory Supervisor ▪ Keeps records of the implementation of corrective actions from the Assessments ▪ Provides hazard communication and safety training to employees, students, and visitors as needed ▪ Defines signage requirements for each laboratory door and

Chemical Hygiene Officer (CHO) continued	coordinate with Facilities to ensure the appropriate signage is installed ▪ Ensures exposure assessments are conducted as requested or when need is identified ▪ Provides assistance on proper signage ▪ Provides copy of chemical inventory, as needed ▪ Provides guidance and support in resolving EHS-related issues ▪ Spot checks inspections to ensure that corrective/preventive actions have been taken and are properly documented ▪ Coordinates with Department Chair to determine appropriate actions if a Laboratory Supervisor does not complete corrective and preventive actions in a timely manner ▪ Preserves all employee exposure records in accordance with recordkeeping requirements ▪ Performs an annual review of the effectiveness of the Plan and ensures that this program is kept up-to-date with regulatory requirements ▪ Works with HR, as appropriate, to arrange employee medical consultations when requested
Environment, Health and Safety (EHS) Director	▪ Appoints the CHO ▪ Oversees the transportation of hazardous materials on public road ▪ Oversees exposure monitoring, surveillance, and records ▪ Certifies employees to wear respiratory protection ▪ Designates areas, activities, and tasks that require specific types of personal protective equipment as described above
Human Resources (HR) Department	▪ Works with the CHO, as appropriate, to arrange employee medical consultations when requested ▪ Keeps medical consultation records in accordance with recordkeeping requirements

5. Requirements

General Requirements

General Laboratory Standard

General standards for laboratory work are contained in Appendix 1. The laboratory supervisor must follow and enforce these standards unless they have been superseded as the result of the **Risk and Hazard Assessment** discussed below.

PPE Assessments, Risk and Hazard Assessments

Laboratories in SCU are generally categorized into 3 hazard levels: high-wet hazard, high-dry hazard, and low hazard. The hazard level of a laboratory determines the minimum attire and PPE requirements for entry, and is based on the highest hazard activities, materials, and/or equipment present in the laboratory. The general criteria for hazard classification and guidance for minimum lab attire by lab hazard level are detailed below:

Lab Hazard Classification	Definition	Minimum Lab Attire and PPE Requirements
High – Wet Hazard	Labs with: ▪ Hazardous chemicals ▪ Biological materials – BSL 2 (and some BSL 1 labs) ▪ Radiological materials	▪ Long pants and closed-toe shoes covering the entire feet ▪ Safety glasses or goggles ▪ Lab coat ▪ Additional PPE may be required for certain activities (e.g. cryo gloves, face shield)
High – Dry Hazard	Labs with physical, mechanical, and electrical hazards, but none or minimal use of chemical or biological materials	▪ Long pants and closed-toe shoes covering the entire feet ▪ Safety glasses ▪ Special PPE may be required for certain activities (e.g. welding jacket, laser safety eyewear)
Low Hazard	Lack of hazardous process, materials, or machinery in the lab	▪ Laboratory supervisor discretion

Each laboratory, including teaching laboratories, will be assessed by the Chemical Hygiene Officer for hazards and risks, with input from the laboratory supervisor, using the SCU Hazard Assessment and Control Program. This assessment will be done initially when a laboratory is set up, when a laboratory undergoes a major change in operations, when a laboratory has successive poor inspection results, and when the Chemical Hygiene Officer determines that the previous assessment needs to be supplemented or redone. The output of this Assessment will include:

- Determination of hazard category of the laboratory (high-wet, high-dry, or low hazard), which sets the minimum attire for lab entry and inspection schedule
- A list of required personal protective equipment (PPE) to be worn during various operations
- Specific SOP(s) to be developed for certain high hazard activity or activities
- Additional control measures or other risk management requirements related to both chemical and non-chemical risks.

The Laboratory Supervisor is responsible for implementing the results of the

Assessments, drawing on the resources of EHS and Facilities as needed, and informing the CHO of when corrective actions are completed. The CHO is responsible for keeping records of the Assessments of the actions taken to resolve them.

A general guide to PPE requirements is given in Appendix 3; these general requirements, along with general chemical SOPs discussed in this document, should be used in the absence of an alternative lab-specific PPE assessment, or until a **Risk and Hazard Assessment** can be completed.

Laboratory Inspections

Inspections are conducted using SCU designated web-based inspection tool (EHS Website: Laboratory Inspections). An example of the items covered during an inspection is provided in Appendix 4. SCU laboratories and/or shops will be inspected according to the frequency and schedule below:

Laboratory Type	Frequency	Laboratory Supervisor Self-Inspection	Joint Inspection (Laboratory Supervisor and CHO)
High – Wet Hazard Labs	Each quarter except summer	Fall and Spring Quarters	Winter Quarter
High – Dry Hazard Labs	Annual	None	Fall Quarter
Low Hazard Labs	Annual	None	Spring Quarter

* If there are significant issues identified during the joint inspections, then follow-up re-inspection may be required for the following quarter.

The laboratory supervisor is responsible for following up and completing all corrective and preventive actions, using resources from Facilities and EHS as appropriate. The inspection software will automatically maintain the inspection records consisting of; completed inspection checklists, what corrective actions were taken, dates of completion and who performed the actions. Unless given an exception, all corrective actions are to be completed within 30 days.

If corrective actions are not taken within required times, the CHO will consult with the Department Chair to determine proper actions, up to shutting down work in the lab until the lab has come into compliance with the Plan.

Working Alone

Working alone in a laboratory requires the prior approval of the Laboratory Supervisor who will be responsible for the safety of their employees and students. For students working alone (including student employees), the work must not involve hazardous materials or equipment. Advance planning should be made in these cases to address

emergency response procedures and informing outside parties of the employee's work plan and schedule.

Other University Safety Programs

Laboratory personnel who work with biological agents and radioactive sources or radiation producing devices, are subject to the requirements of SCU **Biosafety Program** and **Radiation Safety Program**.

Engineering Controls

The best way to prevent exposure to airborne hazards is to prevent their escape into the working atmosphere by use of laboratory fume hoods, biological safety cabinets and other ventilation devices. Operations such as running reactions, heating or evaporating solvents, and transfer of chemicals from one container to another should be performed in a hood when there is reasonable potential for hazardous material exposure. The specific need for an engineering control is included in the laboratory Risk and Hazard Assessment process.

Laboratory Fume Hoods

The laboratory fume hood is the primary engineering control for capturing and removing hazardous airborne materials available in laboratories. Details to the SCU fume hood installation and maintenance program are contained in SCU's **Hoods, Spray Booths, and Local Ventilation Program**.

Prior to use of the fume hood for operations that might result in release of hazardous chemical vapors, gases, mists or dusts, the user must confirm adequate hood performance. A worker should maintain the hood sash at a working height at or below the sash mark when working in the hood; keep materials stored in hoods to a minimum and do not allow them to block air flow. Sashes may be temporarily raised above this height to allow materials and equipment to be removed or added to the hood. All chemicals and wastes located in the hood must be kept closed unless actively in use.[2]

An alarm or indicator must be present to show when hood velocity drops below the allowable level. The hood cannot be used without the alarm on and functioning. In the event of ventilation hood alarm or failure, stop all experiments within the hood (if possible), lower the sash completely, notify EHS (through the Facilities Customer Service Desk at 408-554-4742) and submit a work order to Facilities if appropriate. When appropriate, a notice should be placed on the fume hood closed sash indicating that it is not to be used until its performance is within the specified performance parameters.

Face velocity and airflow monitors will be evaluated by Facilities upon installation of laboratory fume hoods. Each laboratory fume hood is certified annually and rechecked

[2] SCU's exemption from air permitting explicitly forbids using a fume hood to evaporate any chemicals or wastes.

periodically, as needed, for usage and performance. Where performance parameters fall outside specifications, Facilities will ensure performance standards are met after each inspection.

A standard chemical fume hood should not be used for concentrated (above 70%) or hot perchloric acid, due to its ability to form explosive perchlorate salts in the ductwork. Contact the CHO for review and approval if use of perchloric acid is needed.

No work with solvents or other volatile hazardous chemicals shall be performed in non-venting hoods (e.g. laminar flow hoods with in-room venting, some types of biosafety cabinets)

Other Local and Special Ventilation Devices

Exhaust air from glove boxes, fume extraction arms (snorkels), and isolation rooms should release into the hood exhaust system.

Procedures involving radioactive aerosols, powders or gaseous products, or procedures that could produce volatile radioactive effluents must be conducted in an approved hood, glove box, biosafety cabinet or other suitable closed system. Such ventilation systems shall be designed with smooth, non-porous materials and possess adequate lighting to facilitate work within. The hoods shall have a minimum face velocity of 100 lfpm (linear foot per minute) across the face of the hood. Contact the Radiation Safety Officer for further information on hoods for radioactive materials.

Safety Shields, Barriers, or Other Containment Devices

Safety shields, such as the sliding sash of a fume hood, or Plexiglas barriers are appropriate when working with highly concentrated acids, bases, oxidizers, reducing agents or radioactive materials, all of which have the potential for causing sudden spattering, explosive release of material or radioactive energy. Reactions carried out at non-ambient pressures (vacuum or high pressure) also require safety shields, as do reactions that are carried out for the first time or are significantly scaled up from normal operating conditions.

Other devices include the following:

- Other containment devices, such as glove boxes or vented gas cabinets, may be required when it is necessary to provide an inert atmosphere for the chemical procedure, when capture of any chemical emission is desirable, or when the standard laboratory fume hood does not provide adequate assurance that overexposure to a hazardous chemical will not occur. The presence of biological or radioactive materials may also mandate certain special containment devices.
- High strength barriers coupled with remote handling devices may be necessary for safe use of extremely shock sensitive or reactive chemicals.
- Highly localized exhaust ventilation, such as is usually installed over atomic

absorption units, and may be required for instrumentation that exhausts toxic or irritating materials to the laboratory environment.

- Ventilated chemical storage cabinets or rooms should be used when the chemicals in storage may generate toxic or irritating levels of airborne contamination.

Control of Physical and Health Hazards

It is prudent to minimize all chemical exposures by any route, and to observe good laboratory practice by using an exhaust hood, wearing eye and hand protection, and a laboratory coat or chemical apron. All work with these materials in a laboratory should be performed in such a way that they do not enter the body by inhalation, absorption, ingestion, or injection. Quantities of vapors or dust should be prevented from entering the general laboratory atmosphere. Because few laboratory chemicals are without hazards, general precautions and Standard Operating Procedures (SOPs) for handling all laboratory chemicals have been adopted in this Plan, with specific guidelines contained in Appendix 5 (Model SOPs). Supervisors may either use these model procedures or define and document their own procedures (Appendix 6 contains a SOP Template).

General hazards for handling chemicals in the laboratory may be classified broadly as physical hazard or health hazard.

Certain health hazards are sub-classified as acute or chronic. Acute hazards are those capable of producing prompt or immediate effects (such as burns, inflammation, or damage to eyes, lungs, or nervous system). Some chemicals are extremely dangerous in this respect and a small amount can quickly cause death or severe injury. Other toxicological effects of chemicals may be delayed or develop only after exposure over long periods of time and are referred to as chronic hazard.

Corrosive Agents

Corrosive agents shall always be handled using personal protective equipment appropriate for the type of material, the quantity being used and the potential exposure route. This may include gloves, lab coat or protective chemical apron, goggles or face shields. Volatile corrosives shall be used in a fume hood when there is any potential for inhalation exposure. Be aware that many corrosive materials (e.g. hydrofluoric acid, phenol) exhibit additional hazards that must be addressed when they are used in the laboratory.

Handling Flammable and Combustible Materials

Do not use an open flame to heat flammable liquid or to carry out a distillation under reduced pressure. Use an open flame only when necessary, and extinguish it when it is no longer needed. Before lighting a flame, remove all flammable materials from the immediate area. Check all containers of flammable materials in the area to ensure that they are tightly closed. Minimize the amount of flammable materials out on the laboratory bench space. When not in active use, store flammable materials in approved flammable

storage cabinets. When volatile flammable materials may be present use only non-sparking electrical equipment. See the Appendix 7 on Fire Prevention within this plan for more details.

Explosive Controls

Safety shielding shall be used for any operation having the potential for explosion, especially:

- When a reaction is attempted for the first time (in addition, small quantities of reactants should be used to minimize hazards)
- When a familiar reaction is carried out on a larger than usual scale (for example, 5 to 10 times more material)
- When operations are carried out under non-ambient conditions

Shields must be placed so that all personnel in the area are protected from hazards.

