

CHEMICAL HYGIENE PLAN

HARVEY MUDD COLLEGE

Prepared with the cooperation and assistance of:

The Office of Environmental Health and Safety
The Claremont Colleges
and
The Facilities and Maintenance Department
Harvey Mudd College

Revised 2025

Table of Contents

<i>Foreword</i>	4
Contacts	5
Chemical Hygiene Plan – Designations	6
Chemical Hygiene Officer (CHO)	6
Department Chair	6
Laboratory Supervisor	6
Laboratory Employee	7
Laboratory Safety & Chemical Hygiene Committee	8
<i>Standard Operating Procedures</i>	8
Basic First Aid – Chemical Exposure	8
Chemical Spills	8
General Methods	10
Personal Exposure Minimization	12
<i>Personal Protective Equipment</i>	13
<i>Engineering Controls</i>	14
Safety Devices	16
<i>Administrative Controls</i>	16
Personal Monitoring & Environmental Surveillance	17
Medical Surveillance & Overexposure	18
<i>Chemical Inventory</i>	18
Safety Data Sheets	19
Laboratory Hazard Designations	19
Chemical Storage	20
Labeling	21
Gas Cylinder Handling	22
Cryogenics	22
Nanomaterials	22
Carcinogens, Reproductive Hazards, and Acute Toxins (Particularly Hazardous Chemicals)	23
<i>Cal-OSHA Listed, Regulated and Select Carcinogens</i>	24
<i>Prior Approval</i>	25
<i>Designated Area</i>	25
<i>Hazardous Waste: Storage & Disposal</i>	25
Laboratory Satellite Waste Accumulation	25
<i>Training</i>	27
<i>Facility Cleaning</i>	28
<i>Recordkeeping</i>	28
<i>Appendix A: Call List</i>	30

<i>Appendix B: Globally Harmonized System of Labeling and Classification of Chemicals</i>	<i>31</i>
<i>Appendix C: (SOP) Flammable and Combustible Liquids</i>	<i>33</i>
<i>Appendix D: (SOP) Corrosive Chemicals</i>	<i>34</i>
<i>Appendix E: (SOP) Oxidizers</i>	<i>35</i>
<i>Appendix F: (SOP) Highly Toxic Chemicals, Carcinogens, and Reproductive Toxins</i>	<i>37</i>
<i>Appendix G: (SOP) Highly Reactive and Unstable Materials</i>	<i>39</i>
<i>Appendix H: Compressed Gas Cylinder Safety</i>	<i>40</i>
<i>Appendix I: Cryogen Safety</i>	<i>42</i>
<i>Appendix J: Spill Response Procedures</i>	<i>43</i>
<i>Appendix K: Peroxide Formers</i>	<i>48</i>
<i>Appendix L: Protective Gloves/Chemical Compatibility</i>	<i>49</i>
<i>Appendix M: Perchloric Acid Fume Hoods and Test Procedures</i>	<i>50</i>
<i>Appendix N: Chemical Inventories</i>	<i>51</i>
<i>Appendix O: Chemical Storage</i>	<i>52</i>
<i>Appendix P: Personal Monitoring</i>	<i>53</i>
<i>Appendix Q: Hazardous Waste Characteristics</i>	<i>54</i>
<i>Appendix R: Sharps Disposal</i>	<i>56</i>
<i>Appendix S: Training Outline/Basic Chemical Hygiene Program Orientation</i>	<i>57</i>
<i>Appendix T: Developing Laboratory Specific Standard Operating Procedures</i>	<i>58</i>
<i>Annual Review: Chemical Hygiene Plan</i>	<i>65</i>

Foreword

Harvey Mudd College is committed to providing a safe working environment in our academic research and instructional laboratories. All employees who either direct the operations of and/or perform work in any laboratory or clinic space where chemicals are used on a laboratory scale, must become familiar with and follow the requirements of the Chemical Hygiene Plan. This plan is required by the State of California pursuant to Title 8, Section 5191 of the California Code of Regulations, *Occupational Exposure to Hazardous Chemicals in the Laboratory* (<https://www.dir.ca.gov/title8/5191.html>), and is enforced by CAL-OSHA.

The Chemical Hygiene Plan is written to protect the health and safety of HMC faculty, staff, and students. It presents the rules and policies for safe work practices in the handling and storage of hazardous chemicals, requirements for safety equipment, training, and the handling of hazardous waste.

Every laboratory employee is responsible for his/her own safety and is required to attend training, work conscientiously, and to minimize the risks of potential over-exposure and the uncontrolled release of hazardous materials while working in the laboratory. **Employees should report unsafe conditions, practices, close calls and near-misses to their supervisor.**

Notify Campus Safety if emergency medical or fire assistance is needed: Extension 72000, or, from mobile phone dial (909) 607-2000.

The following is a link for the employee accident report form:
[Employee's Report](#)

The following is a link for the student or visitor accident report form:
[Injury-Incident-Report.pdf](#)

Report any uncontrolled release to laboratory supervisor and Chemical Hygiene Officer immediately.

An uncontrolled release is an unexpected release of a hazardous material that due to its configuration, nature, or volume poses a threat to human health or the environment.

Contacts

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Chemical Hygiene Plan – Designations

Chemical Hygiene Officer (CHO)

Chemical Hygiene responsibilities which rest with the Chemical Hygiene Officer include:

- Works with faculty and staff to develop and implement appropriate chemical hygiene policies and practices.
- Calibrates and uses specific chemical surveillance devices.
- Reviews the storage, use, and disposal of laboratory chemicals.
- Conducts industrial hygiene audits of laboratories.
- Provides technical and regulatory guidance to faculty and staff.
- Provides laboratory safety training to faculty, staff, and students.
- Assists in the annual review and revision of the Chemical Hygiene Plan.

Department Chair

Department Chairs are responsible for providing a safe and healthy work environment and for maintaining safety programs in their departments.

- Promote a strong safety and health culture within their department.
- Provide support necessary to implement the Chemical Hygiene Plan.
- Ensure department compliance with applicable codes, regulations and institutional rules and policies.

Laboratory Supervisor

The principal investigator of record shall be the acting supervisor in his or her laboratory and must ensure that individuals in his or her lab have received proper safety training in that laboratory's specific procedures, and when both hazardous and particularly hazardous chemicals are used. This training must be documented.

The instructor of record in the teaching laboratories must ensure that the Chemical Hygiene Plan is implemented in his or her laboratory course. The instructor is responsible for the enforcement of the plan's rules and policies.

The Laboratory Supervisor has direct day-to-day responsibility for:

- Implementation of the Chemical Hygiene Plan in his/her lab(s).

- Ensuring that employees receive CHP/Laboratory Safety training before beginning work with hazardous chemicals, equipment, or procedures.
- Develop laboratory-specific standard operating procedures. An outline for developing laboratory-specific SOPs may be found in Appendix S.
- Training of laboratory personnel in the standard operating procedures specific to their duties and maintaining records of that training.
- Providing regular oversight of proper chemical hygiene and housekeeping practices
- Ensuring that hazards and risks are assessed prior to beginning work. Assessment should include a plan for hazard minimization and worst-case scenarios.
- Ensuring inspection of safety equipment such as eyewash stations and safety showers is conducted monthly to test functionality as mandated by regulations and that those inspections are documented. (8 CCR 5162(e))
- Knowledge of current legal requirements concerning regulated substances used in their labs.
- Maintaining and updating a chemical inventory (8 CCR 5194)
- Reporting employee accidents or injuries to HR within 2 days of the incident, and serious accidents involving releases, exposures or injuries immediately.
- Reporting student injuries to the Dean of Students office using the injury report form. Accident/Injury report forms for employees, students, and visitors may be accessed using the following link: [Emergency preparedness & employee safety](#)
- Directing the use of the required levels of protective apparel and equipment.
- Establishing a designated area when appropriate.

Laboratory Employee

The laboratory employee is responsible for:

- Under the direction of the Laboratory Supervisor or Lead Scientist, planning and conducting each operation in accordance with the Chemical Hygiene Plan and laboratory-specific standard operating procedures (SOPs).
- Complete safety training sessions as required.
- Utilizing appropriate engineering controls and personal protective equipment.
- Developing good chemical hygiene habits, including keeping a neat, uncluttered work area.
- Reviewing procedural changes with the supervisor.
- Becoming knowledgeable about the hazard potential of each raw material used in the laboratory and the safe handling thereof.
- Gain approval before using particularly hazardous substances (highly toxic, unstable, reactive, pyrophoric) or procedures.
- Reporting any injuries, accidents, and near misses to the supervisor.
- Reporting any unsafe conditions to the supervisor.

Laboratory Safety & Chemical Hygiene Committee

This committee is to be comprised of members whose laboratories are directly affected by the Chemical Hygiene Plan and is scheduled to meet once per semester to discuss safety and chemical hygiene issues.

The Claremont University Consortium's Office of Environmental Health & Safety is an ex-officio member of this committee and participates as needed to assist with program and regulatory issues.

Standard Operating Procedures

Basic First Aid – Chemical Exposure

- Eye contact: Promptly flush eyes with tap water for a minimum of 15 minutes. Seek immediate medical attention.
- Ingestion: Call Campus Safety (security) and request emergency medical assistance. Do not induce vomiting. Rinse mouth with water. If unconscious, turn head to the side to avoid choking hazard if vomiting occurs. Never give anything by mouth to an unconscious person.
- Skin Contact: If the contaminate is a solid, brush off as much as possible before rinsing. Remove any contaminated clothing. Promptly flush the affected area with water and; use a safety shower if body drenching is necessary. Rinse for a minimum of 15 minutes. Rinse contaminated clothing prior to removing it from the laboratory. Clothing contaminated with acute toxins or highly hazardous chemicals must be bagged and disposed of as hazardous waste. Launder contaminated clothing before wearing. Seek medical attention.
- Inhalation: Move to fresh air. Seek medical attention.
- Injection: Wash injection site thoroughly. Seek immediate medical attention.
- **EMERGENCIES: DIAL EXTENSION 7-2000 FROM CAMPUS PHONE** or (909) 607-2000 from a mobile phone.

Chemical Spills

Spill clean-up procedures should be planned for in advance of chemical use. Have clean up materials on hand before proceeding. Use the buddy system when confronted with a chemical spill situation. One person can call for help and administer first aid while the other tends to the spill. Do not attempt to clean a spill of unknown material, or if you are not certain how to proceed. Do not place yourself in danger. Notify your supervisor and others in the area in the event of a

spill, even if it is “simple.” The American Chemical Society defines a simple spill as “one that does not spread rapidly, does not endanger people or property except by direct contact, and does not endanger the environment.” Always wear appropriate personal protective equipment, minimally including safety glasses, gloves, and lab coat, when cleaning a spill. Do not attempt to clean up a large or complex spill. Spills that occur outside of the fume hood may be too hazardous or complex to clean up without proper respiratory protection. Spills that are large, occur near incompatible materials or ignition sources, have vapors that may enter the ventilation system, or occur in close proximity to classrooms or offices are considered to be complex. Do not attempt to clean a spill of larger than 100 mL or 50 g of particularly hazardous or highly reactive material. Dike material if it is safe to do so. Call individuals on the call list (Appendix A) for guidance.

Gases:

Shut down the supply system, exit the lab, and allow the fume hood ventilation system to exhaust the material. If the release is large and/or toxic and cannot be contained by the fume hood system, building evacuation may be necessary. Pull the fire alarm to evacuate the building. Contact F & M to shut down the ventilation system in the event of a toxic release. **Do not place yourself at risk trying to shut down the leak.** Flammable gases in enclosed areas create a threat of flash fire or explosion. Extinguish open flames. Do not touch electrical switches as arcing may trigger an explosion. For minor leaks of a nontoxic, nonflammable cylinder, remove the cylinder to a well-ventilated area and call the vendor for pickup. Do not ride the elevator with a leaking compressed gas cylinder. Tag the cylinder with a warning placard and send it alone on the elevator. Meet the elevator on the ground floor. **Notify your supervisor, Chemical Hygiene Officer, and Campus Safety Officer (Appendix A).**

Liquids:

Contain complex spills and prevent the spread of vapors, if safe to do so, using diking materials. Increase room ventilation by opening hoods and windows if possible, and closing doors. Evacuate the lab and alert others in the area to do the same. Notify your supervisor, Chemical Hygiene Officer, and the Director of Operations and Emergency Preparedness. (Appendix A). For simple spills, follow SDS information to contain the material. Dike spill or plug drains to prevent spills from entering the sanitary sewer system. Neutralization may be used in some circumstances to reduce the potential for injury in some cleanup efforts. Do not use paper towels to absorb flammable liquids. This increases vapor concentration. Dispose of absorbent materials as hazardous waste. Rinse the cleaned area and any non-disposable implements with detergent and water.

Solids:

Do not attempt to clean a spill of 1 kg. or larger. For simple spills, consult the SDS for cleanup and disposal information. Dry sweep simple spills, using an anti-static broom, and place in an appropriate hazardous waste container. If dust presents a respiratory hazard, wet the material unless contraindicated by the label or SDS. **WARNING: if the material is shock-sensitive, do not dry sweep. Consult the Laboratory Supervisor and Chemical Hygiene Officer for assistance.**

Notify Campus Safety (Security) EXTENSION 72000 if emergency medical or fire assistance is needed, or if an evacuation is necessary. Uncontrolled releases that exit the property may require notification to regulatory agencies. Contact the Director of Operations and Emergency Preparedness for directions on this issue.

Refer to general SOPs for Flammables (Appendix C), Corrosives (Appendix D), Particularly Hazardous Chemicals (Appendix F), and Highly Reactive/Unstable Materials (Appendix G) and to the HMC Spill Response Procedures (Appendix J) for specific spill information on these hazard classes.

General Methods

- Persons engaging in work with toxic, corrosive, flammable, or pyrophoric reagents or solutions, or those working around hazardous equipment, machinery, high pressure, or high voltage systems should never work alone. Use the buddy system when performing hazardous reactions or procedures.
- Every chemical storage container including temporary containers (e.g. beakers, flasks) must be properly labeled to identify its contents and hazards. The chemical name should be written out. Chemical formulas should not be used on labels. This does not apply to temporary containers which will be used in the course of a single work period and under continuous control of the user.
- Novel chemicals must be labeled with the name of the producing chemist.
- Unknowns used in teaching laboratories must have an identification key stored with them. A hazardous materials label must describe the most toxic of the unknowns.
- If the hazards of a chemical are unknown, the container should have a label indicating that it is “undergoing evaluation.”
- Hazardous wastes held in containers in Laboratory Satellite Accumulation Areas (LSAA) must also include the date accumulation began, and the approximate amount of each compound of the waste.
- Waste Containers must be capped when not in use and at the end of the work period and held in secondary containment.

- Return flammables and other hazardous chemicals to their proper storage at the end of each workday.
- Provide appropriate warnings about experiments in the process and restrict laboratory entry to authorized personnel only.
- The Laboratory Supervisor must provide signage and guidelines for any unattended, overnight, or weekend process. A response procedure should be established prior to beginning the work. Signage should include the name and phone number of the person(s) conducting the unattended procedure.
- Minimize chemical exposures and risks. Determine hazards and risks before beginning any procedure or experiment. Consult the necessary reference materials (including SDSs) about potential chemical hazards. Pre-plan appropriate protective procedures, equipment usage, process design, and hazardous waste collection before beginning any new operation. Leave the laboratory lights on and provide for containment of toxic substances in the event of a failure of a utility service (such as cooling water) in an unattended operation.
- Dispose of broken glass in appropriate containers.
- Containers for broken glass should be labeled “Glass Only”. “Glass Only” collection bins are to be used for non-contaminated glass only as these are disposed of as regular trash. The contaminated glass must be contained as hazardous waste.
- Hypodermic needles and syringes must be disposed of in rigid red plastic biohazard “sharps” receptacles. Needles and syringes contaminated with hazardous chemicals must be disposed of in a sharps receptacle to which an HMC chemical hazardous waste label has been affixed. Biohazard sign must be covered. Do not attempt to recap needles.
- Keep the work area neat and uncluttered. Clean up the work area after the completion of an experiment or procedure, or at the end of the day if feasible. Do not allow unwashed glassware to accumulate in the sink.
- Use care when handling and working with glassware to avoid breakage. Do not use damaged glassware. Specialized components (such as Dewar flask) or vacuum glassware may require extra care when handled. Shield or wrap evacuated glassware, where feasible, to protect against injury from implosion.
- Validate the integrity of partial containers of ether and other peroxide formers for peroxide contamination prior to use (See appendix J). Label peroxide formers with the date they are received and **the date they are first opened. Test for peroxide formation as recommended and record test results on label.**
- When chemicals are hand-carried from the stockroom to the laboratory, they should be placed in a secondary container or bucket.
- Use secondary containment, such as a Pyrex or rubber tray for procedures involving particularly hazardous materials.
- Inspect glassware for cleanliness prior to use to prevent cross-contamination and/or a mixture of incompatibles.

Personal Exposure Minimization

- Do not smell or waft chemical containers.
- Avoid eating, drinking, smoking, chewing gum, or applying cosmetics or lip balm in areas where laboratory chemicals are used. Decontaminate by washing your hands, and then exit the lab before conducting these activities.
- Consumption of food or beverages in the laboratory, preparation rooms, or chemical storage areas is prohibited. A Laboratory desk or writing area may be designated as a “clean area” where food or beverages may be consumed.” The clean area must be separated by at least three feet from chemical use. No chemicals may be brought into the clean area. Wash hands before entering the clean area. Laboratory refrigerators designated for chemicals and raw materials storage, glassware, and utensils are not to be used to hold or store food or beverages.
- Skin and inhalation contact with chemicals should be avoided as a general rule. Avoid underestimation of risk.
- Wash areas of exposed skin thoroughly before leaving the laboratory, even when gloves have been worn.
- Avoid practical jokes or other behavior that might confuse, startle, or distract another worker.
- Do not pipette or start a siphon by mouth.
- Confine long hair and loose clothing.
- Footwear must be worn while in the laboratory, and in buildings where chemicals are in use or transported. Sandals, open-toed, open-heeled, and perforated shoes are prohibited in the laboratory.
- Appropriate attire must be worn in the laboratory. Shirt must cover the abdomen. Halter tops and tank tops are not allowed. Leggings are not appropriate lab wear and may increase the risk of injury in the event of a spill due to close skin contact. Long pants or clothing that covers the legs must be worn when working in the laboratory.
- Wear ANSI approved (Z87.1) eye protection (goggles, safety glasses, face shields, etc.) when working in settings where chemical hazards exist. Safety glasses must have side shields.
- OSHA and the American National Standards Institute (ANSI) agree; “wearers of contact lenses shall be required to wear appropriate eye covering and face protection devices in a hazardous environment. It should be recognized that dusty and/or chemical environments may represent an additional hazard to contact lens wearers.” Employees who wear contact lenses should be provided a pair of indirect-ventilated chemical splash goggles.
- Routinely inspect the laboratory for incompatible storage situations. (See Appendix O)

- Chemicals should not be stored in the fume hoods. Excessive storage of materials in the hood may impede airflow.
- Fume hood sash must be kept at the lowest level at which the procedure can be safely performed.
- Work in the fume hood should be conducted at least six inches from the front.

Personal Protective Equipment

All personal protective equipment (PPE) must be approved for use by the National Institute for Occupational Safety and Health (NIOSH), and meet the applicable American National Standards Institute (ANSI) requirements. A hazard analysis must be performed and the need for PPE be evaluated prior to beginning any chemical handling procedure. PPE must be appropriately protective for the chemical hazards to be encountered. Refer to the PPE manufacturers' specifications and the chemical safety data sheets to verify the application. Safety glasses and chemical splash goggles must meet ANSI Z87.1 requirements. PPE must be used where engineering controls are unable to provide the required level of safety. PPE must be provided and maintained by the employer.

- Any employee who must use either a negative pressure respirator or a powered air-purifying respirator (PAPR), alone or in conjunction with engineering controls, to comply with OSHA established permissible exposure limits (PELs) is required to have an annual pulmonary function test, be fit tested, and otherwise comply with the requirements of [Title 8 CCR Section 5144](#), and of the Claremont Colleges' Respiratory Protection Program, which may be viewed by clicking on the following link: [Respiratory Protection Program CUC \(pdf\)](#)
- Employees are required to wear gloves when there is the potential for direct skin contact with hazardous chemicals, blood, or infectious materials. (See Appendix L for glove material compatibility information).
- Inspect gloves for integrity prior to use.
- **For most laboratory use, gloves provide a barrier only. Disposable gloves should be discarded immediately after contamination. Extra protection may be provided by double gloving disposables.**
- Lab coats are to be worn only in laboratory areas or when transporting chemicals between laboratory areas and stockroom, and should be buttoned to protect the employees' clothing from contamination. Lab coats are provided and maintained by the employer.
- All personal protective equipment and contaminated lab wear must be removed immediately upon leaving the laboratory areas and placed in designated control areas to minimize the potential for cross-contamination or personal exposure.
- Lab wear or personal clothing (such as in the event of a spill) that is heavily contaminated with hazardous (toxic, flammable, corrosive) chemicals must be

disposed of as hazardous waste. Contaminated lab wear must never be taken home for laundering.

- Do not wear lab coats or gloves into “clean” areas such as restrooms, offices, or areas where food is consumed or stored.
- Do not wear gloves outside of the lab unless chemicals are being transported. Leave one hand ungloved for the operation of elevator buttons, door handles, etc.
- Do not wear gloves while using personal equipment, such as cell phones and computers. Do not place personal equipment on lab benches which may be contaminated. Cell phones may be placed in a zip lock bag for protection while used in the laboratory.
- Safety glasses or chemical splash goggles must be worn while working in areas where chemicals are in use or chemical hazards exist. Visitors and maintenance workers must also wear safety glasses in these areas.
- Perform a hazard assessment when selecting the most appropriate protective eyewear. For example, working with large volumes of corrosives may require more protective indirect vented chemical splash goggles.
- The Center for Disease Control recommends that safety glasses be worn in laboratories of all designations of biosafety levels.
- Face shields may be used in addition to, not in place of safety glasses or goggles when there is the presence of a splash hazard.

Engineering Controls

Engineering controls eliminate or reduce hazards by engineered mechanical means. Examples include fume hoods, bench snorkels, biosafety cabinets, and ventilation systems. Refer to the HMC Laboratory Ventilation Management Program for more information:

www.hmc.edu/emergency-preparedness/employee-safety/hmc-laboratory-ventilation-management-program/

- Chemical fume hoods are to be used where feasible to minimize exposure of employees to emissions from flammable, volatile, toxic, or malodorous chemical processes. Fume hoods provide barrier protection from physical hazards such as fires, explosions, etc. Fume hoods must comply with Title 8 CCR Section 5154, *Ventilation Requirements for Laboratory Type Hood Operations*:
[*Ventilation Requirements Laboratory-Type Hoods*](#)
- Each fume hood is to be inspected and certified annually for proper face velocity and the hood’s door frame marked at the maximum opening for the required face velocity, per standards set forth by the American National Standards Institute (ANSI) and the American Society for Heating, Refrigerant, and Air-Conditioning Engineers (ASHRAE). In process, use is to be verified by an

in-place gauge, calibrated in feet per minute (f/m) that can be easily read by the operator/scientist during the use of the fume hood.

For Example:

Standard fume hood velocity = minimum 100 f/m average with no point less than 70f/m.

Actual face velocities for any hazardous material must be verified by reviewing State and Federal safety regulations, if any, for that material.

- Laboratory fume hoods shall be labeled as to their f/m rating, date of the last inspection, and any special use approvals (e.g. perchloric acid, carcinogens, or radioisotopes).
- Laboratory fume hoods are set to alarm when air velocity drops below 100 linear f/m. If this occurs while work is being performed, adjust the sash in order to adjust airflow velocity. If the hood continues to alarm, discontinue work, cap all open containers, and close the hood. Notify F&M of the issue.
- Inspect the in-place gauge for proper face velocity and hood functionality prior to each use.
- All materials and apparatus must be at least six inches from the face of the fume hood. Work in the fume hood should be conducted at least six inches from the plane of the hood face.
- Keep hood sash at the lowest possible level for the performance of work, keeping glass between worker and chemical source. View work through the glass.
- Do not lean into the hood so that your head passes the plane of the hood face.
- Do not use a fume hood for the storage of chemicals or equipment.
- Keep baffle slots free from obstruction.
- Elevate large equipment at least 2 inches off of the work surface so that airflow is not disrupted.
- Avoid rapid or sudden movements outside of the hood as this may cause air turbulence sufficient enough to draw contaminated air from the hood.
- Keep hood sash closed when not in use.
- Perchloric acid fume hoods shall comply with Chapter 7, 7.12, of the 2019 Edition of the National Fire Protection Association Code, No 45. (See Appendix L) **Perchloric acid hoods should be washed down after each use and the final rinsate inspected using a 0.4% (v/v) solution of methylene blue in the water. (A violet precipitate will form in the presence of perchlorates. See Appendix M).** Currently, HMC has no fume hoods rated for use with perchloric acid.

Warning: Where perchloric acid is heated above ambient temperature process vapors should be scrubbed or trapped prior to exhausting to the hood.

Un-captured perchloric acid vapors can condense in fume hoods and ductwork to form explosive perchlorates.

- Evacuated systems capable of imploding and resulting in significant quantities of glass fragments or other flying debris must be protected using a cage, a shield, or other appropriate solid barriers. Smaller systems may be wrapped in tape/foil.
- Centralized vacuum systems must be inspected annually and should be protected from contamination using appropriate process equipment.
- Environmental rooms have re-circulated atmospheres. Precautions must be taken to prevent the release of toxic substances into the air in these areas.

Safety Devices

- Eyewash fountains and safety showers must be activated monthly to flush the line and verify proper operation. ([Title 8 CCR Section 5162](#)). ANSI Z-358.1 recommends a **weekly** activation of eyewash fountains to flush debris and bacteria.
- Safety showers and eyewashes are professionally inspected, tested, and flushed annually. (Title 8 CCR Section 5162)
- Fire Extinguishers are inspected monthly and tested annually. ([Title 8 CCR Section 6151](#))
- All chemical stockrooms/storerooms are adequate and well ventilated.
- Environmental rooms must have provisions for escape in the event of an emergency or electrical failure.
- Airflow through the laboratory should be relatively uniform and be exhausted to the exterior of the building. The quality and quantity of ventilation are to be monitored and verified annually.
- Chemical Hygiene related equipment shall be recommended by the CHO, in conjunction with faculty needs.

Administrative Controls

Administrative controls are procedural and policy measures to be taken in order to reduce or eliminate hazards. Administrative controls may include the development of standard operating procedures, training requirements, and institutional policy regarding chemical use.

SOPs for general hazard classes of chemicals may be found in Appendices C, D, E, F, and G. SOPs for specific chemical use procedures and equipment are available on request by contacting the Chemical Hygiene Officer.

Personal Monitoring & Environmental Surveillance

Laboratory Supervisors are responsible for safety within their areas. Potentially hazardous chemical processes and/or procedures should be reviewed by the Chemical Hygiene Officer and the department chairperson prior to implementation.

Personal monitoring is conducted to determine exposure levels or for the need for medical consultation, examination, and/or surveillance.

The college shall measure personnel exposure to any chemical regulated by a standard that requires monitoring or if there is reason to believe that exposure levels for that substance may exceed the action level or permissible exposure limit (PEL). The PEL is a Cal- OSHA-enforced legal standard. PELs for a given chemical are a concentration level of exposure determined to be safe for most workers. PELs are based on a time-weighted average (TWA) over an eight-hour workday and forty-hour work week for a lifetime of work. The action level (AL) is typically one half of the PEL.

A list of chemicals for which OSHA PELs have been established may be viewed by clicking the following link:

[TABLE AC-1 PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS](#)

Examples where personal monitoring may be conducted include when (1) chemicals are not used in a fume hood and/or (2) personnel develop signs or symptoms associated with **exposure to** hazardous chemicals.

- If the action level or PEL is exceeded during the initial monitoring, personal monitoring will be repeated per the relevant regulatory standards or consensus guidelines.
- Monitoring may be terminated in accordance with relevant regulatory standards or consensus guidelines.
- Monitoring results will be provided to personnel per the time requirements of the relevant regulation or within 15 days of the Chemical Hygiene Officer's receipt of monitoring results.

Where exposure monitoring reveals an exposure above the action level (or in the absence of an action level, the permissible exposure limit (PEL) for a Cal-OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance will be established as prescribed therein.