Particularly Hazardous Substances (PHSs)

The California Occupational Safety and Health Administration's (OSHA) Laboratory Standard (8 CCR 5191(e)(3)(H)), requires that provisions be made by the Laboratory Supervisor for employee protection for work with particularly hazardous substances (PHSs). PHS includes (see Appendix 2 for definitions):

- Select carcinogens
- Reproductive toxins
- Substances with high acute toxicity

To prevent exposure to employee and students, these provisions must be included in the laboratory-specific SOP for use of PHS:

- Establishment of a designated area (may be entire lab, a portion of the lab, or a device such as fume hood). Include, where appropriate:
  - Access control
  - Warning signs posted to identify the designated area
  - Additional PPE and protocol
- Use of containment devices, for example:
  - PHS should generally be used in a fume hood or glove box
  - Spill protection, e.g. use of secondary containment tray
- Procedure for safe removal of contaminated waste
- Decontamination procedure

The laboratory supervisor is responsible for ensuring a laboratory-specific SOP is developed and personnel are trained in the safe use of PHS. Contact the CHO if further guidance is required.

Restricted Substances

SCU has developed a list of Restricted Substances that must be evaluated and formally approved prior to purchase and use. Restricted substances include chemicals that:

(a) Are highly hazardous, or have unique hazards requiring special procedures or equipment for containment, storage, safe use, emergency, and/or waste management, or

(b) Could have wide impact to surrounding personnel, environment, and/or facilities infrastructure, if out of containment, or

(c) Have specific control, reporting, or permitting protocols for their use, per federal and local regulatory requirements

Refer to Appendix 8 for a more detailed list of restricted substances and the approval process. Contact the CHO for review and approval.

Chemical Management

Procurement of Chemicals

To minimize the presence of hazardous materials at SCU, chemicals should be ordered in the smallest quantity needed to conduct the work, considering overall cost and expected needs. Prior to ordering new chemicals, existing chemical stock on campus should be evaluated for use. For new chemicals that have not been previously used on campus, review the Restricted Substances information (Appendix 8) before acquiring in case prior CHO approval is needed. Donated chemicals, including chemicals considered to be non-hazardous, may not be brought into SCU without prior review and approval from the CHO or EHS.

Chemical Inventory

All locations where chemicals are stored and/or used must have a current inventory maintained in the SCU designated online chemical inventory management program. Specific policies pertaining to the chemical inventory system are detailed in the **SCU Chimera Policy and User Guide** (EHS Website: Chemical Inventory). Physical copies of the inventory, if needed, can be requested from the laboratory supervisor or the CHO.

Note: This chemical inventory program excludes radioactive materials, which are managed under the Radiation Safety Program.

Stockrooms / Storerooms

Hazardous substances must be segregated by hazard categories, following manufacturer recommendations. Containers of Potentially Hazardous Substance materials should be placed in unbreakable secondary containers. Stored chemicals shall be examined periodically (at least annually) for replacement, deterioration, and container integrity.

If stockrooms and storerooms are to be used as preparation or repackaging areas, that

information needs to be considered as part of the Risk and Hazard Assessment process to determine if appropriate engineering controls are present and what types of PPE would be appropriate in such operations.

Laboratory Storage

Storage in laboratories shall follow these requirements:

- Incompatible chemicals are stored separately. Acids and bases are stored separately. Acetic acid is treated as a flammable rather than a corrosive. Compatibility information is available on the chemical's Safety Data Sheet.
- A FM or UL Listed flammable liquid storage cabinet must be used to store flammables.
- A corrosive storage cabinet is required for storage of acids and bases.
- Refrigerators used for storage of flammable liquids must be either listed as appropriate for flammable materials or rated as "explosion proof."
- Refrigerators must be labeled as No Food if storing chemicals or hazardous materials.
- Chemical storage in fume hoods and on bench tops is generally not permitted beyond enough to complete the current experiment.[3] Storage of hazardous waste is allowed in the fume hood if waste is deposited in the container at least once every week.
- To meet overall limits on storage under the fire code, no more than 1 gallon of flammable materials may be stored outside of a flammable cabinet or hood for more than a week without special permission.
- Hazardous chemicals (acids, bases, solvents, wastes) should be stored below eye level and in compatible secondary containment. To meet fire code requirements, all liquid and solid hazardous materials above NFPA 704 health, fire, or reactivity hazard class 3 & 4[4] must be stored in secondary containment of size sufficient to hold the contents of the largest single container.

Hazard Communication Labels

All SCU employees and students who work with chemicals must be familiar with conventions used for Hazard Communication through signs and labels. Further details and examples are provided in Appendix 9. Labels on incoming containers of hazardous chemicals must not be removed, covered, or defaced until product is emptied from the container. All chemical containers shipped from the manufacturer, importer, or distributor will have the chemical name and hazard warning on the label of the container.

[3] The acceptability of small amounts of storage will be evaluated during the Risk and Hazard Assessment

[4] The NFPA hazard classification system ("diamond") includes a rating (from 0 to 4) of the hazard of a chemical for health, fire, and reactivity. The higher the number, the more dangerous the chemical is in that category.

If chemicals are transferred from the original container, the new container must be labeled with:

- Product name, chemical name, and/or composition,
- Type(s) of hazard,
- Name of the person who prepared the container, and
- Date of preparation

If a chemical substance is synthesized in the laboratory, produced exclusively for the laboratory's use, the Laboratory Supervisor is responsible for determining if it is hazardous and appropriate labeling. The CHO or EHS department can, upon request, assist the laboratory personnel with hazard determination and appropriate labeling.

Laboratory supervisors may create their own labels with the required information, or obtain pre-printed chemical labels from the CHO, EHS, or the laboratory support staff.

Specific Warning Signs and Labels

The CHO will define the requirements for posting and ensure that signs are provided to include:

- Emergency telephone numbers;
- Emergency Response Guidelines,
- Location signs for safety showers, eyewashes, fire extinguishers, and first aid equipment;
- Warning signs at areas or equipment where special or unusual hazards exist;
- Laboratory door safety signs that must be posted outside each laboratory, as per the local fire code, during the Risk and Hazard Assessment process.

The laboratory supervisor shall ensure that such signs are maintained, are visible, and are kept current. The laboratory supervisor must contact the CHO if the sign needs to be updated due to changes in the type of chemicals that are used.

Globally Harmonized System (GHS)

The GHS is a system for standardizing and harmonizing the classification and labeling of chemicals through the use of a standardized set of symbols. The symbols and their meaning are provided in Appendix 9.

Chemical Label Abbreviation

Chemical names should be fully spelled out on the container label unless the lab creates and manages its own list of agreed-upon chemical abbreviations for use on container labels. Use the Chemical Abbreviation template available on the EHS website (EHS Website: Chemical Hazard Information) . Abbreviations must appear on this list to be used in the lab. This list must be on display near the lab entrance and kept current.

Transport and Shipment of Chemicals

The following safety precautions should be taken for chemical transport:

- Liquid chemicals should be transported in secondary containment (such as a hand carrier). It is a regulatory requirement that all liquids over a pint in size and all liquids and solids rated at NFPA hazard class 4 must be transported in secondary containment [safety containers, or on a wheeled cart with a design capable of containing leakage or spillage and negotiating uneven surfaces (e.g., expansion joints or floor drains)] without tipping the chemical container or cart.
- Chemicals should be transported on elevators without riders where possible. Freight elevator should be used where available. Using passenger elevators for chemical transport should be avoided.
- Chemical containers should be sealed during transport.
- Cylinders should be strapped to a cylinder hand truck specifically designed for that purpose and cylinder valve protective caps shall be in place to protect the valve.
- Laboratory-use gloves should be removed before touching surfaces outside of the laboratory, e.g. door handles, elevator buttons, collaborative/meeting spaces.
- Transportation of hazardous materials on any public road should NEVER be performed except under the oversight of EHS. This transportation is highly regulated and the University MUST ensure that all regulations are followed for such moves.

Exposure Monitoring and Surveillance

All exposure monitoring and surveillance will be performed by or overseen by EHS. All concerns of overexposure should be addressed to the supervisor and CHO and is handled through **Incident Report and Review Process** described in SCU's **Incident and Injury Prevention Program (IIPP)**. The permissible exposure limits (PEL) of OSHA and the threshold limit values (TLV) of the American Conference of Governmental Industrial Hygienists (ACGIH) should not be exceeded. This may be achieved by a combination of experimental design and engineering controls. In general, use of a fume hood is recommended when working with a volatile substance. These exposure limits may be found on a chemical's Safety Data Sheet (SDS). Air sampling specifications, including frequency and test method will be determined by the Chemical Hygiene Officer, in consultation with lab and other EHS personnel.

Waste Disposal Program

Hazardous Waste

Information on the identification, handling, storage, and collection of laboratory wastes, as well as personnel safety of waste generators, is detailed in **SCU's Hazardous and Universal Waste Program**. The program includes procedures for hazard identification, hazardous waste accumulation, requesting removal of hazardous waste, and the disposal

process. Also included is information on waste minimization activities. Hazardous waste generator training is provided by EHS annually.

Other Types of Waste

Certain waste that are not considered as hazardous waste must be handled in specified manners:

- All "sharps" or needles must be disposed of in "sharps containers". Sharps are defined broadly as any laboratory waste item that can puncture human skin. This includes needles, syringes with needles, lancets, scalpels, razor blades, precision knives, and certain pipette tips. Broken glass is specifically excluded and is addressed below.
- All broken glass must be disposed of in "broken glass" containers or in completely sealed cardboard boxes. Filled containers should be completely sealed with sturdy tape (to prevent puncture to the handlers) and marked "FOR DISPOSAL".
- Finely divided powders, such as silica gel or toners, must be placed in tightly sealed containers or bags before disposal.
- Biological and/or radioactive wastes are addressed separately from other laboratory wastes. Contact the CHO for information on these wastes and waste disposal.

Sink Disposal

DO NOT DISCHARGE ANY WASTE TO THE SEWER unless the EHS department has given explicit permission to do so. A list of permissible sewer discharges is given in SCU Wastewater Program.

Emergencies and Exposures

Emergency Safety Equipment

Emergency Eyewash and Shower Equipment

Plumbed eyewashes must be present in or near all lab areas in which there is a potential for hazardous chemicals to be splashed into the eyes. A safety shower must be present in or near all lab areas in which there is a potential for toxicologically significant quantity of a hazardous chemical to be splashed onto the body.

Eyewashes and safety showers are to be installed with equipment complying with ANSI Z358.1-2014 (see SCU's Emergency Eyewash and Shower Program). Emergency eyewash facilities and deluge showers must be in accessible locations that require no more than 10 seconds to access and must not cause the injured person to pass through doorways unless the door opens in the direction of travel and cannot be locked. If both an eyewash and shower are needed, they are located so that one person can use both at the same time. The area of the eyewash and shower equipment must be maintained free of items that obstruct their use.

Fire Extinguishers

A fire extinguisher must be present in or near each laboratory area. The fire extinguisher must be appropriate for the classes of fires possible in a particular laboratory. Employees who have been trained to use extinguishers may, at their comfort, use them to fight incipient fires. Personnel who have not been trained in extinguishers should evacuate rather than attempting to fight fires. Activate the nearest fire alarm pull station on the way to the emergency exit. Once clear of danger, immediately call Campus Safety at 408-554-4444 or the Fire Department by dialing 911.

Incident Response and Notification

Incidents involving fire or explosion will activate installed automatic alarm sensors and fire extinguishing systems. Where automatic systems do not exist, manual alarms are installed in egress routes and must be activated during evacuation.

Incidents involving major chemical spills, fire, or explosion shall be immediately reported to Campus Safety at 408-554-4444 from a cellphone, or extension 4444 from a campus wall-mounted or desk phone. Campus Safety will contact emergency services. Reporting of incidents to Campus Safety should be clear and concise, including the following information:

- Nature of the incident
- Hazardous material(s) involved
- Nature of any injuries or chemical exposures
- Location
- Name of the caller
- Phone number where caller can be reached

Personnel at the immediate scene of the incident should take actions that will mitigate the extent of the incident without jeopardizing their own health and safety. The guidance below should be used to determine when such cleanup could be undertaken without calling for outside aid:

- If you can clean up the spill with standard PPE (gloves, safety glasses/goggles, lab coat) without exposing yourself
- You know the identity of the chemical
- You understand the hazards
- You have the supplies to clean it up

When in doubt, warn others in the area, evacuate the area, travel to a safe location, and call Campus Safety x4444 or 408-554-4444.