Medical Surveillance & Overexposure

All staff and faculty working with hazardous chemicals will be provided with the opportunity to have a medical examination, and a follow-up examination, if necessary, under any of the following circumstances:

- Development of signs or symptoms of overexposure associated with the chemicals to which they have been exposed in the laboratory. For specific substances regulated by Cal-OSHA (e.g. carcinogens) where environmental monitoring demonstrates routine exposure above the action level, or PEL if no action level is given.
- In the event of an uncontrolled release of a hazardous material where there is a likelihood that the individual may have been overexposed to that hazardous material.

The employer shall provide the following information to the physician in the event of possible exposure:

- 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, if available, quantitative exposure data.
- A description of the signs and symptoms of exposure.
- A copy of the SDS for the chemical(s) involved.

The physician will provide a written opinion that will not reveal specific findings or diagnoses unrelated to the exposure, but will include:

- Any recommendations for further medical follow-up.
- Results of the medical examination and any associated tests.
- Any medical conditions that may be revealed in the course of the examination that may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace.

A statement by the physician that the employee has been informed of the consultation/examination results and any medical condition that may require further examination or treatment.

Chemical Inventory

An inventory must be maintained (hard copy or electronic-based) listing all chemicals in the laboratory and storerooms. Chemicals should be listed alphabetically by location according to the most commonly used name. The inventory records should also include the average quantity on hand, the physical state (e.g. solid, liquid, gas) of the

material, the NFPA classification, if known, and the manufacturer's name and complete address. (See Appendix N for more information on HMC Chemical Inventories). In order to ensure accuracy of the chemical inventory, the Chemistry Department Stockroom must be notified when chemicals are acquired, disposed of, or used up.

Safety Data Sheets

SDSs must be provided by the manufacturer of each unique chemical acquired by the college and must provide information necessary for the safe handling of chemicals. SDSs should be consulted before working with an unfamiliar chemical. However, it is recommended that researchers assessing chemical hazards refer to at least two additional sources of information, such as Pubchem, or the NIOSH Pocket Guide to Chemical Hazards. Formatting of SDSs adheres to the policy set forth by the Globally Harmonized System (GHS) of classification and labeling of chemicals and [Title 8 CCR Section 5194](#), *Hazard Communication*. Explanation of SDS formatting and GHS classifications and pictograms may be found in Appendix B.

SDSs for chemicals on hand are available to each laboratory and stockroom with *Chimera*. The [chemical inventory](#) for the college is also kept on this system. SDSs may be viewed by clicking on the following link:

[HMC Safety Data Sheet e-binder](#)

Laboratory Hazard Designations

Chemical Safety Levels, as defined in "Identifying and Evaluating Hazards in Research Laboratories," American Chemical Society 2013 are intended to enhance the management and control of each lab. This Chemical Hygiene Plan addresses, where necessary, specific hazard concerns in the higher risk labs.

The general designations are as follows:

CSL 1

Minimal chemical risk or physical hazard. No concentrated acids, bases, toxics, carcinogens, or teratogens. Ability to work safely with all necessary materials on open benches. No fume hood is required. Typical examples include undergraduate science or demonstration labs with minor chemical use, laser labs (below Class 2B), and microscopy rooms.

CSL 2

Low chemical or physical hazard. Small amounts, less than one liter of concentrated acids or bases, limited amounts of toxic or high hazard chemicals. Less than 40 liters of flammable chemicals in use. May need a fume hood for some activities. Typical

examples include chemistry/biochemistry teaching and demonstration labs, and standard biomedical labs.

CSL 3

Moderate chemical or physical hazard. Lab contains concentrated acids, bases, toxics, other high hazard chemicals or cryogenic liquids. Carcinogens or reproductive hazards are handled. Corrosive, flammable, or toxic compressed gases in cabinets or fume hoods. Larger volume of flammable liquids. Special hazards in limited quantities. Labs are fume hood or local exhaust ventilation intensive. Some use of a glove box for air reactive chemicals or quality control. Examples include chemical research or chemical engineering labs.

CSL 4

High chemical or physical hazard. Work with explosive or potentially explosive compounds, frequent use, or larger quantities of pyrophoric chemicals. Use of large quantities of high hazard materials with significant potential for IDLH (Immediately dangerous to life and health) conditions in the event of an uncontrolled release or foreseeable incident. Use of glove box for pyrophoric or air-reactive chemicals.

The ACS publication “Identifying and Evaluating Hazards in Research Laboratories” may be viewed by clicking the following link:

www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/publications/identifying-and-evaluating-hazards-in-research-laboratories.pdf

Chemical Storage

Proper storage of chemicals and the avoidance of incompatible mixtures present an ongoing safety issue. Quantities of chemicals should be kept as small as practical. Long-term storage of chemicals on working benchtops or in fume hoods may increase the risk of fires or spills and is discouraged. In addition, long-term routine storage of chemicals in fume hoods should not be permitted as the presence of non-process containers can disrupt the airflow in portions of the hood, which could compromise the performance of the engineering control. Appropriate laboratory cabinets and special laboratory refrigerators are to be used for chemicals storage where feasible. Flammable liquids may be stored in flammable storage cabinets or rooms equipped with appropriate ventilation; safety cans with flame-arrested spring-loaded spouts, or specially designed refrigerators. Safety cans should be used for transporting flammable liquids in bulk. Interior lighting and wiring on household refrigerators may provide an ignition source for flammable vapors. Flammables requiring refrigeration must be stored in flame-proof refrigerators built for that purpose.

Toxic chemicals (including but not limited to carcinogens, teratogens, mutagens or poisons) should be stored in access-controlled areas. Whenever possible these materials should be held in break-resistant, chemically resistant secondary containers. All chemical storage containers must be appropriately labeled as to their content and hazards. See Appendix O for more information on storage.

Labeling

All commercial chemical containers that are received, stored, or shipped must be properly labeled. Labels must not be removed or defaced. An SDS attached to a container (e.g. a carboy) is acceptable in lieu of an actual label. Labels may be printed using the [Chimera Inventory Program](#).

“Properly labeled”, according to 2012 hazard communication regulation ([Title 8 CCR Section 5194](#)) means the label must state:

- The identity of the chemical (Chemical Name, CAS No. or Batch No.)
- GHS pictogram
- Signal word (Danger, or Warning)
- Hazard Statements
- Precautionary Statements
- The name and address of the chemical manufacturer.

An example label is shown below:

ACETIC ACID, Glacial	
Health Hazard:	Flammable Liquid
Physical Hazard:	Corrosive; Protect skin and eyes from contact. Do not breathe vapors.
	
Acme Scientific	Danger
Any Street	
City, State, Zip	

- For laboratory prepped solutions, include the name of preparer and date of preparation.
- Novel chemicals generated in HMC laboratories must be evaluated for hazards based on the known hazards of the precursor materials. Hazards of compounds may have a synergistic effect and be more harmful than those of the composition materials. If hazards are unknown, label as “undergoing evaluation”. Assume that the material is hazardous and the requirements of this plan must be implemented. The name of the generator and date must be included on the label. A laboratory notebook reference is recommended.

- Any container that is left out of the immediate control of the user must include the full chemical name, (not in formula), and its hazards if any. This requirement also applies to containers of water.

Gas Cylinder Handling

Compressed gas cylinders must be stored, handled, and used as outlined in Title 8 CCR Section 4650 *Storage, Handling, and Use of Cylinders*.

[Regulations, Title 8, Section 4650. Storage, Handling, and Use of Cylinders.](#)

Cylinders of compressed gases, whether empty or full, are required to be stored upright and tightly strapped or chained to a wall or benchtop by a noncombustible, two-point system, with one strap at the upper and one at the lower third of the cylinder. The valve stem must be capped when not in use so as to assure stability of the cylinder and prevent accidental damage to the tank and valve assembly. Cylinders must be strapped onto cylinder carts for transporting.

Additional information on the safe use of compressed gas cylinders may be found in Appendix H.

Cryogenics

Cryogenics are defined as materials with extremely low boiling points (at or below -150°C, for example). Cryogenic materials include liquid nitrogen, liquid helium, liquid oxygen, and dry ice. They have a high-volume expansion in the liquid to gas phase, thus having the potential to displace oxygen. Hazards include skin burn, frostbite, and asphyxiation due to an oxygen-deficient atmosphere. Cryogenic SOPs may be found in Appendix I.

Nanomaterials

Nanomaterials are defined as a material or particle with any external dimension having a diameter of between 1 and 100 nanometers. They may be engineered or naturally occurring. Because the effects of nanomaterials are still being reviewed, scientists working with nanomaterials must assume that the particles are toxic on a cellular level. Fume hoods, glove boxes, or biosafety cabinets must be used. Respirator use may be required when handling engineered nanomaterials in a fume hood. The small size of the particles may allow them to escape the containment of the fume hood. Use of a glove box is required when handling powdered or “unbound” nanomaterials. Refer to the section titled “Personal Protective Equipment” for information on respirator use. Gloves resistant to the solvents being used should be worn. Work surfaces should be wet wiped at the end of each workday. Waste materials, including contaminated gloves,

wipes, and lab coats must be double-bagged and the bags must be kept sealed when not in use. Label the nanomaterial waste containers with the appropriate label for “Extremely Hazardous Waste” and include all respective hazard characteristics as well as the descriptor word “nanoscale.” More information on nanomaterial safety may be found in the “[Nanotoolkit](#)” published by the California Nanosafety Consortium of Higher Education.

Carcinogens, Reproductive Hazards, and Acute Toxins (Particularly Hazardous Chemicals)

Management programs for carcinogens, reproductive hazards, and acute toxins are specific to the material(s) being used.

Reproductive hazards include teratogens, mutagens, and materials that can, through biochemical means, cause harm to a developing fetus during pregnancy. Reproductive toxins can permanently affect the reproductive health of both male and or female systems. Exposures to reproductive toxins can cause infertility, transmission of chemicals through the placenta which may lead to stillbirth, and during lactation may lead to transmission of chemicals into human milk. All laboratory workers are responsible for safe handling of any potential reproductive toxins. SDSs may vary in reproductive hazard information dependent on the chemical supplier and differences in toxicity due to morphology. Additional external resources such as the [NIOSH Pocket Guide \(NPG\)](#) and the [Proposition 65 list \(Prop. 65\)](#) should be consulted for the identification of reproductive toxins.

In general, environmental and personal monitoring shall be conducted to determine in-process and use baseline levels for regulated carcinogens and toxins. Carcinogens are materials known or suspected to cause cancer in humans. Refer to Appendix F for the complete definition. Toxins can induce sickness in, or cause the death of living organisms. Situations where the process, experiment, or research can be expected to result in exposures below the Action Level, which is calculated as an eight-hour time-weighted average (TWA), will not require additional monitoring unless there are material changes in the laboratory protocols. Records should be maintained which describe the amount and context of use.

The need for a written Engineering and Work Practices Controls Program (EWPCP) for a particular material process is evaluated on a case-by-case basis. For example: When using cadmium, if an employee/scientist is exposed above the permissible exposure limit (PEL) of 30 or more days during a calendar year, an EWPCP is required. This may be encountered during a research project but is generally unlikely in the course of laboratory instruction of students. Where EWPCPs are required,

medical/biological surveillance shall be governed by the appropriate current regulations.

SDSs or current Cal-OSHA tables can provide action level, PEL, and TWA data as required, [Table AC1 - Permissible Exposure LIMITS FOR CHEMICAL CONTAMINANTS](#). Consultation with the CHO or the CUC Office of Environmental Health and Safety is recommended to ensure appropriate regulatory compliance.

Cal-OSHA Listed, Regulated and Select Carcinogens

Title 8 CCR 5209 (Carcinogens) is superseded by Section 5191 (a)(2)- “Occupational Exposure to Hazardous Chemicals in Laboratories”, except for Section 5209(c)(6) – “Laboratory Activities.” Therefore, this section of the CHP does not address any other sections of 5209. Note that Cal-OSHA allows exceptions to the carcinogen standard if the listed compound is used at or below the exempt carcinogen levels (i.e., the compound may be diluted to below the exempt concentration as measured by weight or volume, as indicated in the table below).

Listed Carcinogens Subject to Title 8 CCR 5209

	CARN	Not Regulated If Less Than (%)
2-Acetylaminofluorene	53963	1.0
4-Aminodiphenyl	92671	0.1
Benzidine (and its salts)	92875	0.1
3,3'-Dichlorobenzidine (and its salts)	91941	1.0
4-Dimethylaminoazobenzene	60117	1.0
alpha-Naphthylamine	134327	1.0
beta-Naphthylamine	91598	0.1
4-Nitrobiphenyl	92933	0.1
N-Nitrosodimethylamine	62759	1.0
beta-Propiolactone	57578	1.0
bis-Chloromethyl ether	542881	0.1
Methyl chloromethyl ether	107302	0.1
Ethyleneimine	151564	1.0

It is the policy of the college not to stock, order, or use any of the above- mentioned Cal-OSHA Carcinogens. If you believe that you will need to use one or more of these chemicals, please see the Chemical Hygiene Officer well in advance of your anticipated use.

There are additional requirements that shall be observed for laboratories that handle Cal-OSHA Regulated Chemical Carcinogens subject to individual standards. Pursuant to [Title 8 CCR Sections 5200-5220](#). Requirements may include standard operating procedure training, the establishment of a designated area, and exposure monitoring. For a listing of Cal-OSHA Regulated Carcinogens subject to individual standards, refer to Appendix P.

Select carcinogens include those regulated by Cal-OSHA. Also included are those listed as a known human carcinogen in the Annual Report on Carcinogens published by the National Toxicology Program (NTP), and chemicals listed under Group 1 (carcinogenic to humans), Group 2A or 2B (reasonably anticipated be carcinogens) by the International Agency for Research on Cancer Monographs (IARC).

EPA's Final Rule on Methylene Chloride

In April 2024, the Environmental Protection Agency (EPA) issued a final rule regulating methylene chloride (CAS# 75-09-2, also identified as dichloromethane or DCM) under the Toxic Substances Control Act (TSCA), [Title 40 CFR Part 751](#). The EPA has determined this substance poses unreasonable risk to human health primarily due to neurotoxicity from short-term exposure to the chemical and liver effects and cancer from long-term exposure. This new regulation effectively prohibits most industrial and commercial uses of methylene chloride. Laboratory-use of methylene chloride will be permitted under new and strict regulatory procedures as of May 5th, 2025. Due to the availability of substitute solvents, it is the policy of the college to not purchase, use or store methylene chloride or products and mixtures containing 0.1% or more of methylene chloride.

Prior Approval

The responsibility for approval of the acquisition and use of particularly hazardous chemicals as defined in Appendix F rests with the laboratory supervisor. Researchers are encouraged to select less hazardous chemicals whenever possible. All needed approval must be obtained before experiments are performed. Chemicals classified as acute toxins, reproductive toxins and those with a National Fire Protection Association (NFPA) health rating of 4 must be kept under controlled access.

Designated Area

When working with particularly hazardous chemicals, such as acute toxins, reproductive toxins (mutagens, teratogens), or carcinogens, a designated area shall be

established where entry is controlled. This may be a lab, bench, fume hood, or an entire lab. The designated area must be marked with a sign (i.e. Warning! Reproductive toxins in use! No unauthorized access!).

Hazardous Waste: Storage & Disposal

Laboratory Satellite Waste Accumulation

Hazardous waste is a waste with properties that make it potentially dangerous or harmful to human health or the environment. Hazardous waste is defined by the Federal Resource, Conservation, and Recovery Act of 1976 (RCRA) and the California Code of Regulations (22CCR 66260.10). Regulations are enforced by the Environmental Protection Agency and the California Department of Toxic Substance Control. Hazardous waste is defined as having one of the following characteristics: ignitable, corrosive, toxic, or reactive. RCRA also specifically lists chemicals that must be disposed of as hazardous waste. The characteristics of waste streams are defined in Appendix Q.

Laboratories may accumulate hazardous wastes in satellite accumulation area provided the following criteria are met:

- Waste containers must be appropriately labeled. Labels must include the words “hazardous waste.” If a mixture of compatibles, each container must also have a method for recording each material as it is introduced, its associated hazard(s), and the approximate quantity. Complete chemical names must appear on the label. Formula names are not acceptable. Official HMC Waste Labels are available from the Chemistry Department Stockroom.
- The initial date that hazardous waste is placed in the container must be clearly marked and visible.
- Establish protocols to prevent the accidental mixing of incompatible chemical wastes. (See mixing for treatment exception California Health & Safety Code 25200.3.1 (c))
- Hazardous waste must be stored in secondary containment. Containers must be capped and free of drips. Separate incompatible waste containers in separate secondary containment.
- Laboratory Satellite Accumulation areas must have adequate spill containment materials on hand.
- Laboratory Satellite Accumulation Areas may not accumulate more than fifty-five gallons of hazardous waste or more than one quart of any single extremely or acutely hazardous waste.
- Extremely hazardous waste is defined by 22CCR 66260.10 as “wastes... that may likely result in death, disabling personal injury or serious illness caused by

the hazardous waste or mixture of hazardous waste because of its quantity, concentration or chemical characteristics.” These include wastes that are water-reactive, are of high acute or chronic toxicity based on LD50 values, carcinogenicity, or bioaccumulative persistence.

- College operational maximum accumulation time even if quantity limits are not reached is nine months. Wastes must then be moved to the main waste accumulation area (Jacobs 2314) where it is inventoried and prepared for removal. Full containers must be removed from the satellite accumulation area within 3 days of reaching capacity. Hazardous waste must be removed from the main waste accumulation area by a waste contractor within ninety days. Do not transport hazardous waste from your laboratory satellite accumulation area. Call the Chemistry Department Stockroom (ex 72957) to arrange a pickup.
- The waste accumulation area is managed and under the direct control of “one or more designated personnel who have received training commensurate with their responsibilities and authority for managing laboratory hazardous wastes...” (California Health & Safety Code, section 25200.3.1). Training is also required for unsupervised access to the hazardous waste area within a lab. Hazardous Waste Training meeting requirement is included in the general HMC Laboratory Safety Training. Contact the Chemical Hygiene Officer regarding training requirements.
- Storage space is adequate for the quantities and types of wastes present.
- Waste that is contaminated with both biological and chemical hazards must be disposed of as chemical hazardous waste.

The college attempts to offer for recycling, those organic solvents that are expected by the California Department of Toxic Substance Control to be recycled. A list of those solvents is included in Appendix Q.

Laboratories are encouraged to inquire whether or not a raw material may have value within another laboratory area on campus prior to designating the unneeded material a hazardous waste. Chemical containers that are damaged, unlabeled, mislabeled, or do not contain adequate hazard warnings are also considered hazardous waste if not corrected within ten days. Contact the Chemistry Department Stockroom to dispose of stock chemicals.

Disposal

All disposal of hazardous, regulated, and bio-hazardous waste is to be handled by commercial haulers and Treatment, Storage, and Disposal Facilities (TSDFs) licensed by the State of California and/or other appropriate regulatory agency. In general, hazardous waste may not be disposed of in unregulated trash bins or released into the sanitary sewer system via laboratory sinks.

Sharps

Sharps are defined as any device having acute rigid corners, edges, or protuberances capable of cutting or piercing, including but not limited to hypodermic needles, broken glass items such as Pasteur pipets and vials, and plastic pipet tips. Sharps must be placed in a rigid puncture-resistant container that when sealed is leak-resistant and cannot be reopened without great difficulty. Sharps disposal containers in which the contents are contaminated with hazardous chemicals must be properly labeled as hazardous waste. See Appendix R for more information on sharps disposal.

Training

Training is a necessary and important part of the Chemical Hygiene Plan. All employees who work with or who may be exposed to hazardous chemicals receive Hazard Communication, and/or Laboratory Safety Training depending on duties, at the time of initial assignment to work areas where hazardous chemicals are present and before assignment involving new exposure situations. Refresher information and in-service training sessions are also held as necessary. The Laboratory Supervisor or the Chemical Hygiene Officer may conduct training. Laboratory supervisors must provide training on standard operating procedures specific to the hazards in their laboratories. All training must be documented according to attendance, date provided, subject matter, and name of the person providing the training. Training records are kept by the Chemical Hygiene Officer and laboratory supervisors.

A general training outline is provided in Appendix S.

Facility Cleaning

Floors are to be cleaned regularly by Facilities and Maintenance. (F&M) All affected employees of the F&M department must be formally introduced to and trained in the risks associated with cleaning laboratory areas.

The custodial supervisor will conduct a quarterly inspection of the lab areas to assess whether:

1. Stairwell and hallways are free of obstruction.
2. Waste is deposited in appropriate receptacles and properly removed from the laboratory.
3. Chemical spills which occur during cleaning operations are reported and addressed according to established protocols.
4. Proper storage of cleaning materials is accomplished to minimize clutter.

Recordkeeping

- Accurate records regarding personal monitoring, environmental monitoring, and medical surveillance shall be maintained according to the CCR, Title 8. These records are to be maintained by the Office of Emergency Preparedness and Safety, or Chemical Hygiene Officer.
- The department supervisor and the Office of Emergency Preparedness and Safety conduct accident investigations.
- Issues regarding Workers' Compensation should be directed to the HMC Workers' Compensation Administrator in Human Resources, Kingston Hall.
- Questions regarding high-risk substances ((CSL-4) should be directed to the Chemical Hygiene Officer.
- Training attendance records shall be maintained by the Chemical Hygiene Officer, The Office of Emergency Preparedness and Safety, and the laboratory supervisors.
- All medical surveillance records are kept, transferred, and made available in accordance with 8 CCR 3204.

Appendix A: Call List

Report any uncontrolled release to the laboratory Supervisor and the Chemical Hygiene Officer immediately (see names, locations, extensions below). **Notify Campus Safety (security) at extension 72000** if emergency medical or fire assistance is needed. Uncontrolled releases that exit the property may require special notification procedures. Contact EH&S for directions on this issue. Do not dispose of any chemical waste in the sanitary sewer or in conventional trash receptacles.

Note: An uncontrolled release is an unexpected release of a hazardous material that due to its configuration, nature, or volume poses a threat to human health or the environment.

Chemical Hygiene Officer: Annalee Sendis
Office: Jacobs 2306
Extension: 74217

Biology Laboratory Manager: Jenny Nguyen
Office: Olin 1258A
Extension: 74143

Chemistry Laboratory Manager: Daniel Guerra
Office: Jacobs 2310
Extension: 72957

Engineering Laboratory Manager: Jacob Staimpel
Office: Parsons B174
Extension: 73530

Physics Laboratory Manager: BJ Haddad
Office: Jacobs B122
Extension: 73940

Assistant Vice President for Facilities and Maintenance: Matt Poehlman
Office: Platt
Extension: 72760

Appendix B: Globally Harmonized System of Labeling and Classification of Chemicals

The GHS system of labeling and classification requires that chemical suppliers provide safety data sheets (SDS). The safety data sheets must be published in a standardized sixteen section format as outlined below.

Section 1: Product and Company Information, including product name, CAS and emergency phone numbers

Section 2: Hazards Identification, including hazard category based on a numerical categorization of 1-4. The number 1 categorization is indicative of the most severe hazard class. Number 4 is the least hazardous category. Also included are pictograms, a signal word, either “warning” or “danger” depending on the severity of the hazards, hazard statements and precautionary statements.

Section 3: Composition and Ingredient Information.

Section 4: First Aid Measures

Section 5: Fire Fighting Measures, including suitable extinguishing media and hazardous products of combustion.

Section 6: Accidental Release Measures

Section 7: Handling and Storage

Section 8: Exposure Control/Personal Protection, including the most suitable glove material.

Section 9: Physical and Chemical Properties

Section 10: Stability and Reactivity including incompatible materials and hazardous decomposition products.

Section 11: Toxicological information including LD50 studies, mutagenicity and carcinogenicity

Section 12: Ecological Information

Section 13: Disposal Considerations

Section 14: Transportation Information, including the Department of Transportation packing group, class, and UN number.

Section 15: Regulatory Information including Superfund Amendment and Reauthorization Act (SARA) listings.

Section 16: Other information. National Fire Protection Association (NFPA) hazard ratings may often be found here.

Signal words: “Warning” is used on labels and SDSs for chemicals with less severe hazards. “Danger” appears on labels and SDSs for chemicals with more severe hazards.

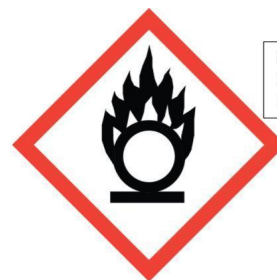
GHS Pictograms



Explosive
Self-Reactives
Organic
Peroxides



Flammables
Self-Reactives
Pyrophorics
Self-Heating
Emits Flammable
Gas
Organic
Peroxides



Oxidizers
Organic
Peroxides



Skin
Corrosion/Burns
Eye Damage
Corrosive to



Carcinogen
Mutagenicity
Reproductive
Toxicity
Respiratory
Sensitizer
Target Organ
Toxicity
Aspiration
Toxicity



Environmental
Toxicity



Gases Under
Pressure



Acute Toxicity
(fatal or toxic)



Irritant (skin
and eye)
Sensitizers
Acute Toxicity
Narcotic
Effects
Respiratory
Tract Irritant

Appendix C: (SOP) Flammable and Combustible Liquids

Application:

This SOP is intended as general guidance for use of flammable or combustible liquids. The SDS should be consulted for safety information on specific chemicals. **This is not intended as a Laboratory Specific SOP. Laboratory Specific SOPs are the responsibility of the Principal Investigator.** Certain chemicals may be flammable *and* particularly hazardous so SOPs for both categories of hazards would apply. Benzene is both flammable *and* carcinogenic,

Definition:

Flammable liquids have a flashpoint of less than 60 °C. Combustible Liquids have a flashpoint of between 60 ° and 93 ° C, A flashpoint is the minimum temperature at which flammable or combustible liquids produce enough vapor to form an ignitable mixture with air.

General Methods:

Perform work with flammable chemicals in a fume hood.

Do not work with or pour chemicals near an open heat source.

Vapors are generally heavier than air and can travel large distances to heating source and flashback.

Minimize the volume of flammable chemicals on the workbench.

Use the smallest quantities possible for need.

Keep containers closed except for transfer.

Large open-mouthed containers should not be used.

Non-sparking, explosion-proof, or intrinsically safe electrical devices (i.e. stirring devices, motors) should be used.

Never heat with open flame. Preferred methods of heating include heating mantles, steam baths, oil, salt, or sand baths.

Store chemicals in a flammables cabinet and return to storage when not in use.

Flammables that require refrigeration should be stored in flameproof refrigerators built for that purpose.

When transferring flammable liquids from a bulk container (5-gallon drum or larger) the containers must be electrically bonded and grounded.

Transfer materials from smaller containers in a fume hood.

Engineering Controls:

Flammables and combustible chemicals should be used in a fume hood or other well-ventilated areas. Some flammable chemicals that are also particularly hazardous or toxic *must* be used in a fume hood.

Personal Protective Equipment:

Safety glasses must be worn at all times. Goggles that meet ANSI standard z.87,1.2015 with side shields are preferred. Safety glasses without side shields do not provide adequate protection from splashes.

Select gloves that are the most impervious to the chemical being used. Consult the glove manufacturers' chart and SDS. Inspect gloves for tears or holes prior to use.

The use of a face shield in addition to safety glasses is appropriate where splash or spray may occur.

Lab coats must be worn and an apron should also be worn when handling materials that are toxic with skin contact.

Wear long pants or long skirts made of cotton or natural fabric. Synthetic fabrics may melt onto skin with fire.

Do not wear loose, dangling sleeves or jewelry.

Wear closed-toed shoes that are not made of canvas, cloth, or absorbent material.

Tie back long hair.

Uncontrolled Release:

Anticipate spills in advance and have containment materials nearby.

Turn off possible ignition sources. Do not attempt to clean a spill of 1 liter or larger, a complicated spill outside of fume hood, or of a chemical with which you are not familiar.

Notify Chemical Hygiene Officer or Campus Safety Officer in the event of a large spill.

Do not use paper towels to absorb flammable chemicals. This concentrates vapors and increases fire risk.

Absorb spill with commercial adsorbents or spill pillows. Sand or vermiculite also works well.

Absorbed material may be dry swept into an appropriately labeled hazardous waste container.

Spill pillows should be disposed of as hazardous waste.

Wash the area with detergent and water, and wash any tools such as scrapers, brooms, and reusable gloves.

First Aid:

In the case of eye contact, use eye wash to rinse eyes for 15 minutes. Hold eyelids open and move eyes.