In the event of a chemical exposure, personnel should take these actions:

1. Remove person from affected spill area if safe to do so, and decontaminate:
    - Skin exposure: remove any contaminated clothing and flush with water for at least 15 minutes. For large exposure to the body, use the safety shower.

**Note: For hydrofluoric acid exposure, flush for 5 minutes and then apply calcium gluconate gel to affected site. If calcium gluconate gel is not available, flush with water for at least 15 minutes. Emergency services must be immediately contacted for further medical attention, even if calcium gluconate gel treatment has been performed.*

- Eye exposure: flush under eyewash station for at least 15 minutes. Eyelids must be forcibly held open and eyes rotated to rinse all surfaces. Remove contact lenses during flushing.
- Chemical inhalation: move person to fresh air

2. Seek medical attention. If immediate medical attention is needed, contact Campus Safety at 408-554-4444 to initiate emergency services.

Incident Investigation and Reporting

Incidents involving injury, illness, exposure, or a hazardous material spill must be reported (EHS Website: Incident Reporting), regardless of severity. For more information, see SCU **Injury and Illness Prevention Program** or contact EHS or HR.

Medical Consultations

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

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

The employee should contact EHS and HR to obtain a medical consultation. All medical consultations will be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place. (Note: In case of emergency, the employee should call 911 or Campus Safety for immediate assistance) EHS must provide the following information to

the physician:

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

For examination or consultation required under this standard, HR must obtain a written opinion from the examining physician which shall include the following:

1. Any recommendation for further medical follow-up;
2. The results of the medical examination and any associated tests, 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.
5. The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

First Aid

First Aid Kits are available for minor cuts and scrapes. Personnel trained in first aid are available during all hours and are accessed through Campus Safety Services at 408-554-4444. Campus Safety may arrange for external emergency response for support as needed.

6. Training

General Chemical Safety Training

Employees working in laboratories receive training by EHS. Each Supervisor for a laboratory will assure that each worker in their laboratory obtains the appropriate training prior to starting work. For faculty hired to work or teach in a laboratory, the Department Chair is responsible for contacting EHS sufficiently in advance to ensure that the person is trained prior to starting work. This training includes the following topics:

- This Chemical Hygiene Plan, its content, and availability;
- The contents of the OSHA standard 8 CCR 5191 and its appendices (Occupational Exposure to Hazardous Chemicals in Laboratories)

- Location of reference material on the hazards (including Safety Data Sheets), safe handling, storage, and disposal of the specific hazardous chemicals found in the laboratory;
- The physical and health hazards of the specific chemicals in the work area (as described on the Safety Data Sheet);
- Methods and observations that may be used to detect the presence or release of a hazardous chemical (examples: monitoring conducted by the EHS Department, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released);
- Measures employees can take to protect themselves from hazards, including specific procedures that SCU, the respective department, or the Laboratory Supervisor has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used

Laboratory Specific Training

Supervisors will ensure that laboratory-specific training is provided to employees for specific procedures and experiments. This training should be provided before laboratory work begins for the employee. It should include specifics of the hazardous materials to be used and specific safe work practices including PPE requirements for the laboratory.

Refresher Training

All employees covered by the Chemical Hygiene Plan will receive annual refresher training by the CHO. Low hazard laboratories may petition the EHS Department to have the refresher training occur every two years. Such petitions will be granted only if (a) risk is considered low; (b) the amount of PPE required is minimal beyond normal general laboratory practices described in Appendix 1; and (c) EHS inspections of the specific laboratory within the last year found no significant issues had been missed.

7. Review and Update of Chemical Hygiene Plan

The Chemical Hygiene Plan will be reviewed and evaluated for effectiveness at least annually and updated as necessary. The results of the review will be transmitted to the Department Chair of all departments that have laboratories controlled by the CHP and to the person supervising the EHS Director. Any changes in the Chemical Hygiene Plan will be transmitted to employees in the next scheduled training.

8. Document Retention

The following documents are retained at these locations for three years, unless otherwise indicated:

Document	Location	Retention	Responsible Party
Chemical Hygiene Plan	Web or other location available to all employees	Retain current	EHS Director
Laboratory-specific PPE & Hazard Evaluations (including corrective actions)	EHS files	5 years	EHS Director
Laboratory-specific SOPs	Laboratory Supervisor files	Retain current	Laboratory Supervisor
Training Records	EHS	3 years	EHS Director
Laboratory-specific Training Records (records recommended)	Laboratory Supervisor files	3 years	Laboratory Supervisor
Inspection Records and Corrective Actions	Laboratory, EHS files, or web-based inspection software	1 year	Laboratory Supervisor
Exposure Assessment Records	EHS	30 years	EHS Director
SDS Records	Designated online system for SCU SDSs	Retain current	EHS Director
Medical Consultation Records	Medical File	Length of employment + 30 years	Human Resources

9. Key References and Resources

The documents listed below may be obtained from EHS:

- 8 CCR 5191 Chemical Hygiene Plan Requirements
- SCU Injury and Illness Prevention Plan
- SCU Hazard Assessment and Control Program
- SCU Chemical Inventory System Policy
- SCU Biosafety Program
- SCU Radiation Safety Program
- SCU Hoods, Spray Booths and Ventilation Program
- SCU Emergency Eyewash and Shower Program
- SCU Hazardous and Universal Waste Program
- SCU Wastewater Program

10. Program Approval

Signature on file in EHS office	7/3/2025
Signature	**Date**
Samantha Nordberg Sr Director, Environment, Health and Safety	

11. Revision History

Revision Number: 1		
Name	**Title**	**Department**
Jeff Charles	Director	Facilities
Esther Pham	Director	Office of Research Initiatives
John Hyde	Lab Technician	Chemistry
Daryn Baker	Lab Manager	Biology
Janice Edgerly Rooks	Department Chair	Biology
John Gilbert	Department Chair	Chemistry
Yuling Yan	Director	Bioengineering
John Birmingham	Department Chair	Physics
Revision Number 2: **Minor changes based on 2012 Review**		
Sean Collins	Director	Environment, Health and Safety
Revision Number 3: **Minor changes based on 2014 Review – Updated for GHS and LabCliQ**		
Sean Collins	Director	Environment, Health and Safety
Revision Number 4: **Updates based on 2025 Review:** Major addition: WCPP for dichloromethane (methylene chloride) use Other changes: Lab hazard classification, inspection schedule, chemical inventory/SDS database, Restricted Substances requirements		
Yizheng Tan	Lab Safety Manager (Chemical Hygiene Officer)	Environment, Health and Safety

Appendix 1 – General Laboratory Standards

The following general standards should be followed by employees and students performing laboratory work with chemicals and hazardous materials. These general guidelines can be modified based on a written laboratory-specific evaluation of hazards and risks which lead to a laboratory-specific operation and protective equipment program.

Employees and students should:

- Know the safety rules and procedures that apply to the work that is being done
- Determine the potential hazards and appropriate safety precautions before beginning any new operation
- Know the location of and how to use the emergency equipment in the work area, as well as how to obtain additional help in an emergency, and be familiar with emergency procedures
- Be alert to unsafe conditions and actions and call attention to them so that corrections can be made as soon as possible
- Use equipment only for its designed purpose
- Use only those chemicals for which appropriate safety controls and protective equipment are available
- Eating, drinking, smoking, gum chewing, or application of cosmetics should not occur in areas where laboratory chemicals are present
- Wash their hands prior to leaving the laboratory after using chemicals, even if gloves or other similar PPE was employed
- Do not store or handle food or beverages in storage areas, refrigerators, glassware, or areas that are also used for laboratory operations
- Refrain from using personal electronics such as cell phones in the laboratory
- Refrain from using noise-cancelling headphones or earphones in the laboratory
- Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware
- Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur
- Leave all protective equipment in the lab when exiting including lab coats and protective gloves
- Avoid practical jokes or other behavior that might confuse, startle, or distract other workers
- Do not use mouth suction for pipetting or starting a siphon
- Confine long hair and loose clothing

- Wear closed-toe shoes that encloses the entire feet at all times in the laboratory; NO SANDALS ARE PERMITTED TO BE WORN IN THE LABORATORY
- Safety goggles or alternative eyewear that was designated through the hazard review process must be worn in the lab at all times when chemicals are present and in use
- Long pants or skirt covering legs and ankles must be worn in the laboratory. Bare midriff, legs, or shoulders are not allowed in the laboratory as directed by the laboratory supervisor
- Dispose of chemicals properly at the end of the experiment. Never put hazardous chemicals down the drain unless specific authorization has been granted
- Hazardous experiments should not be unattended
- All new procedures must be evaluated for potential hazards associated with the work by the laboratory supervisor
- Report incidents following the SCU **Injury and Incident Reporting Process** (EHS Website: Incident Reporting)

The following resources are available for those who wish to explore additional or alternative controls:

- Safety Data Sheets (SDS) for the materials in question, available at https://chimeracloud.org/sds/
- "Safety in Academic Chemistry Laboratories" American Chemical Society. https://www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/publications/safety-in-academic-chemistry-laboratories-students.pdf

Appendix 2 - Definitions

Action level: The airborne chemical concentration that triggers air monitoring and the implementation of additional control measures. The action level is always lower than the corresponding Cal/OSHA permissible exposure limit (PEL) and is designed to protect personnel from overexposure. Best Management Practice is to use the more conservative of either the Cal/OSHA defined action level (generally one-half the PEL) or one-half the ACGIH Threshold Limit Value.

Aerosol: any non-refillable receptacle containing a gas compressed, liquefied, or dissolved under pressure, and fitted with a release device allowing the contents to be ejected as particles in a suspension in a gas, or as a foam, paste, powder, liquid, or gas.

Carcinogen: See "Select Carcinogen"

Compressed gas: See "Gases under Pressure"

Controlled substances: Drugs and certain other chemicals, both narcotic and non- narcotic, which come under the jurisdiction of federal (DEA) and state laws regulating their manufacture, sale, distribution, use and disposal.

Corrosive: Substance causing irreversible destruction of living tissue by chemical action at the site of contact (dermal or respiratory). Major classes of corrosive substances include strong acids, strong bases, and dehydrating agents.

Cryogenic liquids (or cryogens): Liquids with extremely low boiling points, below -238 °F or -150 °C. Common examples of cryogenic liquids are liquid nitrogen, helium, and argon. One special property of both cryogenic liquids and dry ice (frozen carbon dioxide) is that they undergo substantial volume expansion when converted to a gas phase, which can potentially lead to an oxygen deficient atmosphere where ventilation is limited.

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

Flammable: (Per 29 CFR 1910.1200 Appendix B) a chemical that falls into one of the following categories:

- Flammable gas: gas having a flammable range in air at 20 °C (68 °F) and a standard pressure of 101.3 kPa (14.7 psi)
- Flammable liquid: liquid having a flash point below 93 °C (199.4 °F)
- Flammable Solid: solid which is a readily combustible solid, or which may cause or contribute to fire through friction. Readily combustible solids are powdered, granular, or pasty chemical which are dangerous if they can be easily ignited by a brief contact

with an ignition source, such as a burning match, and if the flame spreads rapidly.

Gases under Pressure: (Per 29 CFR 1910.1200 Appendix B) Gases which are contained in a receptacle at a pressure of 200 kPa (29 psi) or more at 20 °C (68 °F), or which are liquefied or liquefied and refrigerated. They comprise compressed gases, liquefied gases, dissolved gases, and refrigerated liquefied gases:

- Compressed gas: A gas when under pressure is entirely gaseous at -50 °C (-58 °F)
- Liquefied gas: A gas when under pressure is partially liquid at temperatures above -50 °C (-58 °F)
- Refrigerated liquefied gas: A gas which is made partially liquid because of its low temperature
- Dissolved gas: A gas which is under pressure is dissolved in a liquid phase solvent

Hazardous chemical: (Per Cal/OSHA 8 CCR 5191) Any chemical classified as a health hazard or simple asphyxiant in accordance with the 8 CCR 5194 (Hazard Communication Standard)

Health Hazard: A chemical that is classified as posing one of the following hazardous effects: acute toxicity; skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenicity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); or aspiration hazard. Criteria for determining whether a chemical is classified as a health hazard are detailed in 8 CCR 5194(c)

Acute Toxicity: refers to serious adverse effects (i.e. lethality) occurring after a single or short-term oral, dermal, or inhalation exposure to a substance or mixture. Different categories depending on oral, dermal, or inhalation route based on median lethal dose, LD50 (oral, dermal) or median lethal concentration LC50 (inhalation) values

Incompatible: Materials that could cause dangerous reactions by direct contact with one another.