In the case of skin contact, remove contaminated clothing and rinse skin for 15 minutes, using safety drench shower if necessary.

In the event of a burn, cool with cold water and seek medical attention. Do not apply ice to burns.

In the event of ingestion, do not induce vomiting. Give water and call for immediate medical attention. If the victim is vomiting, turning their head to the side to minimize choking hazard.

Provide responder/physician with a copy of SDS.

Dial Extension 72000 from campus phone for emergency response.

Appendix D: (SOP) Corrosive Chemicals

Application:

This SOP is intended as general guidance for the use of corrosive chemicals. The SDS should be consulted for safety information on specific chemicals. **This is not intended as a Laboratory Specific SOP. Laboratory Specific SOPs are the responsibility of the Principal Investigator.** Certain chemicals may be classified in more than one hazard category. In these cases, more than one SOP would apply. For example, hydrofluoric acid is both corrosive *and* toxic.

Definition:

Corrosive chemicals cause visible destruction of, or irreversible alterations in living tissue by chemical action at the site of contact, including the respiratory tract when corrosive vapors are inhaled. Corrosive liquids have a pH of less than or equal to 2, or greater than or equal to 12.5, according to the Environmental Protection Agency (EPA) definition.

Examples of corrosives include acids such as hydrochloric, nitric, or sulfuric, bases such as sodium hydroxide or potassium hydroxide, solids such as phenol or phosphorus, or gasses such as chlorine or ammonia. Strong oxidizers such as hydrogen peroxide or bromine are also corrosive.

General Methods:

Corrosives with harmful vapors must be handled in a fume hood.

Only heat resistant glassware should be used.

Slowly add acid to water only. Never add water to acid.

Store acids separately from bases, and below eye level.

Do not store on high shelves or cabinets.

Employ secondary containment when hand carrying from the stockroom to laboratory,

Engineering Controls:

Corrosive chemicals should be handled in a fume hood if they produce harmful vapors.

Personal Protective Equipment:

Safety glasses or goggles must be worn at all times. Eye protection must

Meet ANSI standard Z87.1-2015. Indirect vented goggles with side shields are preferred as they afford the most protection from splashes entering the eye area.

Face shield use in addition to safety eyewear is appropriate where splash or spray may occur.

Select gloves that are the most impervious to the chemical being used.

Nitrile disposable gloves provide adequate protection for exposure to small amounts of corrosives in laboratory use but should be changed when they become contaminated. Consult manufacturers' charts and SDS for the most appropriate gloves.

Lab coats should be worn to protect against skin contact.

Do not wear clothing with loose or dangling sleeves.

Wear closed-toed shoes that are not made of canvas or cloth or absorbent material.

Tie back long hair.

Uncontrolled Release:

Anticipate spills in advance and have containment materials nearby.

Do not attempt to clean a spill of 1 liter or more of a liquid, a complicated spill outside of fume hood, or 1 kg or more of a solid.

In the event of a large spill, contact the Chemical Hygiene Officer or Campus Safety Officer and your supervisor.

Do not attempt to clean a spill of a chemical with which you are not familiar.

Consult the SDS for appropriate cleanup information.

Acids spills may be neutralized with sodium bicarbonate. Bases may be neutralized with citric acid. Commercial neutralizers are available. Do not attempt to neutralize with water

Very large volumes of water are needed to neutralize a relatively small amount of corrosive, which will only result in a larger spill, amplifying the hazard.

Neutralized material may be absorbed with pillows or dry swept into an appropriately labeled hazardous waste container.

Tools used in the cleanup may be wiped with a laboratory tissue (Kimwipe). Deposit the tissue in the hazardous waste container.

Wash the spill area with detergent and water.

Wash any non-disposable brooms or scrapers, and gloves with detergent and water.

First Aid:

In case of eye contact, use eye wash for 15 minutes. Hold eyes open and move eyeballs.

In case of skin contact, remove contaminated clothing and rinse skin for 15 minutes, using a safety drench shower if necessary.

In the event of inhalation, move to fresh air and call for medical assistance.

In the event of ingestion, do not induce vomiting. Give water unless SDS instructs otherwise.

If the victim is vomiting, turn their head so as to reduce the choking hazard. Immediately call for medical attention. **Dial extension 72000 from campus phone for emergency assistance.**

Appendix E: (SOP) Oxidizers

Application:

This SOP is intended as general guidance for use of oxidizers. The SDS should be consulted for safety information on specific chemicals. **This is not intended as a Laboratory Specific SOP. Laboratory Specific SOPs are the responsibility of the Principal Investigator.** Certain chemicals may be classified as oxidizers *and* particularly hazardous or toxic so SOPs for these categories of hazards would also apply. Certain oxidizer chemicals such as chlorites, nitrates, and perchlorates are also shock sensitive. They may be explosive when subject to heat or friction.

Definition:

Oxidizers act as electron acceptors, thus oxidizing other materials. They may increase the intensity of fires. They are capable of forming explosive mixtures with flammables. Oxidizers may transfer an oxygen atom or other electronegative atom. Oxidizers are hazardous due to their ability to increase the combustibility or flammability of certain materials. Oxidizers may undergo vigorous decomposition due to heat or contamination. Some oxidizers may be corrosive to skin, eyes and cause burning of respiratory tissue if inhaled. Oxidizing liquids include hydrogen peroxide, nitric acid, and household bleach.

Oxidizing solids include potassium permanganate, and ammonium nitrate, sodium chlorate, and perchlorate compounds.

NFPA 430 classifies oxidizers as follows:

Class 1: An oxidizer that does not moderately increase the burning rate of combustible materials with which it comes into contact. Examples include inorganic and organic nitrates, ammonium persulfate, hydrogen peroxide solutions between 8 and 27.5%

Class 2: An oxidizer that causes a moderate increase in the burning rate of combustible materials with which it comes in contact. Examples include bleach, potassium permanganate,

Class 3: An oxidizer that causes a severe increase in the burning rate of combustible materials with which it comes into contact. Examples include sodium bromate, sodium chlorate, hydrogen peroxide solutions between 52 and 91%, nitric acid greater than 86%

Class 4: An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock and that causes a severe increase in the burning rate of combustible materials with which it comes into contact. Examples include ammonium perchlorate greater than 15 microns (Less than 15 microns is considered explosive and not covered by NFPA 430)

General Methods:

Perform a hazard analysis for each step of procedure.

Purchase, store, and use the minimum quantity necessary.

Store oxidizers away from flammables, reducing agents, and active or finely divided metals. Do not store on combustible shelving such as wood.

Perform work in a fume hood that has been cleared of all unnecessary materials and combustibles.

Avoid mixing with combustibles.

Work away from heat sources.

Engineering Controls:

Oxidizers should be used in a fume hood.

Personal Protective Equipment:

Safety glasses rated for impact resistance must be worn. Chemical splash goggles are recommended if a splash hazard exists. Working behind a blast shield is recommended if there is risk of explosion.

Select gloves that are most impervious to the chemical being used. Consult glove manufacturers' charts and SDS. Inspect gloves for holes or tears prior to use.

Use a face shield in addition to safety glasses when working with shock sensitive materials.

Lab coat must be worn.

Wear long pants or skirts to the ankle made of cotton or natural fabric. Synthetic fabrics may melt on to the skin in fire.

Do not wear loose, dangling jewelry or sleeves.

Wear closed toed shoes which are not made of absorbent or permeable material.

Tie back long hair.

Uncontrolled Release:

Anticipate spills in advance and have containment materials nearby.

Turn off sources of ignition. Prevent contact with combustibles.

Do not attempt to clean a spill of a material with which you are not familiar. Do not attempt to clean a large or complicated spill outside of fume hood. Indicate spill with signage and evacuate lab or spill area.

See “Uncontrolled Release” information for reactive chemicals, Appendix G. **Spills of shock sensitive materials must be treated as an emergency. Contact Chemical Hygiene Officer and Campus**

Safety (ex 7200. Evacuate building by activating fire alarm. Be prepared to provide emergency responders with the nature, extent, and location of the spill, along with a copy of the SDS.

For small spills inside of a fume hood, ensure that the spill has not become contaminated. **If there signs that a reaction is occurring such as hissing or bubbling, evacuate immediately and contact**

Chemical Hygiene Officer and Campus Safety. Do not use combustible materials such as paper towels to clean spills. Use inert material such as vermiculite or sand to absorb liquid oxidizers.

Absorbed material may be placed in a non-combustible hazardous materials bag or bucket with a lid and labeled as hazardous waste. Clean spill area with detergent and water.

First Aid:

In case of eye contact, use eye wash for 15 minutes. Hold eyes open and move eyeballs.

In case of skin contact, remove contaminated clothing. Brush solid material from skin before rinsing skin for 15 minutes, using a safety drench shower if necessary.

In the event of inhalation, move to fresh air and call for medical assistance.

In the event of ingestion, do not induce vomiting. Give water unless SDS instructs otherwise.

If the victim is vomiting, turn their head so as to reduce choking hazard. Immediately call for medical attention. **Dial extension 72000 from campus phone for emergency assistance.**

Appendix F: (SOP) Highly Toxic Chemicals, Carcinogens, and Reproductive Toxins

Application:

This SOP is intended as general guidelines for the use of particularly hazardous chemicals. Particularly hazardous chemicals include those that are highly toxic, carcinogens, or reproductive hazards including teratogens, mutagens. **This SOP is not intended to be a Laboratory Specific SOP. Laboratory Specific SOPs are the responsibility of the Principal Investigator.**

Definition:

OSHA defines a highly toxic chemical as one with a median lethal dose (LD50) of 50 mg or less per kg of body weight when administered orally to albino rats weighing between 200 and 300 grams each. Or with a median lethal dose (LD50) of 200 mg. or less per kg of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kg each. Or a lethal concentration (LC50) in air of 200 ppm by volume or less of a gas or vapor, or 2 mg per liter or less of mist, fume, or dust when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 gm each.

Cal OSHA defines carcinogen as a chemical that is regulated by Cal OSHA as a carcinogen (Refer to Appendix I). Or, it is categorized as “known to be carcinogens” in the Annual Report on Carcinogens published by the National Toxicology Program (NTP). Or it is listed under Group 1 (“carcinogenic to humans”) by the International Agency for Research on Cancer (IARC). Or it is listed in either Group 2A or 2B by IARC or under the category “reasonably anticipated to be carcinogens” by NTP and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria: 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 dosages of less than 50 mg/kg of body weight per day. Regulated carcinogens may require exposure monitoring to ensure that exposure does not exceed the action level.

Reproductive hazards are defined as chemicals that affect the reproductive capabilities including causing chromosomal damage (mutagen) or adversely affect fetal development (teratogen). Due to variances in reproductive hazard information on SDSs per each chemical supplier, refer to additional external resources such as the [NIOSH Pocket Guide \(NPG\)](#) and the [Proposition 65 list \(Prop. 65\)](#).

General Methods:

Access to particularly hazardous chemicals must be controlled.

Conduct sound and thorough planning, including apparatus, layout, waste containment, clean up materials, and first aid.

Use the smallest amount of chemical possible, and substitute less hazardous chemicals if possible.

Avoid powders if possible. Order premade solutions to avoid excess handling. If powders must be used, they should be weighed in a fume hood, unless this would pose an additional hazard due to turbulent airflow. Surround the balance area with wetted paper towels.

Perform work in a fume hood or glove box.

Lay down plastic backed bench paper under apparatus.

Employ secondary containment for apparatus and glassware where possible.

Label all containers with the correct chemical name. Formulas and chemical structures are not to be used as labels.

Decontaminate workbench and equipment when work is complete. Wash hands and forearms with soap and water.

Dispose of bench paper and other disposable equipment as hazardous waste

Designated Area:

A designated area with limited access shall be established. This may be an entire lab, a specific workbench, or hood. Designated area should be marked with signs (i.e. Warning! Hydrofluoric Acid Work Area, Highly Toxic Material). Specific lab benches may be demarcated with hazard tape.

Remove personal protective equipment before leaving the area and thoroughly wash hands and forearms.

Engineering Controls:

Particularly hazardous chemicals must be used in a fume hood. Ensure that the fume hood is working properly before use. Air flow should be at a face velocity of 100 fpm, averaged over the face of the hood. The sash must be kept at the lowest possible level.

Inspect hood before use to make sure that airflow is sufficient. Hoods must be inspected and certified annually.

Personal Protective Equipment:

Safety glasses must be worn at all times. Goggles that meet ANSI Z87.1-2015 with indirect venting offer more protection from splashes and sprays than standard safety glasses. Face shields are appropriate where sprays or splashes may occur.

Lab coats must be worn. Lab coats contaminated with a particularly hazardous chemical must be disposed of as hazardous waste. Disposable lab coats are commercially available.

Select gloves that are most impervious to the chemical being used. Consult glove manufacturers' charts and SDS for information on the most protective glove material. Inspect gloves for holes or tears before use.

Wear long pants and closed toed shoes which are not made of canvas or cloth.
Tie back long hair.

Uncontrolled Release:

Anticipate spills in advance and have containment materials nearby.
Consult SDS for spill clean-up information prior to beginning work.
Do not attempt to clean a spill of 100 ml or more of a particularly hazardous liquid chemical, or 50 g. or more of a solid.
Do not attempt to clean up a material with which you are unfamiliar.
Dike area, if it is safe to do so, using booms to prevent material from entering sanitary sewer via sinks and floor drains.
Evacuate the area and restrict access with signs and barriers. Close laboratory doors.
Call Campus Safety (ex 72000), Chemical Hygiene Officer, and Campus Emergency Preparedness Coordinator.
For small, incidental spills, don personal protective equipment including safety goggles, gloves, lab coats, and shoe covers.
Use commercially prepared absorbent materials, such as pillows and towels. Dispose of these as hazardous waste.
Dry sweep any material that has been absorbed with powdered neutralizers into a hazardous waste container.
Label waste container with the appropriate warning. (Particularly Hazardous Material, Carcinogen, Reproductive Hazard, etc.)
Clean spill area with detergent and water. Dispose of any wipes, etc. as hazardous waste.
Decontaminate any non-disposable personal protective equipment with detergent and water.

First Aid:

In case of eye contact, use eye wash to rinse eyes for 15 minutes. Hold eyelids open and move eyes.
In the case of skin contact, remove contaminated clothing and rinse skin for 15 minutes, using a safety shower if necessary.