Irritant: a substance, which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. (dermal, eye, or respiratory).

Laboratory Supervisor: The individual in charge of the laboratory. It may be a Principal Investigator (PI), laboratory instructor, laboratory manager, or laboratory associate, or other designated personnel. The laboratory supervisor is appointed by the Department Chair or the laboratory director.

Non-laboratory personnel: Workers such as administrative staff, plumbers, and Heating,

Ventilation & Air Conditioning (HVAC) technicians entering research laboratories to perform maintenance, administrative, or other non-research laboratory tasks.

Organic peroxide: (Per 29 CFR 1910.1200 Appendix B) An organic compound that contains the bivalent –o-o- structure and as such is considered a derivative of hydrogen peroxide where one or both of the hydrogen atoms have been replaced by organic radicals.

Oxidizer: (Per 29 CFR 1910.1200 Appendix B) A chemical (gas, liquid or solid) while in itself not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material. For gases, cause or contribute to the combustion of other materials more than air does

Permissible exposure limit (PEL): Per Cal/OSHA, the maximum permitted 8-hour time-weighted average concentration of an airborne contaminant.

Physical Hazard: A chemical that is classified as posing one of the following hazardous effects: explosive, flammable (gas, aerosols, liquids, or solids); combustible liquid; oxidizer; self-reactive; pyrophoric; self-heating; organic peroxide; corrosive to metal; gas under pressure; in contact with emits flammable gas; water-reactive; or combustible dust. The criteria for determining whether a chemical is classified as a physical hazard are in 8 CCR 5194(c)

Pyrophoric: (Per 29 CFR 1910.1200 Appendix B))

- Pyrophoric Gas: flammable gas that is liable to ignite spontaneously in air at a temperature of 54 °C (130 °F)
- Pyrophoric Liquid or Solid: liquid or solid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air

Reproductive toxin: (Per Cal/OSHA 8 CCR 5191) A chemical that affects the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis). Under Proposition 65, the State of California maintains a list of known chemicals causing reproductive toxicity.

Restricted Substances: substances that require prior approval by CHO before purchase and use (Appendix 8 contains the list of substances).

Standard Operating Procedure (SOP): a written set of instructions that document how to safely perform work involving hazardous materials or hazardous operations.

Sensitizer: A substance that can cause exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the substance. The reaction may be as mild as a rash (contact dermatitis) or as serious as anaphylactic shock.

Select agents: Bacteria, viruses, toxins, rickettsia, and fungi identified by the United States Department of Health and Human Services (HHS), Centers for Disease Control and Prevention (CDC), the United States Department of Agriculture (USDA), and the Animal and Plant Health Inspection Service (APHIS) that pose a potential threat to public health or welfare. NOTE: The safety practices and precautions provided by the Chemical Hygiene Plan is most applicable with the use of Select Agent toxins as opposed to infectious agents. List of these agents is available at: CDC Select Agents. Researchers who use infectious agents in their work are also potentially subject to SCU's **Biosafety Program** and should evaluate their obligations under that program.

Select carcinogen: (Per Cal/OSHA 8 CCR 5191) A substance or agent that meets one of the following criteria:

1. It is regulated by Cal/OSHA as a carcinogen.
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 ("carcinogenic to humans") by the International Agency for Research on Cancer (IARC).
4. It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

   (a) 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/m3;
   (b) After repeated skin application of less than 300 mg/kg of body weight per week; or
   (c) After oral doses of 50mg/kg of body weight per day.

Substitution: When designing and planning a laboratory operation, using the least hazardous chemical possible to minimize risk to personnel and property.

Toxic gas: A material that is regulated under Santa Clara County's Toxic Gas Ordinance as:

Class I Material: Has a median Lethal Concentration (LC 50) in air of 200 parts per million or less by volume of gas or vapor, or 2 milligrams per liter or less of mist, fume or dust, when administered by continuous inhalation for an hour, or less if death occurs within one hour, to albino rats weighing between 200 and 300 grams each.

Class II Material: Has a LC 50 in air more than of 200 parts per million but not more than 3,000 parts per million by volume of gas or vapor, or more than 2 milligrams per liter but not more than 30 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for an hour, or less if death occurs within one hour, to albino rats weighing between 200 and 300 grams each.

Class III Material: Has a LC 50 in air more than of 3,000 parts per million but not more than

5,000 parts per million by volume of gas or vapor, or more than 30 milligrams per liter but not more than 50 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for an hour, or less if death occurs within one hour, to albino rats weighing between 200 and 300 grams each.

Unstable (self-reactive): (Per 29 CFR 1910.1200 Appendix B) Thermally unstable liquid or solid chemical liable to undergo a strongly exothermic decomposition even without participation of oxygen (air)

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

Appendix 3 – Personal Protective Equipment Guidelines

Minimum attire and PPE requirements for laboratory entry are detailed in the General Requirements section of this document. Each lab will be assessed to identify additional PPE appropriate for the space and the specific task. Below are general guidelines for PPE use:

Eye Protection

Eye protection is required for all employees whose eyes may be exposed to chemical or physical hazards. Side shields on safety glasses provide some protection against splashed chemicals or flying particles, but goggles or face shields (with safety glasses) are required when there is a greater than average danger of eye contact such as when pouring, agitating, or heating large amounts of liquid materials.

A higher than average risk exists when working with highly reactive chemicals, concentrated corrosives, or with vacuum or pressurized glassware systems. At a minimum, safety glasses with side shields shall be worn when handling, mixing, heating, stirring, or transferring chemicals unless a specific alternative eyewear has been approved.

Safety glasses do not need to be worn while viewing through the eyepieces of optical equipment such as microscopes, macroscopes, or similar equipment where there is no external hazard and the safety glasses interfere with vision while performing research. Safety glasses must be replaced to protect eyes as soon as this equipment use is completed.

Body and Hand Protection

Lab coats or other similar clothing protectors are required for all laboratory employees who may be exposed to chemicals, unless alternate means of protection have been approved. This includes laboratories that work with select carcinogens (California Code of Regulations, Title 8, Article 110, "Regulated Carcinogens"), reproductive toxins, substances which have a high degree of acute toxicity, strong acids and bases, and any substance for which the SDS lists a significant skin hazard. Lab coats, aprons, face shields, etc. will be removed and stored in the designated location when leaving the lab.

Gloves made of appropriate material (glove material(s) compatible with the chemical hazard or physical hazard potentially exposed to) are required to protect the hands and arms from thermal burns, cryogenic materials, cuts, or chemical exposure that may result in absorption through the skin or reaction on the surface of the skin. Gloves are also required when working with hazardous substances where possible transfer from hand to mouth must be avoided. Gloves are required for work involving pure or concentrated solutions of select carcinogens, reproductive toxins, substances which have a high degree of acute toxicity, strong acids and bases, and any substance with significant skin hazard. If one pair of gloves is deemed insufficient for protection, double gloving is recommended. As with lab coats, gloves are generally to be removed and stored/disposed in the designated location prior to leaving the laboratory.

Reusing disposable gloves should be avoided. Once gloves are contaminated, damaged, or the task requiring PPE is completed, safely remove them and discard in the appropriate waste container. Use the following steps for safe removal of disposable gloves:

1. Pull one glove near your wrist towards your fingertips until the glove folds over. Carefully grab the fold and pull towards your fingertips. As you pull you are turning the inside of the glove outwards.
2. Pull the fold until the glove is almost off.
3. To avoid contamination of your environment, continue to hold the removed glove. Completely remove your hand from the glove.
4. Slide your finger from your glove free hand under the remaining glove. Continue to slide your finger towards your fingertips until almost half of your finger is under the glove.
5. Turn your finger 180 degrees and pull the glove outwards and towards your fingertips. As you do this, the first glove will be encased in the second glove. The inside of the second glove will also be turned outwards.
6. Grab the gloves firmly, by the uncontaminated surface (the side that was originally touching your hand). Release your grasp of the first glove you removed. Pull your second hand free from its glove.
7. Dispose of the gloves properly.

Gloves should be carefully selected using guides from the manufacturers. General selection guides are available; however, glove-resistance to various chemical materials will vary with the manufacturer, model and thickness. Information concerning gloves and compatibility can be obtained from various glove charts. An example of such a chart is at Table 4 in OSHA Publication 3151: Personal Protective Equipment (pages 26-29). The CHO can provide further assistance in making the proper glove selection.

Respiratory Protection

Respiratory protection is generally not necessary in the laboratory and must not be used as a substitute for adequate engineering controls. Availability of respiratory protection for emergency situations may be required when working with chemicals that are highly toxic and highly volatile or gaseous. If an experimental protocol requires exposure above the action level (or PEL) that cannot be reduced, respiratory protection will be required. Personnel will not be allowed to wear respiratory protection until they have been properly trained, fit-tested, and certified by the EHS Department.

The EHS Department will designate areas, activities, and tasks that require specific types of personal protective equipment as described above. If there are questions concerning the type of Personal Protective Equipment (PPE) that should be used for the chemical(s) in use, contact the CHO or the EHS Department.

Appendix 4 – Sample Laboratory Inspection Checklist

Laboratory Supervisor: _____ Department: _____

Building: _____ Room: _____

Inspector(s): _____ Inspection Date: ____/____/____

*Provide an explanation or corrective action on the next page for responses. Be sure to retain all documentation regarding inspections, including findings **and** corrective actions taken for a minimum of 1 year. Contact EHS for questions or additional information.*

General Safety

Yes	No	N/A	Inspected Item
			1) Have there been any changes in the setup of the laboratory or types of processes and procedures conducted in the laboratory? *If there has been a change, stop this inspection and request that a Laboratory Risk and Hazard Assessment and/or PPE Assessment be conducted.*
			2) Are the appropriate warning signs posted at the lab door (radioactive, flammable, corrosive, etc.)?
			3) Does the chemical fume hood have the annual inspection, flow rate test and flow rate indicator?
			4) Are the areas around fire extinguishers, pull alarms, emergency showers/eyewash, and electrical panels clear?
			5) Is there an eighteen-inch vertical clearance maintained from fire sprinkler heads (e.g., over shelves)?
			6) Are the cabinets, furniture, and equipment taller than 4 feet seismically anchored?
			7) Are the refrigerators/freezers/microwaves labeled either "Food & Drink Only" or "No Food & Drink" and "Flammable Storage" or "No Flammable Storage" as appropriate?
			8) Are food and drink present in laboratory?
			9) Are any extension cords and power strips daisy chained and are there permanent extension cords in use?
			10) Are there unapproved uses of portable heaters or halogen lamps?
			11) Is there exposed wiring or damaged electrical cords?
			12) Are soldering and heat guns unplugged when not in use?
			13) Are ceramic hot plates cracked or otherwise damaged?
			14) Are floors dry with aisles and doorways unobstructed with 36" minimum clearance (i.e. no material storage or other blockages)?
			15) Are bench tops (including hoods) reasonably organized and clean?
			16) If present, are exit signs visible?
			17) Exit doors can be opened from the inside without special knowledge, keys, slide bolts or locks?
			18) Is PPE, as specified by the Laboratory Hazard Assessment, available and in use?

Hazardous Materials and Waste

Yes	No	N/A	Inspected Item
			19) All containers, including non-hazardous chemicals and wastes, legibly labeled and for hazardous chemicals and waste, labeled according to the SCU Hazard Label requirements (Appendix 9 of the Chemical Hygiene Plan)?
			20) Incompatible materials and wastes are properly segregated?
			21) Chemical and waste containers are in good condition, free of spillage in the secondary containment and closed except during use (no funnels)?
			22) Flammable liquids (including flammable waste and acetic acid) are stored in flammable cabinets or refrigerators as appropriate when not in use?
			23) Are hazardous materials or wastes are stored near sinks or drains?
			24) Peroxide-forming chemicals (PFCs) are labeled according to the receipt date, opened date, and 'dispose by' date. Class B PFCs are tested every 3 months. PFCs past their discard by date or PFCs that tested positive for peroxides are disposed in a timely manner
			25) Extremely Hazardous wastes are properly identified and kept in quantities of less than one quart?
			26) Do the hazardous waste labels indicate that the waste has not been stored more than nine months?
			27) Is the red bag hazardous waste treated/disposed of within 7 days?
			28) Laboratory practices minimize volatilization (i.e. traps used, open-container procedures minimized)?
			29) Is storage in fume hoods minimized and sashes are kept closed when not in use?
			30) Glass and sharps (needles, syringes, razor blades, etc.) are disposed in appropriately labeled sharps container?
			31) Have the eyewash, safety shower and/or fire extinguisher been inspected in the last 30 days?

Compressed Gas

Yes	No	N/A	Inspected Item
			32) Cylinders greater than 26" tall are secured to a rigid structure at 1/3 and 2/3 heights with metal chains?
			33) Cylinder valves are closed and valve caps in place when cylinders not in use?
			34) Are incompatible cylinders (i.e. oxygen and hydrogen) separated by distance or fire-resistant barriers, while in storage?

Training

Yes	No	N/A	Inspected Item
			35) Do student employees work in this area? (If Yes, answer the following question)
			36) Have students/employees received area-specific training within the last 12 months?

Comments:

List the number of the Inspection Checklist Item marked no and the explanation and/or corrective action:

Checklist Item #	Explanation and/or Corrective Action	Proposed Corrective Action Completion Date and who will complete it

Appendix 5 - Standard Operating Procedures (SOPs)

The special precautions described in the following sections are to be used in conjunction with the information detailed in the Appendix 1 - General Laboratory Standards. The special precautions sections and any other relevant instructions in this Chemical Hygiene Plan may be used as part of the written standard operating procedures required by the OSHA Laboratory Standard. **Project-specific and/or area-specific standard operating procedures must be written by departments, work units, Supervisors, Laboratory Supervisors for hazardous chemical and hazardous operations work not covered by the following special precautions sections.**

The use of certain chemicals (for example, toxic gases, pyrophoric substances, and the 13 specific carcinogens that require OSHA notice) must be pre-approved by the CHO due to the likelihood of specific permitting or exposure control requirements (see Appendix 8, Restricted Substances for more details).

Physical & Chemical Hazards

"Physical hazard" refers to a chemical for which there is evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive), corrosive, or water-reactive. Materials which present a physical hazard can be safely used if the specific hazard(s) are understood, and measures are taken to address the hazards. If appropriate precautions are not taken, a fire, an explosion, unwanted corrosion, personal injury, or property damage could occur. Certain chemicals cannot be safely mixed or stored with other chemicals because a severe reaction can take place or an extremely toxic reaction product can result.

An eyewash and safety shower must be readily accessible to areas where hazardous materials are used and stored. In the event of skin or eye contact with a hazardous material, immediately flush the area of contact with cool water for 15 minutes. Remove all affected clothing. Get medical help by calling Campus Safety (408-554-4444). Additional information concerning eyewash and safety shower requirements is available in SCU's **Emergency Eyewash and Shower Program**.

Laboratories present special challenges in the prevention of repetitive stress injuries. Laboratory employees are urged to contact EHS to request an ergonomic workstation evaluation if they have any concerns regarding the setup of their workstations.

Working with Flammables:

Flammable/combustible materials are materials which under standard conditions can generate sufficient vapor to cause a fire in the presence of an ignition source. Flammable materials can generate sufficient vapors at temperatures below 199 °F (93 °C). The vapors of these materials are invisible, and a vapor trail to an ignition source away from the immediate area can result in a flashback. Flammables are more hazardous at elevated

temperatures due to more rapid vaporization. In addition, flammable materials react with oxidizers which can result in a fire. Observe the following special precautions:

1. Eliminate ignition sources such as open flames, smoking materials, hot surfaces, sparks from welding or cutting, operation of electrical equipment, and static electricity.
2. Minimize the quantity of flammable materials kept in the work area.
3. Store in approved flammable liquid containers (original containers or safety cans) and storage cabinets, or in a special storage room designed for that purpose. Store away from oxidizers.
4. Flammable liquids stored in glass containers shall not exceed 1 quart. Exception: For conditions where chemical purity must be protected, flammable liquids stored in glass containers shall not exceed 1 gallon unless specific permission for such use has been granted.
5. Refrigerators and freezers used for the storage of flammable materials must have no internal sources of ignition ("lab-safe" or "flammable rated").
6. Ensure that there is proper bonding and grounding when it is required, such as when transferring or dispensing a flammable liquid from a large container or drum. Bonding and grounding must be checked regularly.
7. Ensure that appropriate fire control systems or extinguishers are available and accessible.

Working with Corrosives:

Corrosives are materials that can react with the skin causing burns similar to thermal burns, and/or which can react with metal causing deterioration of the metal surface. Acids and bases are corrosives. Observe the following special precautions:

1. Containers and equipment used for storage and processing of corrosive materials should be corrosion resistant.
2. Eye protection (safety glasses or splash goggles, as appropriate) and rubber gloves should always be used when handling corrosive materials. A face shield, rubber apron, and rubber boots may also be appropriate, depending on the work performed.
3. When mixing concentrated acids (caustics) with water, add the acid (caustic) slowly to water. **Never add water to acid (caustic)**.
4. Acids and bases should be stored separately from each other. Organic acids should be stored with flammable materials, separate from oxidizers and oxidizing acids.

Working with Oxidizers

Oxidizers are materials that readily yield oxygen or another oxidizing gas, or that readily

react to promote or initiate combustion of flammable/combustible materials. **Oxidation reactions are a frequent cause of chemical accidents.** Observe these precautions to reduce risk when storing or handling oxidizers:

1. Know the reactivity of the materials involved in experiment or process. Make sure that there are no extraneous materials in the area which could become involved in a reaction.
2. If the reaction can be violent or explosive, use shields or other methods for isolating the materials or the process.
3. Use the minimum amounts necessary for the procedure. Do not keep excessive amounts of the material in the vicinity of the process.
4. Store properly, away from organic materials, flammable materials, and other reducing agents.
5. Perchloric acid should be used only in specially-designed perchloric acid fume hoods equipped with wash-down systems to prevent deposition of shock-sensitive perchlorates in the ductwork and machinery. Contact the CHO for review and approval if use of concentrated or hot perchloric acid is needed.

Working with Water-Reactive Materials

Water-reactive materials are substances that generate a flammable, toxic, or hazardous gas upon contact with water or moisture. Fire and explosion are serious concerns when working with these materials. Special precautions for safe handling of water-reactive materials will depend on the specific material, and the conditions of use and storage.

Contact CHO for information on the safe use and storage of a specific material. Examples of water-reactive materials include alkali and alkaline earth metals (e.g. Li, Na, K, Ca, Mg), metal hydrides, some metal and nonmetal chlorides (e.g. $SiCl_4$, PCl_3, $AlCl_3$), calcium carbide, and acid halides.

Working with Pyrophoric Materials

Pyrophoric materials ignite spontaneously upon contact with air. The flame may or may not be visible. Examples include butyllithium, silane, and yellow phosphorous.

Contact CHO for information on the safe use of pyrophorics. All pyrophorics must be stored in an inert atmosphere.

Working with Peroxide-Forming Chemicals (PFCs)

Peroxide-forming or peroxidizable chemicals are substances or mixtures that react with oxygen to form peroxides. Some peroxides can explode with impact, heat, or friction such as that caused by removing a lid. Peroxides form inside the containers of some materials even if they have not been opened. Examples include ethyl ether, tetrahydrofuran, liquid paraffins (alkanes), and olefins (alkenes).

Follow the Guideline for Peroxide-Forming Chemicals (EHS Website: Laboratory Safety) to

ensure PFCs are managed appropriately. Contact CHO for further guidance on safe use of PFCs.

Working with Light-Sensitive Materials

Light-sensitive materials are unstable with respect to light energy. They tend to degrade in the presence of light, forming new compounds that can be hazardous, or resulting in conditions such as pressure build-up inside a container which may be hazardous. Observe the following precautions:

1. Store light-sensitive materials in a cool, dark place in amber colored bottles or other containers that reduce or eliminate penetration of light.
2. Date containers on receipt and upon opening, and dispose of surplus material after one year if unopened or 6 months if opened.

Working with Shock-Sensitive or Explosive Materials

Shock-sensitive/explosive materials are substances or mixtures which can spontaneously release large amounts of energy under normal conditions, or when struck, vibrated, or otherwise agitated. Some materials become increasingly shock-sensitive with age and/or loss of moisture. The inadvertent formation of shock-sensitive/explosive materials such as peroxides, perchlorates, picrates, and azides is of great concern in the laboratory.

1. Contact the CHO when work with shock-sensitive or explosive materials is planned or when it is suspected that the inadvertent formation of shock-sensitive materials in ductwork, piping, or chemicals being stored has occurred.
2. Date all containers of explosive or shock-sensitive materials upon receipt and when opened. Unless an inhibitor has been added, unopened shock-sensitive materials should be discarded within 12 months after receipt. Open containers of shock-sensitive materials should be discarded within 6 months of the date opened.
3. Use the minimum amount of materials necessary for a procedure. Keep a minimum amount of material on hand.
4. If there is a chance of explosion, use barriers or other methods for isolating the materials or the process.

Working with Gases Under Pressure (Compressed Gases)

Special systems are needed for handling materials under pressure. Toxic and corrosive gases present special problems in design of engineering controls. The physical and health hazards of any material are typically compounded by the pressure hazard. Carefully observe the following special precautions:

1. Signs shall be provided by the CHO and posted by the Laboratory Supervisor identifying type of cylinders to be stored and identifying any potential hazard.
2. Compressed gas cylinders shall be stored and secured in an upright position. Gas cylinders in storage and in use shall be kept tightly secured with chains. City of Santa

Clara Fire Department requirements for gas cylinder restraints are ¼ inch thick steel welded link chain secured around the cylinder at 1/3 the height of the cylinder and 2/3 the height of the cylinder. The restraints shall be secured to the wall or counter in such a manner to prevent demounting due to a moderate earthquake. Lecture bottles shall be supported in a lecture bottle tube support to provide upright support.

3. Always use the smallest size cylinder required to perform the work.
4. Cylinders of compressed gases must be handled as high energy sources.
5. Cylinders on wheeled carts must be capped and secured by an approved (either UL or FM listed) cylinder support strap or chain. The cart must be an approved cylinder cart. Do not attempt to take a loaded cylinder cart up or down a stairway.
6. Close the gas cylinder at the top of the tank when not in use and remove the regulator if the cylinder is not to be used for an extended period of time. Lecture size gas cylinders are too small to have valve protective caps.
7. Cylinders shall be stored and transported with the protective valve cap in place to prevent damage to the cylinder valve in the event the cylinder falls or the valve sustains impact. No cylinder shall be stored or transported with the regulator still installed.
8. All uncapped cylinders must be secured independently (not ganged behind a single chain) to a solid element of the lab structure. Carts are not acceptable for supporting uncapped or in-use cylinders.
9. Never bleed a cylinder completely empty. Leave a slight pressure to keep contaminants out.
10. Do not lubricate an oxygen regulator or use a fuel gas regulator on an oxygen cylinder. Oil or grease on the high-pressure side of an oxygen cylinder can cause an explosion.
11. Always wear goggles or safety glasses with side shields when handling compressed gases.
12. Always use appropriate gauges, fittings, and materials compatible with the particular gas being handled. Regulators must be compatible with gas cylinders (do not use adapters).
13. All compressed gas cylinders and chemical containers should be stored away from heat sources and direct sunlight.
14. Wherever carbon monoxide or hydrogen sulfide is present in quantities greater than one standard lecture bottle size, detection alarms must be present and properly tested and maintained.
15. Wherever hydrogen is present, all tubing must be of braided stainless-steel hose.
16. Alternative tubing materials shall be reviewed by CHO on a case-by-case basis, to

ensure that the alternative materials meet fire protection requirements.

17. When work with other toxic, corrosive, or reactive gases is planned, the CHO should be contacted for information concerning specific handling requirements for the gas involved. (see Appendix 8, Restricted Substances) Generally, these gases will need to be used and stored with local exhaust ventilation such as a lab hood or a gas cabinet and a formal permit with the Santa Clara Fire Department may be required as per City Ordinance.