Any exposure to a particularly hazardous chemical requires medical attention! Report exposures to Chemical Hygiene Officer and Campus Safety Coordinator.

For emergency medical response dial extension 72000 from a campus phone. Provide responder/physician with a copy of the SDS.

Appendix G: (SOP) Highly Reactive and Unstable Materials

Application:

This SOP is intended as general guidance for the use of highly reactive or unstable materials. The SDS should be consulted for safety information on specific chemicals. **This is not intended as a Laboratory Specific SOP. Laboratory Specific SOPs are the responsibility of the Principal Investigator.** Certain chemicals may be classified in more than one hazard category. In these cases, more than one SOP would apply. For example, perchloric acid may be corrosive and unstable, depending on the concentration.

Definition:

Highly reactive materials are defined as those that when subject to heat, friction, detonation or other suitable initiation undergoes rapid chemical change with a sudden release of pressure, gas, and heat. Examples include peroxides, perchloric and picric acids.

Pyrophorics ignite spontaneously when exposed to air at temperatures of 130°F (54.4°C) or below. Examples include metal powders and organolithiums.

Water Reactive materials react violently with water to produce toxic, corrosive, or flammable gases and liberation of heat. Examples include Alkali metals, alkali metal hydrides, alkali metal nitrides, calcium carbide, phosphorus pentoxide, metal and non-metal halides, organic acid halides, anhydrous metal hydrides

General Methods:

Perform hazard analysis. Determine risks and mitigation in advance (emergency procedures).

Have sand or other neutralizing media nearby.

Have proper fire extinguishing equipment nearby. (Class D fire extinguisher for metals) Do not use water or CO2 extinguisher.

Develop and follow written procedures.

Use a blast shield in combination with fume hood sash.

Minimize the quantity of reactive materials used and stored.

Keep other chemicals away from the reaction area.

Limit access to the reaction area.

Label containers with date of receipt and upon opening.

Do not use past expiration dates.

Seek prior approval before using highly reactive materials or making procedural changes.

Decontaminate work surfaces at the end of each procedure and at the end of the day.

Decontaminate reaction equipment before removing from the designated area.

Decontaminate personal protective equipment.

Remove gloves after decontamination, and wash hands and arms with soap and water.

Engineering Controls:

Conduct procedures in a fume hood, or under inert conditions in a glove box as appropriate.

Personal Protective Equipment:

Long pants and shoes that completely cover the foot must be worn. Canvas and cloth fabric athletic shoes do not provide adequate protection. Clothing must be made of natural and not synthetic material that may melt and stick to skin in the event of a fire.

Utilize personal protective equipment including goggles (not safety glasses), face shield with throat protector, heavy gloves if the material is toxic or may be absorbed through the skin, consult MSDS and glove manufacturers' guides for glove selection. Flame resistant lab coats with snap closures (to facilitate quick removal) must be worn.

Uncontrolled Release:

All spills of air- and water-reactive materials are emergencies. Dike and cover spill with sand or vermiculite if it is safe to do so. For spills of reactive metals, a class D fire extinguisher (yellow) may be used. Alert others in the area and evacuate. Notify others in the building. Contact Campus Safety (ex 72000) and persons on the emergency contact list. Be prepared to provide emergency responders with the nature, extent, and location of the spill, along with a copy of the SDS.

First Aid:

In case of eye contact, use eye wash to rinse eyes for 15 minutes. Hold eyes open and move eyeballs. Seek medical attention.

In the event of skin contact, remove contaminated clothing and flush with water for at least 15 minutes, using a safety shower if necessary.

In the event of inhalation exposure, move the victim to fresh air and seek medical assistance.

In the event of ingestion, immediately seek medical assistance. If the victim is vomiting, turn their head to reduce choking hazard. Provide emergency responders with a copy of SDS. **Dial 72000 from campus phone for medical assistance.**

Appendix H: Compressed Gas Cylinder Safety

Storage

- Compressed gas cylinders must be stored and used according to California Code of Regulations Title 8 Section 4650, *Compressed Gas and Air Equipment*.
- Compressed gas cylinders must be double chained or strapped. One strap should be at the upper third, and one at the bottom third of the cylinder. The two-point restraint affords extra security in the event of an earthquake.
- Flammable gasses must be separated from oxidizing gases by a minimum distance of 20 feet or by a non-combustible barrier of at least five feet high.
- Storage inside buildings must be in a well-ventilated area.
- Store away from combustibles, flammable solvents, oils, flames, electrical equipment and other sources of ignition.
- Cylinders not in use or attached to equipment must have the regulator removed and the valve cap in place.
- Cylinders must be tagged indicating whether they are full, in use, or empty.

Handling

- Compressed gas cylinders must be used only by those who have been properly trained. Training may be performed by laboratory supervisors as part of the laboratory specific standard operating procedures. Training must be documented.
- Inventory of compressed gas cylinders must be reviewed annually.
- Read the SDS for the particular gas you are handling. Gases may be explosive, flammable, toxic, corrosive, oxidizing, or simple asphyxiants.
- When handling compressed gas cylinders, ANSi approved safety glasses must be worn. Closed toe shoes must be worn. Additional PPE may be required depending on the hazards of the particular gas. For example, use of corrosive or toxic gases may require self-contained breathing equipment availability in case of emergency. Use of respirators requires special pulmonary evaluation, training, and fit testing. Contact the Chemical Hygiene Officer for assistance.
- Cylinders must be transported on a cart specifically designed for that purpose. They must be transported with the valve closed and cap in place. The valve stem must be protected as it is the most fragile part of the cylinder. Cylinders must not be rolled or dragged.
- Inspect cylinders for damage prior to use. Do not use cylinders that appear damaged (cracks, dents, bulging) or that do not indicate contents. Color of the cylinder is not indicative of its contents. Do not accept cylinders that are past due for hydrostatic testing. Hydrostatic testing must be performed by the vendor every 5 years per Department of Transportation (DOT) regulations and dates must be indicated on the cylinder. A star indicates that the cylinder testing may extend to 10 years.
- Do not attempt to repair a damaged cylinder. Only an authorized vendor may refill a compressed gas cylinder.
- Use only regulators that are designated for the specific gas you are using. Use only a CGA approved regulator. Match the number on the regulator with that on the valve stem. Regulators must be free of dirt, grease and other contaminants. Do not use Teflon or plumber's tape to correct a poor fit. Tape may disintegrate and contaminate the regulator fittings.
- The regulator and cylinder valve must be closed when attaching the regulator. Do not over-tighten valves. Hand-tighten only.
- Stand to the side of the cylinder when opening the regulator. Open valves only enough to allow a flow of gas necessary for the desired pressure.

Leaks and Uncontrolled Release

- Use a leak detector such as “Snoop” to detect leaks on cylinder valves and regulators. Do not use a leaking cylinder or regulator. Do not attempt to repair a leaking cylinder valve. If it is safe to do so, move the leaking cylinder to the loading dock or another well-ventilated area where it may be safely secured. Call the vendor for a replacement.
- If leaking gas is flammable, post signs in the area that warn of potential fire hazards and the importance of the elimination of ignition sources. If the leaky flammable gas cylinder cannot be moved safely, extinguish any open flames and evacuate the area. Do not turn off lights or other electrical equipment as this may cause arcing, therefore creating a source of ignition. If ignition occurs, do not try to extinguish flame unless the gas source may be shut off safely. If the gas source may not be stopped, activate the fire alarm, evacuate the building, and call for emergency assistance.

Leaks of corrosive and toxic gases require immediate evacuation of the area. If possible, direct leaking gas into a fume hood. If building evacuation is necessary, fire alarms may be activated.

Emergency

An emergency is defined as a release of gas that cannot be stopped by closing the cylinder valve. An emergency may require the assistance of the fire department and hazardous materials teams. It may involve the rescue of injured people by specially trained responders who are equipped with proper PPE, including self-contained breathing apparatus.

First Aid

For inhalation exposure move the victim to fresh air. Seek medical assistance if symptoms continue. For exposure to toxic or corrosive gasses, seek medical attention immediately.

Any exposure to a particularly hazardous chemical requires medical attention! Report exposures to Chemical Hygiene Officer and Campus Safety Coordinator. For emergency medical response dial extension 72000 from a campus phone. Provide responder/physician with a copy of the SDS.

Appendix I: Cryogen Safety

Cryogenic materials are defined as solidified or liquid gases at extremely low temperatures. Cryogenic liquids boil at temperatures at or below -150°C . Examples include liquid nitrogen, liquid helium, and liquid oxygen. Small amounts of cryogenic liquid can expand into large volumes of gas. The volume of gas to liquid expansion volume ranges from 650 to 1500 units of volume gas to 1 volume liquid (1500:1). Sublimation of cryogenic solids (solid phase directly to gas phase) occurs from -78.5°C to -109.3°C . Dry ice (carbon dioxide) is an example of a cryogenic solid.

Hazards

Hazards of cryogenics include tissue damage similar to thermal burns. Eyes are extremely susceptible to cryogen damage. If the liquid boils to the gas phase and is released into the air in a confined space, oxygen displacement may occur resulting in asphyxiation. Cryogenics stored in pressurized containers must be equipped with pressure release valves to prevent container failure due to rapidly expanding gas and pressure build up.

Use cryogenic materials in well-ventilated areas.

Cryogenic baths should be open to the atmosphere to avoid pressure build up.

When transporting liquid cryogenics use a Dewar with a cap that allows for the escape of built-up pressure but keeps air and moisture out. Special transport Dewars are built for this purpose. Fill only to 80% capacity. Do not ride the elevator with cryogenic materials. Send cryogen separately with the label cautioning others not to board the elevator while cryogenic material is in transport.

Transport Dewars should be wrapped in heavy tape to shield from possible explosion and propulsion of glass shards.

Liquid oxygen must be used away from open flames and combustible materials.

Some cryogenic liquids such as helium and nitrogen have the potential to cause the accumulation and condensation of liquid oxygen from the atmosphere causing liquid oxygen enrichment. Enriched oxygen environments increase fire danger.

Do not tamper with, disable, or remove pressure relief devices on cryogen containers.

Do not touch cryogenic materials or items cooled with cryogenic materials with bare hands. Use tongs or similar implements to handle cryogenically cooled items.

Personal Protective Equipment

Personal protective equipment includes safety glasses or chemical splash goggles and lab coat. Face shield must be worn when transferring cryogenic material from a pressurized Dewar. Attire must include long pants that do not have cuffs. Cuffs may trap cryogenic material causing burns. Shoes must cover the entire foot and must not be made of a fabric or mesh type material.

Wear cryogenic gloves when handling cryogenics. These are intended for incidental contact and not for immersion.

Spills/Uncontrolled Release

If a large spill occurs or a Dewar leaks uncontrollably, evacuate the area and notify campus safety at ex 72000. Rapid gas expansion may create an oxygen deficient atmosphere.

Waste Disposal

Do not dispose of excess dry ice or cryogenic liquids in sinks. Thermal shock may damage the pipe system. Allow small amounts of excess materials to evaporate naturally.

First Aid

For frostbite, warm area with warm, not hot water. Do not rub the affected area. For splashes to the eyes, use eye wash for 15 minutes to warm the affected area. Safety showers may be used in the event of large body area contact. Remove affected clothing before using a safety shower. Keep the victim at normal body temperature until responders arrive. **Report exposures to Chemical Hygiene Officer and Director of Operations and Emergency Preparedness. For emergency medical response dial extension 72000 from a campus phone. Provide responder/physician with a copy of the SDS.**

Appendix J: Spill Response Procedures

CONSIDER SAFETY FIRST! DO NOT JEOPARDIZE YOUR SAFETY! DO NOT RUSH IN TO A SPILL AREA WITHOUT FIRST EVALUATING THE HAZARDS!

DO NOT ATTEMPT TO CLEAN A SPILL OF AN UNKNOWN MATERIAL OR IF YOU ARE NOT CERTAIN HOW TO PROCEED!

DO NOT ATTEMPT TO CLEAN A LARGE OR COMPLEX SPILL, OR 100 ML OR MORE OF A PARTICULARLY HAZARDOUS LIQUID OR 50 G OR MORE OR A PARTICULARLY HAZARDOUS SOLID OUTSIDE OF FUME HOOD! PARTICULARLY HAZARDOUS MEANS HAVING AN LD50 (ORAL) OF 50 MG/KG BODY WEIGHT OR LESS FOR ORAL EXPOSURE, AN LC50 OF 200 PPM OR LESS FOR A GAS OR VAPOR, 200 MG/KG BODY WEIGHT OR LESS FOR SKIN CONTACT, A REGULATED, LISTED, OR SELECT CARCINOGEN, OR A REPRODUCTIVE HAZARD. THIS DEFINITION ALSO INCLUDES HIGHLY REACTIVE, PYROPHORIC, WATER REACTIVE, OR SHOCK SENSITIVE CHEMICALS. SPILLS THAT OCCUR NEAR INCOMPATIBLE MATERIALS OR IGNITION SOURCES, OR HAVE VAPORS THAT MAY ENTER VENTILATION SYSTEMS, OR THAT ARE IN CLOSE PROXIMITY TO CLASSROOMS OR OFFICES WHERE OCCUPANTS ARE NOT PROTECTED FROM CHEMICAL HAZARDS ARE CONSIDERED TO BE COMPLEX SPILLS. EVACUATION OF SPILL AREA AND POSSIBLE BUILDING EVACUATION MAY BE NECESSARY. CALL THE CHEMICAL HYGIENE OFFICER FOR ASSISTANCE IN THESE SITUATIONS.

The American Chemical Society defines a simple spill as “one that does not spread rapidly, does not endanger people or property except by direct contact, and does not endanger the environment”.

BASIC CLEANUP PROCEDURES FOR SIMPLE SPILLS

- Use the buddy system so that one person may render first aid and call for help if needed while the other may tend to spill.
- Don appropriate PPE, including safety glasses, gloves, and lab coat. Don shoe covers if the spill is on the floor.
- Administer chemical exposure first aid, and call for emergency response, if warranted
- Notify others in close proximity who may be affected by fumes or secondary hazard. Evacuate area if necessary. Notify your supervisor.
- Contain material with spill pillows or dike tubes.
- Control vapors and dusts. Close the laboratory door and open fume hoods.
- If broken glass is involved, use tongs or scoop to place it in a bag, then place the bag in a sturdy cardboard box or another rigid container. Glass must not be placed in a laboratory broken glass bin unless free of contamination.
- Use appropriate media to absorb or neutralize spill. Neutralizers are recommended for most acids, bases, and formaldehyde.
- Use a broom and dustpan to sweep absorbed or neutralized material, or use tongs to retrieve soaked spill pads.
- Place absorbent materials in a hazardous waste bag.