Working with Cryogens and Dry Ice

Some of the hazards associated with cryogens (fluids used to maintain extremely low temperatures such as liquid nitrogen) and dry ice are fire, pressure, embrittlement of materials, and skin or eye burns upon contact with the liquid. Cryogens can condense nearly pure liquid oxygen from the air, creating a severe fire risk. A pressure hazard exists because of the large expansion ratio from liquid to gas, causing pressure build up in containers. The large expansion ratio may displace oxygen gas in the lab, potentially introducing an asphyxiation hazard. Many materials become brittle at extreme low temperatures. Brief contact with materials at extreme low temperatures can cause burns similar to thermal burns. Carefully observe the following special precautions:

1. Equipment should be kept clean, especially when working with liquid or gaseous oxygen.
2. Mixtures of gases or fluids should be strictly controlled to prevent formation of flammable or explosive mixtures.
3. For flammable cryogens the precautions for working with flammables section of this appendix should also be followed
4. Always wear goggles when handling cryogens. If there is a splash or spray hazard, a face shield over the goggles, an impervious apron or coat, cuff less trousers, and fully-covering, non-lacing shoes should be worn. Watches, rings, and other jewelry should not be worn. Gloves should be impervious and sufficiently large to be readily thrown off should a cryogen be spilled. Cryo-gloves or pot holders should also be used. Respirators or gas detection monitors may be required if the cryogen is toxic and sufficient local exhaust ventilation is not available. Contact CHO or EHS to determine if exposure monitoring is necessary.
5. Oxygen gas monitors equipped with alarms are required in spaces where there is a potential asphyxiation hazard. If oxygen concentration falls below the safe level and alarms activate, all lab occupants must evacuate the room and initiate appropriate emergency actions.
6. Containers and systems containing cryogens should have pressure relief mechanisms.
7. Containers and systems should be capable of withstanding extreme cold without becoming brittle. Glass containers should be taped solidly around the outside or

encased in plastic mesh.

8. Neither liquid nitrogen nor liquid air should be used to cool a flammable mixture in the presence of air because oxygen can condense from the air, which could lead to an explosion hazard.
9. Funnels should not be used for pouring liquid nitrogen or any other cryogen.
10. Large mobile dewars or liquid nitrogen refrigerators (or the trolleys carrying these) used for transporting cryogens within a building or between buildings should be equipped with a braking mechanism.
11. Large containers with cryogen should be transported on a freight elevator, if one is available. No passengers may ride on the elevator during cryogen transport.
12. Large mobile dewars at risk for tipping should be transported on appropriate carts.
13. Wheeled trolleys may not be used if the vessel must pass over elevator thresholds or other slots/crevasses wider than 25% of the wheel width.
14. Dispensing stations designed to allow employees and students to fill smaller vessels from a larger self-pressurizing dewar must be located in non-public areas, and should be posted with standard operating procedures.
15. Smaller vessels of liquid nitrogen or other cryogens transported by hand within or between buildings must have a handle or bail, and must be covered.

Health Hazards

"Health hazard" refers to chemicals 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. This term includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system and agents which damage the lungs, skin, eyes, or mucous membranes.

For many toxic materials, hygienic standards have been established and action must be taken to prevent personnel from receiving exposures in excess of these standards. These standards may be referred to as threshold limit values (TLVs) or permissible exposure limits (PELs).

The SDS will list the hygienic standard for the hazardous chemical or each component of a mixture. In addition, the CHO can be contacted for information regarding published TLVs, PELs, other toxicology concerns. For more thorough review of a particular compound, or an evaluation of the exposure to a specific material used in the work area, contact the CHO.

Protection from health hazards is provided by ensuring that exposure to such hazards is minimized or eliminated. To minimize the exposure, it is necessary to determine the route

by which the exposure may occur, i.e. inhalation, skin contact, puncture, ingestion, or a combination of exposure routes.

Working with Allergens

The term allergens describe a wide variety of substances that can produce skin and lung hypersensitivity. Examples include diazomethane, chromium, nickel dichromates, formaldehyde, isocyanates, and certain phenols. Wear suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity. Conduct aerosol producing procedures in a fume hood.

Working with Reproductive Toxins

The term "reproductive toxins" is used to describe substances that cause harmful effects on the male or female reproductive system or the developing embryo and fetus. These effects include but are not limited to menstrual irregularity, lowered fertility, testicular atrophy, and birth defects. Embryotoxins or teratogens can cause malformations or death of an embryo or fetus. Because the period of greatest susceptibility to embryotoxins is the first 8-12 weeks of pregnancy, which includes a period when one may not know that one is pregnant, women of child-bearing potential should take care to avoid contact with these toxins. Special precautions when working with these substances include:

1. A review should take place for use of embryotoxins between the Laboratory Supervisor and CHO. Review continuing uses annually or whenever a procedural change is made.
2. Label embryotoxins as follows: EMBRYOTOXIN: READ SPECIFIC PROCEDURES FOR USE.
3. Store embryotoxins and reproductive toxins in unbreakable containers or unbreakable secondary containers in a well-ventilated area.
4. Guard against spills and splashes. Appropriate safety apparel, especially gloves, should be worn. All hoods, glove boxes, or other essential engineering controls should be known to be operating properly before work is started.
5. Report of all incidents of exposure or spills.

Working with Chemicals of Moderate Chronic or High Acute Toxicity:

Examples of chemicals of moderate chronic toxicity or high acute toxicity include diisopropylfluorophosphate, hydrofluoric acid, and hydrogen cyanide. Observe the following precautions:

1. Consult one of the standard compilations that list toxic properties of known substances and/or other reputable sources and learn what is known about the substance that will be used. Follow the specific precautions and procedures for the chemical.
2. Use and store these substances only in designated (restricted access) areas

placarded with appropriate warning signs.

3. Use a hood or other containment device for procedures that may result in the generation of aerosols or vapors; trap released vapors to prevent their discharge with fume hood exhaust.
4. Avoid skin and eye contact by use of safety eyewear, gloves, lab coat, and other protective apparel as appropriate.
5. Purchase and use the minimum amount necessary for the procedure.
6. Be prepared for accidents and spills. At least two people should be present at all times if compounds in use are highly toxic or of unknown toxicity.
7. Store breakable containers in chemically resistant trays; also work and mount apparatus above such trays or cover work and storage surfaces with removable, absorbent, plastic backed paper.
8. If a major spill occurs outside the hood, evacuate the area and call for assistance.
9. Thoroughly decontaminate or dispose of contaminated clothing or shoes. If possible, chemically decontaminate by chemical conversion to a less toxic product.
10. Store contaminated waste in closed, suitably labeled, impervious containers.

Working with Chemicals of High Chronic Toxicity

Examples of chemicals exhibiting high chronic toxicity include dimethylmercury, nickel carbonyl, benzo-a-pyrene, N-nitrosodiethylamine, and other human carcinogens or substances with high carcinogenic potency in animals

1. Conduct all transfers and work in designated (restricted access) areas: a restricted access hood, glove box, or portion of a lab, designated for use of highly toxic substances, for which all persons with access are aware of the substances being used and necessary precautions.
2. Protect vacuum pumps against contamination with scrubbers or HEPA filters and vent effluent into the hood.
3. Decontaminate vacuum pumps or other contaminated equipment, including glassware, before removing them from the designated area. Decontaminate the designated area before normal work is resumed there.
4. On leaving the area, remove protective apparel (placing it in an appropriate, labeled container) and thoroughly wash hands, forearms, face, and neck.
5. Use a wet wiping method or a vacuum cleaner equipped with a HEPA filter to decontaminate surfaces. DO NOT DRY SWEEP SPILLED POWDERS.
6. If using toxicologically significant quantities of a substance on a regular basis (in quantities above a few milligrams to a few grams, depending on the substance, 3 or more times per week), contact the CHO.

7. Keep accurate records of the amounts of these substances stored and used, the dates of use, and names of users.
8. The designated area must be conspicuously marked with warning and restricted access signs and all containers should be appropriately labeled with identity and warning labels (e.g., CANCER-SUSPECT AGENT).
9. Ensure that contingency plans, equipment, and materials to minimize exposures of people and property in case of accident are available.
10. For a negative pressure glove box, ventilation rate must be at least 2 volume changes/hour and at a pressure of at least 0.5 inches of water gauge. For a positive pressure glove box, thoroughly test for leaks before each use. In either case, trap the exit gases or filter them through a HEPA filter and/or appropriate chemical filter/ scrubber before releasing into a fume hood.
11. Use chemical decontamination whenever possible; ensure that containers of contaminated wasted are transferred from the designated area under the supervision of the CHO.

Working with Nanomaterials

Nanomaterials are materials or particles having at least one external dimension in the size range of approximately 1 – 100 nanometers. Work with nanomaterials in most laboratory setting specifically involves *engineered* nanomaterials, which are nanomaterials that have been intentionally designed and synthesized with very specific size, shape (e.g. sphere, rod, tubes), and other properties. These very small particles exhibit properties different from larger particles of the same composition, which potentially introduce additional health hazards. Contact the CHO if a risk assessment or further guidance is needed. Observe the following precautions:

1. Whenever possible, minimize handling of nanomaterials in a dry, powder form to avoid release of airborne particles. Nanomaterials dispersed in liquid or bound to a solid substrate/matrix generally present less risk of becoming airborne.
2. Perform any activities that may generate aerosols or airborne particles (e.g. handling powder, sonication, pouring, mixing) in a ventilated enclosure, such as fume hood or glove box/bag.
3. Clean up spills of nanomaterial solutions immediately to avoid drying of solvent and potential creation of airborne particles.
4. Clean work areas potentially contaminated with nanomaterials with wet wiping or vacuum cleaner equipped with a HEPA filter. Do not dry sweep or use compressed air.
5. Dispose waste nanomaterials as hazardous waste, unless they are known to be non-hazardous.

Appendix 6 – Laboratory Standard Operating Procedure (SOP) Template

Section A: Laboratory Information and SOP Description

Procedure Title	
Principle Investigator or Lab Manager:	
Date of Creation / Revision:	
Location(s) covered by this SOP (Building, Room numbers):	
Restricted substance use (see Appendix 8 of Chemical Hygiene Plan)	
☐	YES: additional regulatory permitting and/or requirements may be required. Contact the Chemical Hygiene Officer (CHO) for review and approval
☐	NO

SCOPE OF SOP	
This SOP is for a:	
☐	Specific laboratory procedure or experiment Examples: synthesis of chemiluminescent esters, folate functionalization of polymeric micelles, etc.
☐	Generic laboratory procedure that covers several chemicals Examples: distillation, chromatography, etc.
☐	Generic use of specific chemical or class of chemicals with similar hazards Examples: ethidium bromide, organic azides, mineral acids, etc.
Frequency: ☐ one time ☐ daily ☐ weekly ☐ monthly ☐ other: _____	
Duration per experiment (in minutes or hours)	
Brief Description:	

Section B: Safety Literature & Hazards Review

List all physical and health hazards associated with the chemicals, equipment, and/or process used in this SOP. Examples of potential hazards include: toxicity, reactivity, flammability, corrosivity, pressure, electrical, hot/cold. Include any references you are using for the safe and effective design of your process or experiment, e.g. safety literature, peer-reviewed journal articles.

Some Suggested Safety References:

- ACS Chemical Health and Safety (Journal publications): https://pubs.acs.org/journal/achsc5
- Laboratory Chemical Safety Summary (LCSS) by PubChem: https://pubchem.ncbi.nlm.nih.gov//docs/lcss
- Chemical Safety Library (CSL): https://safescience.cas.org/
- NOAA CAMEO Database of Hazardous Chemicals: https://cameochemicals.noaa.gov/
- NRC Prudent Practices in the Laboratory: https://nap.nationalacademies.org/catalog/12654/prudent-practices-in-the-laboratory-handling-and-management-of-chemical

B1. HAZARDOUS CHEMICALS OR AGENTS
List all physical and health hazard of hazardous chemicals in this SOP. Examples of potential hazards include: toxicity, reactivity, flammability, corrosivity. Include any applicable references

B2. HAZARDOUS EQUIPMENT OR PROCESS
List all hazards associated with equipment, process, or activities. Examples of potential hazards include: electrical, extreme temperatures (hot/cold), moving parts, large mass or volume, high pressure, high vacuum, UV, open flame. Include any applicable references

Section C: Hazard Controls

C1. ENGINEERING CONTROLS
☐ Local Exhaust ☐ Fume Hood ☐ Glove Box ☐ Biosafety Cabinet ☐ Other: _____

C2. PERSONAL PROTECTIVE EQUIPMENT (PPE)
THE MINIMUM PPE IN ALL WET LABS IS LONG PANTS/SKIRT, SHOES THAT ENCLOSE ENTIRE FEET, LAB COAT, AND SAFETY GLASSES. Specify below if there are any additional PPE required due to special or unusual hazard of the chemical or equipment involved Eyewear: ☐ Splash Goggles ☐ Face shield ☐ Other: _____ Special protective clothing: ☐ Chemical resistant apron ☐ Flame resistant lab coat ☐ Other: _____ Gloves: chemical compatibility, thickness, length, and disposable or reusable must be considered ☐ Nitrile ☐ Butyl ☐ Neoprene ☐ PVC ☐ Latex ☐ Silver shield or 4H ☐ Other: _____ Other: ☐ Respirator (Contact EHS for review if checked) Note: Respirators may not be used as a substitute for proper engineering controls ☐ Other PPE: _____
Special PPE requirement (e.g. double glove, face shield over safety glasses):

C3. TRAINING AND OTHER ADMINISTRATIVE CONTROLS
General Training (check all that apply): ☐ Chemistry and Biochemistry Camino Online Course

☐ Biology and Bioengineering Camino Online Course
☐ Other:

Laboratory Specific Training (check all that apply)
☐ Review of SDS for all chemicals involved in this SOP
☐ Review of this SOP
☐ Other: _____
Note: PIs are responsible to retain all lab-specific training records

Other Administrative Controls (e.g. posting signage, special work practice):

C4. STORAGE REQUIREMENT

Use this section to describe any special handling and storage requirements for the hazardous chemicals used in this SOP, especially for highly reactive/unstable, very flammable, and corrosive materials.