- Clean spill area with detergent such as Simple Green, and water.
- All tools used in cleanup must be decontaminated using a wet paper towel or laboratory wipe. Place the laboratory wipe in a hazardous waste bag with other spill materials.
- Rinse tools and reusable gloves with copious amounts of water, air dry, and return to the spill kit.
- Place disposable personal protective equipment (PPE) such as shoe covers, gloves, and disposable lab coats in hazardous materials bag.
- Seal the hazardous materials bag with heavy tape and label appropriately as hazardous waste.
- Restock spill kit items.

Flammable liquids:

- Immediately control ignition sources such as heating mantles, hot plates, and open flames. Remember that vapors can travel a distance and flashback.
- Don appropriate PPE, administer first aid as necessary, and notify others as outlined above.
- Lay chemical spill pads over spill, or use adsorbent spill powder for flammables. Sand or vermiculite also work well. Begin by sprinkling powder on the outside perimeter of the spill, working your way towards the middle until it is completely covered.
- **DO NOT USE PAPER TOWELS TO ABSORB FLAMMABLE LIQUIDS!** Paper towels increase vapor pressure and therefore increase fire danger.
- Continue with procedures as outlined above.

Acids and Bases

- Don appropriate PPE, administer first aid as necessary, and notify others as outlined above.
- Cover spill with appropriate acid or base neutralizer. Sprinkle powdered neutralizer over spill beginning on the outer edges and working toward the center.
- Allow time for neutralization. Some commercial powders may undergo a color change when neutralization has occurred.
- Continue with procedures as outlined above.

Solid Materials

- Don appropriate PPE, administer first aid as necessary, and notify others as outlined above.
- Use a plastic scoop to place spilled material into a hazardous materials bag. Care should be taken not to create dust or cause solid material to become airborne.
- After the bulk of the material has been cleaned up, sweep up the remaining material.
- Use a wet paper towel to wipe down the area. Dispose of the paper towel in the hazardous material bag.
- Continue with procedures as outlined above.

Mercury Spill Cleanup

Do not mix mercury waste with other waste streams.

Most mercury spills occur when a thermometer is broken. Today non-mercury thermometers are readily available and their use is encouraged whenever possible. Spilled mercury typically forms bead-like droplets that roll and scatter. These droplets have the potential to hide in cracks and crevices, perhaps going unnoticed. Mercury vaporizes readily and is thus inhalable. Mercury is a known neurotoxin. Symptoms of acute mercury poisoning include tightness in chest, cough, headache, gastrointestinal symptoms, and malaise. Chronic symptoms due to unchecked vaporization of spills include behavioral changes, fatigue, weight loss, gastrointestinal dysfunction, memory loss, and insomnia. Thorough cleanup of a mercury spill is crucial.

Small Spills (i.e. Broken Thermometer)

1. Set up a perimeter of at least 3 feet. Persons not involved in spill cleanup must be kept out of the perimeter area to keep from tracking through spill and possibly spreading contamination. Determine if mercury was tracked away from the spill site. Post chemical spill signs or barricade tape.
2. Remove all metal jewelry. Don disposable nitrile gloves. If the spill is on the floor, don shoe coverings. Anyone who has walked through a potential spill area, or whose clothing has become contaminated must remain in the area. Contaminated clothing must not be washed in a home washing machine as this will contaminate the home with mercury. Contaminated clothing and footwear must be bagged and discarded as hazardous waste.
3. Shine a flashlight in many directions and angles to locate all beads of mercury. It may be helpful to turn off lights when this task is performed.
4. Using an index card, scrape together beads of mercury. Never use a household vacuum or broom to sweep up mercury. This would disperse mercury droplets into the air and cause more widespread contamination. Use care to avoid scraping mercury into cracks and crevices. Duct tape may also be used to collect mercury beads.
5. If broken glass is involved, carefully pick up glass using tongs. Place glass pieces on a paper towel. Fold paper towel and place in a zip lock bag. Collected mercury and contaminated glass must be disposed of as hazardous waste. If cleanup involves broken glass, place a zip lock bag containing broken glass into a rigid container such as a cardboard box such that glass does not poke through the plastic.
6. Beginning from outside of the mercury pile, sprinkle mercury spill powder over mercury. Use a damp sponge or water from a spray bottle to moisten mercury and powder. Scrub to make a paste. The powder and mercury will form a less hazardous amalgam. Scoop up amalgam into a plastic zip lock bag or hazmat bag. Double the zip lock bag or place in a glass jar, as vapors may escape through the plastic bag.
7. Label container with a hazardous waste label.
8. Store container in fume hood and arrange pickup with the Chemistry Department Stockroom, ex 74957.

Large Spills

For large spills of a pound or more of mercury (approximately 2 tablespoons), evacuate the area and contact campus safety. Only persons wearing respirators equipped with mercury vapor cartridges may clean up large mercury spills. Open windows to ventilate area. Call F&M to shut down any recirculating ventilation. Do not re-enter area until it has been determined that vapor concentrations are under the permissible exposure limit (Cal OSHA 0.025mg/m³)

In the event of a mercury spill on carpet, the carpet may have to be removed and disposed of as hazardous waste. This is dependent on mercury vapor determinations in the contaminated area.

Complete Chemical Incident Report (below) for all simple and complex spills. Return report to Chemical Hygiene Officer and department supervisors.



**Harvey Mudd College
Chemistry Department Incident Report**

Incident Date

Incident Time

Involved/Injured Person

Involved person is: Student _____ Faculty _____ Staff _____

Incident Location

Witness(es) and Contact Information:

Nature of Incident (check all that apply):

Chemical Exposure, Eye _____
Chemical Exposure, Inhalation _____
Chemical Exposure, Skin _____
Chemical Ingestion _____
Chemical Injection _____
Chemical Spill _____
Cut or Abrasion _____
Electrical Shock _____
Explosion _____

Fire _____
Frostbite _____
Fainting/Seizure _____
Head/Injury _____
Laser Exposure _____
Mechanical Pinching/Crushing _____
Needle Stick _____
Slip/Trip/Fall _____
Thermal Burn _____

Other (describe): _____

Incident Description (Include details of how the incident occurred and chemicals involved, if any. Include any spill clean-up procedures. Attach SDS for chemical exposure incident.):

Description of Injuries (state “none” if none sustained):

Describe first aid administered and by whom (state “none” if none administered):

Follow-up Treatment (provide responders with copy of SDS for all chemicals involved)

Emergency Room (facility name)

Urgent Care (facility name)

Personal Physician (name)

Workers’ Compensation Physician (name)

Emergency Responders/Ambulance Assistance (name)

Incident Analysis (recommendations for avoiding similar incident):

Injured/Involved Person Signature

Date

Supervisor Signature

Date

Appendix K: Peroxide Formers

The following is a list of chemicals known to form explosive peroxides and hydroperoxides when exposed to air over time. Peroxides may form upon concentration during laboratory activities such as distillation or evaporation, or by polymerization. These chemicals must be dated upon arrival in the laboratory, and again when initially opened. Bottles should be visually inspected for crystallization, discoloration, or liquid stratification before each opening. A flashlight should be used to inspect amber bottles. Bottles with obvious crystal formation should not be opened or moved. In this case, notify the Chemical Hygiene Officer for assistance. Test for peroxide formation prior to performing distillation or evaporation procedures. Never use a metal spatula with peroxide formers. Instead use plastic or ceramic. Bottles in use should be periodically tested for peroxides using test strips. Test strips are available in the Chemistry Stockroom. There should never be an attempt to force open a stuck cap. Only bottles of which the age and identity is known should be opened and tested. Purchase only the amount to be used within one year or within recommended storage time limit. Order chemicals with inhibitors whenever possible. Ethers should be purchased in iron containers. Never dispose of peroxide formers down the drain!

Peroxide Formers Upon Concentration (Test or dispose within 12 months)

Acetal	
Acetaldehyde	Methyl Isobutyl Ketone
Benzyl Alcohol	
1,4-dioxane	Methyl Cyclopentane
2-Butanol	4-Pentene-1-ol
Cyclohexene	2-Propanol
Cumene	2-Pentanol
Decahydronaphthalene	2-Phenylethanol
Dicyclopentadiene	Tetrahydrofuran
Diethyl Ether (Ether)	Tetrahydronaphthalene
Ethylene Glycol Diethyl Ether	Vinyl ethers
Furan	Other Secondary Alcohols
Isopropyl Ether	
3-methylbutanol (isoamyl alcohol)	

Auto Polymerization due to Peroxide Formation (Test or dispose within 24 hours if not inhibited, 12 months if inhibited) Peroxides formed in these compounds are shock and heat sensitive.

Acrylic Acid	Methyl Methacrylate
Acrylonitrile	Styrene
Butadiene	

Forms Explosive Polymerization Without Concentration (Dispose of within 3 months)

Potassium Metal

This list is not exhaustive. Investigators should check the SDS on any chemical used for information on chemical stability and peroxide formation.

Appendix L: Protective Gloves/Chemical Compatibility

Material (non-disposable)	generally suitable for:
Butyl rubber	aldehydes, carboxylic acids, glycols and ethers, hydroxyl compounds and alcohols, peroxides, ethyl acetate halogenated hydrocarbons (methylene chloride), ketones
Latex	water soluble/miscible substances, weak acids, weak alkalis, however not recommended for use due to allergenicity.
Natural Rubber	acetone, alcohols, acids and caustics, ammonium fluoride, dimethyl sulphoxide (DMSO), phenol, plating solutions
Neoprene	alcohol, alkalis and caustics, degreasing solvents, mineral acids, oils, plating solutions
Nitrile rubber	alcohols, ammonium fluoride, freons, hexane, hydrofluoric and hydrochloric acid, perchloric acid, potassium and sodium hydroxide
Nomex	Pyrophoric chemicals and temperature extremes. Disposable nitrile gloves may be worn under Nomex gloves.
Poly vinyl alcohol (PVA)	methylene chloride, carbon tetrachloride, chloroform, hexane, heptane, ethyl ether, toluene, xylene
Silvershield™	Most hazardous chemicals, highly toxic materials, materials that may be absorbed through skin. May be worn under butyl gloves for more dexterity.
Vinyl (PVC)	General prevention of contamination, medical examination, nuisance materials
Viton™ (Fluorinated Rubber)	Chlorinated (methylene chloride) and aromatic solvents (benzene).

Known suppliers of protective gloves such as Ansell provide information in their product catalogs regarding chemical compatibility of various types of protective gloves. Visit www.ansellpro.com for information on chemical resistance of gloves.

Appendix M: Perchloric Acid Fume Hoods and Test Procedures

Perchloric Acid Fume Hoods shall comply with section 6 – 12 of the National Fire Protection Association Code, no 45.

For access to NFPA codes and standards go to the National Fire Protection Association's website at www.nfpa.org.

Warning! Where perchloric acid is heated above ambient temperature, process vapors should be scrubbed or trapped prior to exhausting to the hood. Perchloric acid vapors that have not been captured can condense in a fume hood's ductwork and form explosive perchlorates.

Perchloric acid should be heated only in hoods where the ducts are clean and free of organic materials and there is no possibility of the contamination of the solution.

Chemical Hood Perchloric Acid Test Procedures

To avoid the possibility of explosive perchlorates forming in fume hood ductwork, perchloric acid hoods should be washed down after each use and the final rinsate inspected using a 0.4 % (v/v) solution of methylene blue in water.

Note: Upon testing the rinsate with the 0.4% solution of methylene blue (if perchlorates are present) a violet precipitate will be formed.

At present, HMC has no hoods rated for use with perchloric acid.

Appendix N: Chemical Inventories

Chemical Inventories are maintained using the service provider [Chimera](#). Chemical inventory may be accessed by contacting the Chemical Hygiene Officer at extension 74217. Newly acquired chemicals and safety data sheets will be added to the inventory upon receipt by the Chemistry Department Stockroom Manager. Laboratory supervisors must reconcile their inventories annually. Dispose of expired chemicals or chemicals that are no longer needed. Inquire with colleagues prior to disposal of chemicals as unwanted materials may be of use to others. Inform the Chemistry Department stockroom manager at ex 72957 when a chemical has been used up, moved to a new location, or is to be disposed of as hazardous waste.

For additional information on chemical inventory in each department, contact:

- Biology Department: Jenny Nguyen/Laboratory Manager, Olin1258A
- Chemistry Department: Daniel Guerra/Laboratory Manager, Jacobs 2310
- Engineering Department: Jacob Staimpel, Department Manager, Parsons B174
- Physics Department: BJ Haddad, Laboratory Manager, Jacobs B122

Appendix O: Chemical Storage

Certain chemicals may react with each other and create hazards, such as fire or generation of toxic gases. Separate storage areas **must** be provided for incompatible chemicals. The following are guidelines only. Consult container labels and SDSs for further information on chemical incompatibilities and storage.

<u>Chemical Class</u>	<u>Keep out of contact with:</u>
Oxidizing Mineral Acids, (Sulfuric, Nitric, Perchloric*)	Organic Acids, Alkalis, Organic Solvents, Water Reactives
Non-Oxidizing Mineral Acids (Hydrochloric Acid, Hydrofluoric Acid, Phosphoric Acid)	Organic Acids, Alkalis, Organics Solvents, Water Reactives
Organic Acids (Acetic, Butyric, Formic, Propionic)	Mineral Acids (oxidizing and non-oxidizing), Alkalis, Oxidizers, Water Reactives
Alkalis (Bases) (Sodium Hydroxide, Ammonium Hydroxide, Glutaraldehyde)	Organic Acids, Mineral Acids, Water Reactives, Oxidizers, Organic Solvents
Oxidizers (Hydrogen Peroxide, Permanganates, Persulfates, Chlorates, Perchlorates)	Organic Acids, Organic Solvents Combustible materials and shelving
Organic Solvents (Acetone, Ethyl Acetate, Methanol, Hexanes, Toluene)	Mineral Acids (oxidizing and non-oxidizing), Alkalis, Oxidizers,
Water/Air Reactives (Sodium Borohydride, Calcium Hydride, Lithium Aluminum Hydride, Ammonium Nitrate, sodium metal, potassium metal)	Organic Acids, Mineral Acids, Alkalis, Oxidizers, overhead fire sprinklers
Toxic/Poisonous Compounds (Heavy Metals, chloroform, carbon Tetrachloride, Ethidium Bromide)	Organic Acids, Mineral Acids, Alkalis, Oxidizers, Flammables

*Perchloric Acid must be isolated from combustibles such as wood and paper. Never store on wooden shelves. Provide secondary containment such as a polyethylene tub.

Appendix P: Personal Monitoring

Personal Monitoring is to be performed wherever processes may involve potential exposures at or above the Cal-OSHA established PELs (permissible exposure limits)

Where regulated carcinogens are involved in the process the Cal-OSHA action level (AL) must be evaluated. If the process remains unchanged and exposure does not meet or exceed the AL, no further monitoring is required.

Ordinarily the PEL (permissible exposure limit), the TLV (threshold limit value) and STEL (shorter-term exposure limit) for a particular chemical may be found by referring to the material safety data sheet for that chemical.

Cal-OSHA Regulated Carcinogens and Action Level

Acrylonitrile: 1 part per million

Arsenic, Inorganic: 0.005 milligrams per cubic meter

Benzene: 0.5 ppm

1,3-Butadiene: 0.5 part per million where concentrations are 0.1% or more by volume

Cadmium: 2.5 micrograms per cubic meter

Chromium: (VI) 2.5 micrograms per cubic meter

Coke Oven Emissions

1,2 Dibromo-3-Chloropropane: 1.0 parts per billion

Ethylene Oxide: 1 part per million

Ethylene Dibromide: 15 parts per billion

Formaldehyde: 0.5 parts per million

Lead: 50 micrograms per cubic meter

Methylene Chloride: 12.5 parts per million

4,4 Methylenebis (2 Chloroaniline) urine: conc. of 100 micrograms per liter

Methylenedianiline: 5 parts per billion

Vinyl chloride: 0.5 parts per million

Appendix Q: Hazardous Waste Characteristics

The Code of Federal Regulations (CFR), Title 40, and the California Code of Regulations (CCR), Title 22 address characterizations of waste streams. The Federal Resource Conservation and Recovery Act (RCRA) established lists and characteristics of hazardous wastes. Additionally, CCR Title 22, Appendix X lists hazardous wastes (Non RCRA Hazardous Waste). A waste is defined as hazardous if it is listed by the California Code of Regulations or RCRA, or it exhibits one of the following characteristics:

Ignitable: A liquid with a flash point lower than 60° C, or if not liquid but capable of causing fire through friction, absorption, or moisture, or spontaneous chemical changes, or is an oxidizer, or an ignitable compressed gas.

Corrosive: Has a pH of less than or equal to 2.0 or greater than or equal to 12.5, or is not aqueous, but when mixed with an equivalent weight of water produces a pH of less than or equal to 2.0 or greater than or equal to 12.5, or corrodes steel at the rate of 6.35 mm (0.250 inch) per year at a test temperature of 55°C.

Reactive: Reacts violently with water or generates toxic gases when mixed with water, or is capable of detonation if subject to strong initiating source or heated under confinement, or is capable of detonation at standard temperature and pressure.

Toxic: As determined by Toxic Characteristic Leaching Procedure (TCLP) or contains substances listed as toxic by the EPA in concentrations greater than or equal to the soluble threshold limit as defined in 22 CCR 66261.24. Material has an acute oral LD₅₀ of less than 2,500 mg/kg, acute dermal LD₅₀ of less than 4,300mg/kg, an acute inhalation LC₅₀ less than 10,000ppm as gas or vapor, or has been shown through experience or testing to pose a hazard to human health or environment because of its carcinogenicity, acute or chronic toxicity, bioaccumulative properties, or persistence in the environment.

Extremely Hazardous Wastes and Wastes of Concern:

Has an acute oral LD50 of less than or equal to 50mg/kg, an acute dermal LD50 of less than or equal to 43 mg/kg, or an acute inhalation LC50 of less than or equal to 110 ppm as a gas or vapor. It is water reactive or listed as a persistent and bioaccumulative toxic substance. It is 1 of 16 listed carcinogens with a concentration equal to or greater than 0.1 percent by weight. Hazardous wastes of concern as identified by the US Department of Transportation include explosive hazard (Divisions 1.1, 1.2, or 1.3), a poisonous liquid or solid (Division 6.1 Packing Group I or II, Poisonous gas Hazard Division 2.3

In the State of California, used petroleum or lubricating oil or materials that are contaminated with oil are hazardous waste.

Recyclable Hazardous Wastes

Recyclable Hazardous Waste may be pure or a mixture of the following (label with a green HMC waste label):

- Acetone
- Benzene
- Carbon Tetrachloride
- Chloroform
- Ethanol
- Ethyl Acetate
- Ethylene Glycol
- Freons
- Hexanes
- Lead-Acid Batteries
- Methanol
- Methylene Dichloride
- Methyl Ethyl Ketone (MEK)
- Mixed Hydrocarbon Solvents
- Paint Thinner
- Perchloroethylene
- Trichloroethylene
- Toluene
- Xylenes
- Used Oil

Waste is always presumed to be hazardous unless it can be proven otherwise via process knowledge or laboratory evaluation of the waste product.

Appendix R: Sharps Disposal

Definition: Sharp waste is defined by the State of California as “any device having acute rigid corners edges, or protuberances capable of cutting or piercing.” This includes, but is not limited to hypodermic needles, hypodermic needles with syringes, needles with attached tubing, and blades. Also included are broken glass items, Pasteur pipettes, pipet tips capable of puncturing, and slides.

Non-Contaminated (non-regulated) Sharps

Non-contaminated sharps are any item defined as a sharp that has not been contaminated with a biohazard or a hazardous chemical.

Non-contaminated sharps must be disposed of in a rigid container that is not labeled or intended for biohazardous waste. Label should read “non-regulated sharps.” When the container is $\frac{3}{4}$ full it should be sealed with tape and disposed of in regular trash.

Hypodermic needles and syringes must be disposed of in a rigid red sharps disposal container, even if they have no hazardous contaminants. They may not be placed in the regular trash bins. The containers will be collected when $\frac{3}{4}$ full and disposed via a contracted waste disposal service.

Clean glass for disposal must be placed in a cardboard glass collection bin. Pasteur and serological pipets are considered “clean” if they have been triple rinsed with a material capable of removing contamination. Containers from chemical suppliers must be triple rinsed and the label defaced before placing in the clean glass bins. Chemically contaminated rinsate must be placed in a hazardous waste container. When full the glass collection bin must be securely taped on all sides including the bottom for increased support. Glass collection bins may be disposed of as regular trash.

Chemically Contaminated Sharps

Any sharp such as syringe, needle, or pipet tip which has contained or has been contaminated with a chemical that meets the definition of hazardous waste (Appendix Q) must be disposed of as chemical hazardous waste. Chemically contaminated sharps must be disposed of in a rigid plastic sharps container with the biohazard label covered. Sharps contaminated with biological *and* chemical hazards must be disposed of as chemical hazardous waste. A hazardous waste label must be secured on the container listing the full chemical names of contaminating materials as well as the date that the container was started. Chemical hazardous waste containers must be closed when material is not being added. When the container is $\frac{3}{4}$ full, contact the Chemistry Department Stockroom for pickup. Containers for collection of chemically contaminated sharps should be located in the vicinity of the work being performed. All hazardous waste regulations apply.

Biohazard Contaminated Sharps Any sharp contaminated with a biohazard must be disposed of in a rigid plastic sharps container labeled with the biohazard symbol. When the container is $\frac{3}{4}$ full notify Jenny Nguyen, Biology Department Lab Manager for collection.

Appendix S: Training Outline/Basic Chemical Hygiene Program Orientation

Laboratory Safety Training is required before beginning work in laboratories where hazardous chemicals are in use. Training is refreshed annually. Covered topics include:

1. Identifying the Chemical Hygiene Officer by name and title. and how to access the Harvey Mudd College Chemical Hygiene Plan.
2. A general overview of the chemical hygiene program.
3. Contents of CCR Title 8 Section 5191, *Occupational Exposure to Hazardous Chemicals in the Laboratory*, (The Lab Standard).
4. A review of general laboratory safety procedures as outlined in Chemical Hygiene Plan.
5. Hazard communication including understanding the Globally Harmonized System for Labeling and Safety Data Sheets, and routes and symptoms of chemical exposure.
6. Explanation of the 16-section format of safety data sheets and where to locate them.
7. Physical and health hazards of chemicals that may be encountered.
8. Basic standard operating procedures for working with flammables, corrosives, and toxins.
9. Identification of personal protective clothing and PPE requirements.
10. Instructions on the proper use of PPE.
11. Instruction on proper use of fume hoods.
12. A review of personal and environmental monitoring requirements
13. General first aid for chemical exposure including the use of safety equipment and evacuation procedures.
14. Spill cleanup procedures
15. Hazardous waste collection and disposal.

Additional training may be performed as requested. These may include GHS Hazard Communication Training, Compressed Gas Safety, Respirator Fit Testing, Radiation Safety Training, Autoclave Training, and Hazardous Waste Training. Contact the Chemical Hygiene Officer for information on these training sessions.

Laboratory supervisors are responsible for laboratory specific standard operating procedure training. This training must be documented with signatures. Records shall be maintained by the laboratory supervisor.

All introductory and in-service training will be documented and the training records for each HMC employee will be maintained by the Chemical Hygiene Officer and individual supervisors

Appendix T: Developing Laboratory Specific Standard Operating Procedures

It is the responsibility of principal investigators to train researchers under their supervision in standard operating procedures (SOPs) specific to the materials and equipment used. PIs must carefully perform hazard analyses in the course of research planning. Risks must be mitigated through establishment of laboratory administrative controls, training, and proper use of protective equipment. SOPs consist of written instructions that clearly identify hazards, and include step by step instructions for safe performance of tasks with chemicals or equipment. SOPs may be developed for specific chemicals, equipment, or entire procedures. SOP training must be documented with signatures and be kept available in the laboratory for reference.

The American Chemical Society has published “Identifying and Evaluating Hazards in Research Laboratories.” This guide for hazard assessment and sop development may be accessed by the following link:

[Identifying and Evaluating Hazards in Research Laboratories](#)

A template for SOP development follows. However, any format that includes the information as outlined is acceptable.

A library of chemical SOPS has been developed and is maintained by the Chemical Hygiene Officer. The Chemical Hygiene Officer may assist in SOP development upon request.

Laboratory Specific Standard Operating Procedure



For (specify experiment, chemical, or instrument/equipment):

Date SOP Written: _____ OP Prepared by: _____

SOP Reviewed and Approved by (Name & Signature): _____

Approval Date: _____ Department: _____ Room: _____

PI/Laboratory Supervisor: _____

SOP Type (Check all that apply)

Procedure _____ Hazardous Chemical _____ Instrument or equipment _____

Emergency Contact:

Campus Safety: (909) 607-2000

HMC Chemical Hygiene Officer, Annalee Sendis: ex 74217

Office of Emergency Preparedness and Safety, ex 79700 or ex 72760

Hazardous Waste, Chemistry Department Stockroom, Daniel Guerra: ex 72957

1. List chemicals to be used, physical hazards (corrosive, ignitable, reactive, toxic), and health hazards (i.e. hepatotoxin, reproductive toxin, hemotoxin, neurotoxin, irritant, sensitizer). Indicate GHS classifications.

2. Frequency and duration of chemical use, if applicable:

3. Protective Equipment (goggles, gloves, lab coat, fume hood)

Specify most suitable gloves as indicated in SDS:

4. Describe any special handling procedures for the above listed chemical(s) (attach extra page if necessary):

5. Process, experiment description (Attach separate page if necessary):

6. Accidental release measures:

DO NOT ATTEMPT TO CLEAN A SPILL OF A MATERIAL OF WHICH YOU ARE UNFAMILIAR, OR IF YOU ARE UNSURE OF CLEANUP PROCEDURE. CONTACT YOUR SUPERVISOR OR THE CHEMICAL HYGIENE OFFICER.

File an incident report (Appendix J of the Chemical Hygiene Plan) with the Chemical Hygiene Officer in the event of a spill larger than incidental drip or splash, or for spills resulting in chemical exposure of a toxic or corrosive chemical.

7. First aid measures: _____

Call ex. 72000 from campus phone, or (909) 607-2000 from a mobile phone if immediate medical attention is required.

For employee injury which is not an emergency, obtain authorization for treatment from the Workers Com & Disability Office, Ext 18847 or 77946. An employee accident report must be filed with HR within 48 hours of the incident whether or not treatment was sought. Below is a link for the employee accident report:

[Employee's Report](#)

For student injuries notify DOS, Ext 18125

An accident report must be filed whether or not medical treatment was sought. Below is a link for the student accident report:

https://drive.google.com/file/d/0BzR_KHZNACM_VmRRbDg2WFdaT1E/edit

Seek treatment at:

- Pomona Valley Health Center at Claremont-Urgent Care Center, 1601 Monte Vista Ave, Suite 190, Claremont 91711 (909) 865-9977
- Pomona Valley Hospital Medical Center 1798 N. Garey Ave, Pomona 91767
- San Antonio Community Hospital 999 San Bernardino Rd, Upland 91786 (909) 985-2811.

Skin exposure: _____

Eye exposure: _____

Ingestion: _____

Inhalation: _____

Injection: _____

8. Waste disposal procedures:

STANDARD OPERATING PROCEDURE TRAINING

Printed Name

Signature

Date

Annual Review: Chemical Hygiene Plan

Name Print	Name Signature	Date	Revise or Review
Penny Manisco		July 24, 2012	Revision
Penny Manisco		July 23, 2013	Revision
Penny Manisco		July 15, 2014	Revision
Penny Manisco		July 20, 2015	Revision
Penny Manisco		July 27, 2016	Revision
Penny Manisco		August 28, 2017	Revision
Penny Manisco		August 10, 2018	Revision
Penny Manisco		October 22, 2019	Revision
Penny Manisco		October 20, 2020	Revision
Penny Manisco		Dec 1, 2021	Revision
Annalee Sendis		January 26, 2022	Revision
Annalee Sendis		March 29, 2023	Revision
Annalee Sendis		May 23, 2024	Revision
Annalee Sendis		July 1, 2025	Revision