C5. STEP-BY-STEP OPERATING PROCEDURE

Step-by-Step Description of Procedure Include any step-specific hazard, PPE, engineering controls, special equipment, or designated work areas. (Guidance text below may be deleted when completing the form)	**Potential Risks if Step is Not Done or Done Incorrectly**
Put on required PPE:	
Check the location and accessibility of the safety equipment in your lab including fume hoods, safety showers, fire extinguisher, spill kits, etc.	
Describe next steps in the procedure. Add additional rows as necessary	
Dispose all hazardous solvents, solutions, mixtures, and reaction byproducts in the appropriate waste containers. Describe specific waste protocol	
Clean up work area and lab equipment Describe specific clean up and any specific decontamination procedure	
Remove PPE and wash hands	

C6. EMERGENCY PROCEDURES

Life-threatening emergencies (fire, explosion, hazardous material spill/release, gas leak, etc.)

1. Call SCU Campus Safety: 408-554-4444 or 911
2. Alert people in the vicinity and if necessary, activate the local alarm systems
3. Evacuate to your emergency assembly point (EAP). Fill in your EAP here: _____
4. Remain nearby to advise emergency responders

Medical emergencies:

1. Stay with the individual if it is safe to do so. Do not move the individual unless absolutely necessary
2. Call SCU Campus Safety or 911

3. Administer first aid if you are trained to do so

If person exposed to hazardous materials:

1. Remove the exposed individual from the area, unless it is unsafe to do so, and decontaminate:
   - Skin exposure: remove contaminated clothing and flush with water for at least 15 minutes. For large exposure to the body, use the safety shower
     *Note: For hydrofluoric acid exposure, flush for 5 minutes and then apply calcium gluconate gel to affected site. If calcium gluconate gel is not available, flush with water for at least 15 minutes. Emergency services must be immediately contacted for further medical attention, even if calcium gluconate gel treatment has been performed.
   - Eye exposure: flush under eyewash station for at least 15 minutes. Hold eyelids open and rotate the eyes to rinse all surfaces. Remove contact lenses during flushing
   - Chemical inhalation: move person to fresh air
2. Seek medical attention. If immediate medical attention is needed, contact SCU Campus Safety or 911

Spills

Small Spill (<1 L of non-toxic or low-hazard chemical): If comfortable doing so, contain the spill with appropriate absorbent materials. Clean the spill working from the outside perimeter in. Dispose soaked materials as hazardous waste. Follow the above procedure if there is an exposure. See section 6 of SDS for additional information

Large Spill (> 1 L or highly hazardous chemicals): If possible and safe to do so, contain the spill. Warn others and evacuate the lab. Call SCU Campus Safety and be prepared to provide information such as specific location, chemical name, any personnel exposure, and other relevant information. Follow the above procedure if there is an exposure. See section 6 of SDS for additional information

For hazardous materials releases that have impacted the environment (via the storm drain, soil, or air outside the building), call SCU Campus Safety

Building maintenance emergencies (e.g. power outages, plumbing leaks):
Call Facilities 408-554-4742

REPORT all injuries and incidents (including near misses) to faculty advisor and EHS

C7. APPROVAL

Chemical Hygiene Officer (CHO) approval is required if you plan to use a Restricted Substance (see Chemical Hygiene Plan)

CHO Name	Signature	Date

Appendix 7 – Ignition and Fuel Source Guide for Laboratories

Each Laboratory Supervisor is responsible for ensuring that there is effective fire prevention in their laboratory. For laboratories, most fire prevention depends on controlling potential sources of ignition and keeping potential fuel away from potential sources of ignition.

Typical potential sources of ignition in a laboratory include the following:

- Bunsen burners
- Soldering irons
- Portable Floor Heaters
- Heat guns
- Incompatible chemicals that mix
- Hot plates, ovens, and similar types of heaters
- Electrical equipment, especially items in poor repair
- Electrical cords and power strips (especially improperly used cords or items in poor repair – see the SCU Electrical Standards for further information on proper use of such items)

Typical potential sources of fuel in a laboratory include the following:

- Paper or cardboard of various types
- Flammable gases such as propane or natural gas
- Flammable or combustible liquids
- Plastics

The process of fire prevention involves:

1. Housekeeping and attention to ongoing operations to ensure that ignition and fuel sources are properly separated, and
2. Periodic inspections of electrical and other equipment to ensure that it is in good repair

Appendix 8 – Restricted Substances

SCU has developed a list of Restricted Substances that must be evaluated and formally approved prior to purchase and use. Restricted substances include chemicals that:

(a) Are highly hazardous, or have unique hazards requiring special procedures or equipment for containment, storage, safe use, emergency, and/or waste management,

(b) Could have wide impact to surrounding personnel, environment, and/or facilities infrastructure, if out of containment, or

(c) Have specific control, reporting, or permitting requirements for their use, per federal and local regulations

List of Restricted Substances:

Prior approval is required for work with the substances listed below:

- Any of the 13 "listed" carcinogens that requires reporting to Cal/OSHA
- Certain uses of "regulated" carcinogens that may require reporting to Cal/OSHA
- Toxic gases regulated by Santa Clara County (Link to relevant code: Toxic Gas Ordinance)
- DEA Controlled Substances (Link to DEA website: Drug Scheduling and List)
- Pyrophorics
- Highly Reactive, Water Reactive, or unstable materials, e.g. chemicals with an NFPA reactivity hazard of 3 or more
- Explosives, or materials that can easily decompose to explosive substances
- Cryogenic liquids, with the exception of small amounts of liquid nitrogen, argon, or helium (i.e. not exceeding common handheld dewars)
- Acutely toxic substances and gases, e.g. chemicals with an NFPA health hazard of 4
- Select Agents and Toxins (Link: List from CDC)
- High potency active pharmaceutical ingredients, with occupational exposure limit (OEL) of ≤100 $\mu g/m^3$
- Chemicals requiring special procedures or equipment for safe use, e.g. hydrofluoric acid, picric acid, concentrated (>70%) or hot perchloric acid
- Highly flammable gases, e.g. hydrogen, propane, if the use exceeds the size of a lecture bottle or similar
- Chemicals requiring a Workplace Chemical Protection Plan (WCPP) per EPA under Section 6 of the Toxic Substances Controls Act (TSCA) – see Appendix 10: WCPP for

laboratory use of dichloromethane (also known as methylene chloride)

Additional Restricted Substances beyond the list above may be identified by the Chemical Hygiene Officer (CHO).

Restricted Substances Approval Process

The laboratory supervisor is responsible to ensure that a Restricted Substances determination is made on existing chemical inventory and any future purchases for their laboratory. Contact the CHO for guidance if unsure whether a chemical is considered a Restricted Substance.

The laboratory supervisor must contact the CHO to request a formal review *prior* to purchasing a Restricted Substance. A hazard and risk assessment for the specific Restricted Substance must be conducted with the laboratory supervisor, laboratory operations director, and the CHO. Depending on the substance, additional input may be required by others, (e.g. Facilities, EHS).

The Restricted Substances request may be approved by the CHO once the following requirements have been met:

1. All appropriate equipment or facility infrastructure for safe containment and use are in place and operational
2. Completion of any permitting, registration, reporting, or exposure monitoring per regulatory requirements
3. A written laboratory-specific Standard Operating Procedure (SOP) for use of the Restricted Substance (see Appendix 6 for template). CHO review of the SOP is required.
4. Any additional necessary protocols to meet internal SCU or external regulatory requirements. These could include establishing:
    - Designated work area(s) and containment devices
    - Access controls
    - Warning signage
    - Decontamination procedure and waste management
    - Required recordkeeping (e.g. training and approved users, usage logs)
    - Exposure monitoring methods
    - Special first aid, spill or leak clean up procedures

Appendix 9 - SCU Hazard Label Requirements

Hazard Labeling and Examples

From Guide to California Hazard Communication Regulation published by Cal/OSHA:

If during the course of work, hazardous substances are transferred from the original container to a secondary portable container, the employer needs to ensure that the secondary container is labeled with the following information:

1. Identity of the hazardous substance
2. Hazard warning statements

Example of a secondary container label with hazard classes identified:

Chemical Name: Acetone

Hazard(s): ☒ Flammable ☐ Corrosive ☐ Toxic ☐ Reactive
☐ Oxidizer ☒ Irritant ☐ Non-Hazardous ☐ Other: _____

Owner: _____ **Date:** ____/_____/_____

Alternative label with NFPA diamond hazard warning:

Substance Name: Acetone

Prepared By: _____

Date: _____

Hazardous Waste Labeling Requirements

Satellite Accumulation Labels must have the following information, per regulatory requirement (https://dtsc.ca.gov/satellite-accumulation/):

- Accumulation start date (i.e., the date waste was first placed in the container)
- The words HAZARDOUS WASTE
- Composition of the waste
- Physical state of the waste (i.e., solid or liquid)
- Hazardous properties of the waste (e.g., flammable, corrosive, reactive, toxic)
- Name and address of the waste generator

Example:

HAZARDOUS WASTE

Santa Clara University (408) 554-4441 500 El Camino Real Santa Clara, CA, 95053

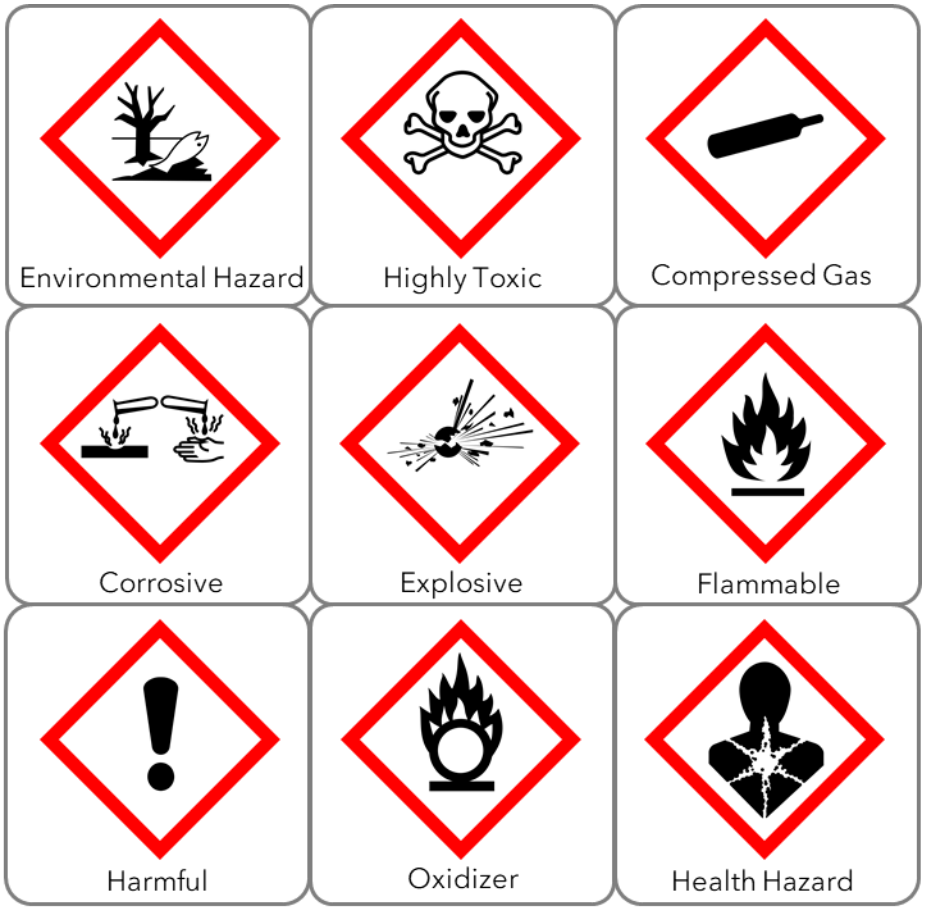
ACCUMULATION START DATE: 06 / 15 / 2024

WASTE COMPOSITION: Isopropanol 85%, water 10%, Potassium Hydroxide, 5%

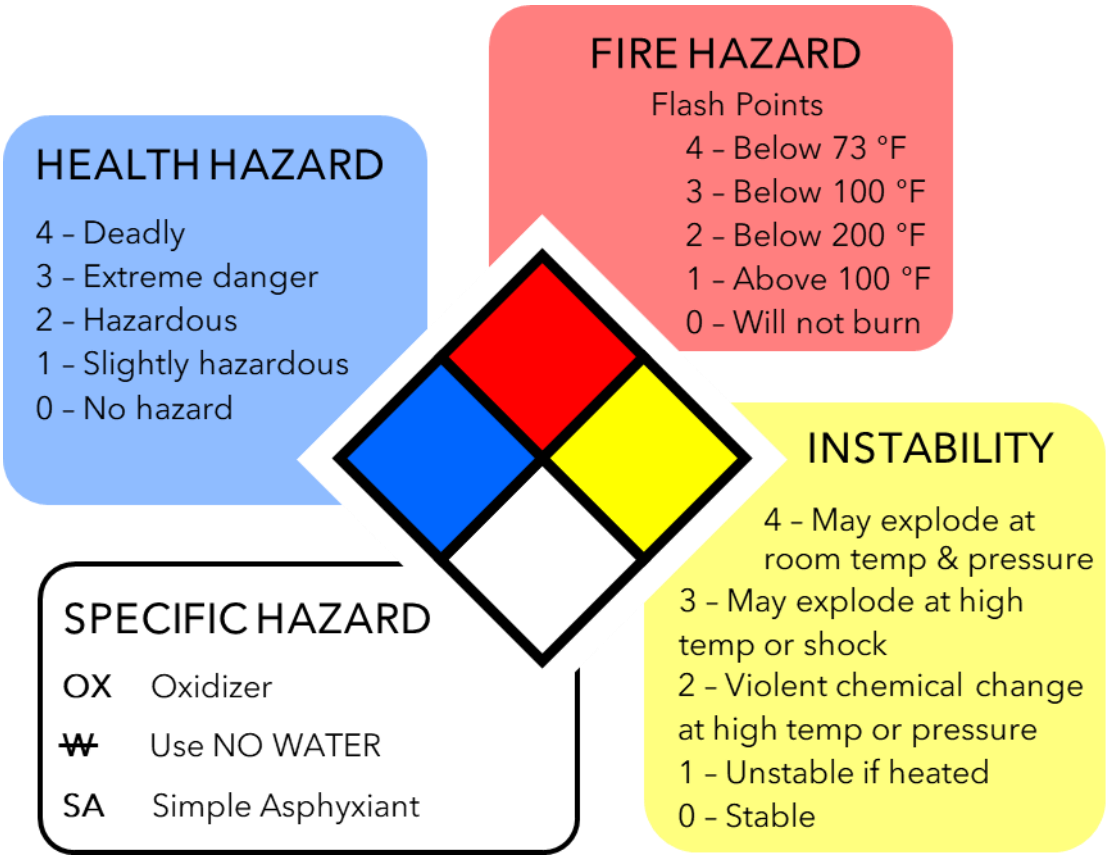
PHYSICAL STATE ☐ Solid ☒ Liquid

HAZARD CLASS ☒ Flammable ☐ Toxic ☒ Corrosive ☐ Reactive

Globally Harmonized Symbols and Their Meanings



Guide to NFPA Hazard Diamond Colors and Ratings



Appendix 10 - Workplace Chemical Protection Program (WCPP) for Laboratory Use of Dichloromethane

The Environmental Protection Agency (EPA), under the Toxic Substances Control Act (TSCA), has determined that dichloromethane (DCM), also known as methylene chloride, poses an unreasonable risk of injury to health because cumulative exposures to DCM can cause cancer and damage to the liver and kidneys. Acute exposures to high concentrations of DCM vapor in poorly ventilated spaces has caused central nervous system harm, up to and including unconsciousness and death through respiratory paralysis.

As a result of this risk determination, the EPA has prohibited nearly all commercial and industrial DCM uses,[5] such as use as a solvent or paint remover. A limited number of DCM applications may continue, one of which is the use as a laboratory chemical. SCU has implemented a Workplace Chemical Protection Program (WCPP) to comply with the regulation for continued use of DCM per 40 CFR 751.109

Definitions

- **Existing Chemical Exposure Limit (ECEL):** airborne concentration at or below which a potentially exposed person will be protected against unreasonable risk. Calculated as an 8-hour time weighted average (TWA)
- **ECEL Action Level:** a level at which certain compliance activities would need to be taken, such as exposure monitoring, and at what frequency
- **EPA STEL:** A short term exposure limit, which is an EPA regulatory limit, on workplace exposure to an airborne concentration of a chemical, based on an exposure of less than 8 hours
- **Exposure Control Plan (ECP):** A written plan that documents actions taken to mitigate occupational exposures and comply with the WCPP at the individual lab, research group, or department level
- **Potentially exposed person**: Any person who may be exposed to a chemical or mixture in a workplace as a result of a condition of use of that chemical substance or mixture. This term applies to both employees and non-employees (e.g. contractors, students, visitors) in the work area where the chemical is present and who may be exposed to the chemical.
- **Regulated area:** An area demarcated where airborne concentrations exceed, or there is a reasonable possibility they may exceed, the applicable ECEL or EPA STEL

[5] Products containing DCM below 0.1% by weight are not subject to this restriction (de minimis threshold)

Exposure Limits

Under this program, long-term exposures to DCM will be kept below ECEL (2 ppm for 8-hour TWA) and short-term exposures will be kept below EPA STEL (16 ppm for 15-minute TWA). Additional monitoring will be implemented whenever long-term exposures exceed the ECEL Action Level (1 ppm for 8-hour TWA).

Laboratory supervisors must develop appropriate controls to reduce exposure to below ECEL and EPA STEL, if monitoring results in exceedance. The chemical hygiene officer (CHO) is available to assist in control measure assessments and provide further guidance.

Exposure Monitoring

Initial Monitoring Requirements:

Initial monitoring for DCM is required to establish a baseline for DCM users and to inform the development of the Exposure Control Plan (ECP). All initial monitoring shall be conducted within 30 days after the introduction of DCM in the workplace. Initial monitoring results will be used to determine the frequency of periodic monitoring. Monitoring must be taken when and where operating conditions are best representative of each potentially exposed person's highest likely full shift and 15-minutes exposures occur.

As Needed Monitoring:

Monitoring must be re-taken when there is any change that may result in additional sources of DCM exposure, or a change in exposure levels.

Exemptions to Initial Monitoring:

If exposure to DCM is less than 30 days per year, personnel monitoring is not required if the following two conditions are met:

1. Direct reading measurements must be taken in the environment to ensure levels are below the ECEL action level and EPA STEL
2. Appropriate controls put in place to ensure levels are below ECEL and EPA STEL

Periodic Monitoring Frequency

The results of initial monitoring will determine how frequently periodic monitoring must occur. Periodic monitoring can range from every 3 months, every 6 months, or every 5 years depending on the following conditions:

DCM Concentration (exposure monitoring results)			Re-monitoring Frequency
8-hr TWA (ECEL)		15-min TWA (STEL)	
< 1 ppm	and	≤ 16 ppm	ECEL and EPA STEL periodic monitoring at least once every 5 years
< 1 ppm	or	> 16 ppm	ECEL monitoring at least once every 5 years AND EPA STEL periodic monitoring required every 3 months
> 1 ppm & ≤ 2 ppm	or	< 16 ppm	ECEL monitoring every 6 months
> 1 ppm & ≤ 2 ppm	or	> 16 ppm	ECEL periodic monitoring every 6 months AND immediate suspension of tasks causing the 15-min TWA to exceed 16 ppm in the monitored lab
> 2 ppm	or	> or ≤ 16 ppm	Immediate suspension of use of DCM in the monitored lab

Changes in Condition

The frequency of periodic monitoring may be reduced if two consecutive samples taken at least 7 days apart show the 8-hour TWA exposure has decreased from between 1 and 2 ppm to below 1 ppm.

Lifting of suspension DCM use requires two consecutive samples taken at least 7 days apart show the 8-hour TWA exposure has decreased to below 2 ppm AND that the 15-minute TWA exposure has decrease to below 16 ppm.

Suspension of Periodic Monitoring

Monitoring may be suspended if work with DCM will not occur during the timeframe where monitoring would be required under this WCPP. The next use of DCM must be monitored. The laboratory supervisor is responsible for notifying the CHO (or EHS) in advance, and may not proceed with DCM use until monitoring has been scheduled.

Sampling Requirements and Reports

1. Sampling Requirements:
    - Sampling must be conducted for every potentially exposed person or a representative sample representing all exposed persons
    - Sampling must be taken when and where the operating conditions are representative of full shift exposures

- All potentially exposed persons must be given the opportunity to observe exposure monitoring
- Must be taken at the personal breathing zone
- Notification of monitoring results to monitored person and potentially exposed persons (e.g. similar exposure group) within 15 working days after receipt of results

2. Sampling Reports:
   - Provide the ECEL, action level, EPA STEL, and significance of each
   - Provide the quantity, location, and manner of DCM use at the time of monitoring
   - Provide the monitoring results
   - Indicate whether the concentration exceeds the ECEL, action level, and EPA STEL
   - Provide a description of actions taken to reduce the exposure to below exposure limits
   - Provide the description of respiratory protection measures if needed
   - List any identified DCM releases during monitoring

Regulated Areas

Per EPA WCPP requirements, a regulated area must be established wherever airborne concentrations of DCM exceed, or could reasonably be expected to exceed, the ECEL of 2 ppm or EPA STEL of 16 ppm based on monitoring. Establishing a regulated area requires area signage, access control, and respiratory protection. *At SCU, DCM use will be suspended if exposure exceed ECEL and EPA STEL.* Laboratory supervisors must develop appropriate control measures to reduce exposure to below ECEL and EPA STEL limits, such as substituting DCM with a lower hazard solvent, utilizing engineering controls, modifying experimental procedure. Contact the CHO for further guidance.

Exposure Control Plan

Per WCPP requirements, each laboratory planning to use DCM must develop an Exposure Control Plan (ECP). ECP is a written plan that documents safety practices used to mitigate personnel exposures. The ECP must describe efforts taken to protect potentially exposed persons through use of the hierarchy of controls:

1. Elimination: Describe why DCM use is essential
2. Substitution: Describe inadequacy of available substitutes
3. Engineering Controls: Local exhaust ventilation must be used for all processes with DCM. Acceptable controls include fume hoods, glove boxes, exhausted enclosures, and snorkels.

4. Administrative Controls:
    a. Standard Operating Procedure (SOP): see Appendix 6 for template.
    b. Training: Include review of this WCPP, ECP, and laboratory specific SOP(s) with DCM
    c. Stop all use of DCM if any malfunction of local exhaust ventilation is suspected
    d. Designated storage and use locations
    e. Procurement controls
5. Personal Protective Equipment: DCM may only be handled while wearing a lab coat, safety glasses or goggles, and either polyvinyl alcohol (PVA) gloves or double nitrile gloves. LLDPE laminate or butyl Viton gloves may be used for procedures involving strong oxidizing acids. PVA or LLDPE laminate gloves may be used for procedures involving significant risk of fire. Laboratory supervisor is responsible for the final glove selection.

Laboratory supervisor must review and update the ECP as necessary, and at least every 5 years.

Training

The EPA rule includes requirements for training and references general training requirements as well as task-specific training. Training must be consistent with OSHA Methylene Chloride Standard 1910.1052(l)(1) to (6), and must be done in a comprehensive manner that is understandable to potentially exposed persons. Training should:

1. Cover hazards associated with DCM, and include appropriate controls (exhaust ventilation, specific PPE) to ensure safe use and handling
2. Be updated if there are modifications of procedures, or new procedures
3. Include review of this WCPP, ECP, and laboratory specific SOP(s) with DCM

WCPP Recordkeeping

Compliance records will be kept for at least 5 years, and will be available upon request for inspections. Exposure monitoring records will be maintained by EHS. Exposure Control Plans (ECPs) and their implementation records (e.g. training) will be maintained by laboratory supervisors.