

CHEMICAL HYGIENE PLAN

HARVEY MUDD COLLEGE

Prepared with the cooperation and assistance of:

The Office of Environmental Health and Safety
Claremont University Consortium

and: The Facilities and Maintenance Department
Harvey Mudd College

Revised 2007

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Foreword

Harvey Mudd College is committed to providing a safe working environment in our academic research laboratories. All employees who either direct the operations of and/or perform work in any laboratory where chemicals are used must become familiar with 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 and is enforced by CAL-OSHA.

Every laboratory employee is responsible for his/her own safety and is required to minimize the risks of potential over-exposure and the uncontrolled release of hazardous materials while working in the laboratory.

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Effective Date: June 1, 2005	

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Standard Operating Procedures

Basic First Aid – Chemical Exposure

- Eye contact: Promptly flush eyes with normal saline or tap water for a minimum of 15 minutes for acids, 30 minutes for alkalis. Seek immediate medical attention.
- Ingestion: Call Campus Safety (security) and request emergency medical assistance.
- Skin Contact: Promptly flush the affected area with water and remove any contaminated clothing; use a safety shower if drenching is necessary. Seek medical attention.
- **EMERGENCIES: DIAL EXTENSION 7-2000**

Uncontrolled Releases

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. **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.

Liquids:

For small spills, follow MSDS information to contain the material. Dike 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 clean-up efforts. If the spill is large and poses a threat to health or the environment, evacuate the lab immediately and follow emergency notification procedures.

Solids:

Dry sweep small spills and place them in an appropriate container. If dust presents a respiratory hazard, wet the material unless contraindicated by the label or MSDS. **WARNING**; if material is shock sensitive, do not dry sweep. Consult the Lab Supervisor and MSDS for safe containment procedures.

Report any uncontrolled release¹ to the Lab Supervisor, Chemical Hygiene Officer, and the Office of Environmental Health & Safety (EH&S) immediately. (See Appendix A) **Notify Campus Safety (security) EXTENSION 7-2000 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 refuse. (See Hazardous Waste section for more details).

Personal Exposure Minimization

General Methods

- Every chemical storage container including temporary containers (e.g. beakers, flasks) must be properly labeled to identify its contents and hazards.
- 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.
- 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 present. 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. Laboratory refrigerators designated for chemicals and raw materials storage, glassware, and utensils are not to be used to hold or store food or beverages.
- 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 for peroxide contamination prior to use (See appendix B). Make a record of the date for any storage container of ether when it is first opened.
- Inspect glassware for cleanliness prior to use to prevent cross contamination and/or mixture of incompatibles.

¹ 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.

- Wash areas of exposed skin thoroughly before leaving the laboratory.
- 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.
- Use appropriate footwear while in the laboratory. Sandals and open-toed shoes are prohibited.
- 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.
- Wear appropriate eye protection (goggles, safety glasses, face shields, etc.) when working in settings where chemical hazards exist.
- Routinely inspect the laboratory for incompatible storage situations. (See Appendix C)
- 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 non-ventilated chemical splash goggles.
- Consult the necessary reference materials (including MSDSs) about potential chemical hazards. Pre-plan appropriate protective procedures, equipment usage and process design 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.
- Provide appropriate warnings about experiments in process and restrict laboratory entry to authorized personnel only.
- Dispose of broken glass or contaminated glass in appropriate containers.
- Containers for broken glass should be labeled “Glass Only”.
- The Laboratory Supervisor should provide notice and guidelines for any unattended, overnight, or weekend process. A response procedure should be established prior to beginning the work.

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 regarding exposure limits. The need for PPE must be reviewed and specified prior to beginning any chemical handling procedure. Also, PPE must be used where engineering controls are unable to provide the required level of safety.

CAUTION: The compatibility of the PPE materials with the chemical hazards to be encountered must be evaluated prior to selecting the protective equipment. Refer to the PPE manufacturer's specifications and the material safety data sheet for the chemical to verify proper use application.

- Any employee who must use either a negative air 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 the Claremont Colleges' Respiratory Protection Program.
- Employees are required to wear gloves when there is the potential for direct skin contact with hazardous chemicals, blood, or infectious materials. (See Appendix D for glove material compatibility information)
- Lab coats are to be worn only in laboratory areas 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.

Engineering Controls

- Chemical fume hoods are to be used where feasible to minimize exposure of employees to emissions from chemical processes. Each fume hood is to be inspected annually for proper face velocity and the hood's doorframe marked at maximum opening for the required face velocity. In process use is to be verified by an in-place gauge, calibrated in lineal feet per minute (lfm), that can be easily read by the operator/scientist during the use of the fume hood.

For Example:

Standard fume hood velocity = minimum 100 lfm

Carcinogen fume hood velocity = minimum 150 lfm

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 Ifm rating, date of last inspection, and any special use approvals (e.g. perchloric acid, carcinogens, or radioisotopes).
- Perchloric acid fume hoods shall comply with section 6-12 of the National Fire Protection Association Code, No 45. (See appendix E)

Warning: Where perchloric acid is heated above ambient temperature, process vapors should be scrubbed or trapped prior to exhausting to the hood. Uncaptured perchloric acid vapors can condense in fume hoods and duct work to form explosive perchlorates.

- 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. (A violet precipitate will form in the presence of perchlorates. See Appendix F)
- 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 barrier. 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.

Chemicals

Chemical Inventory

An inventory should be maintained (hard copy or PC 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 manufacturers name and complete address. (See Appendix G for more information on HMC Chemical Inventories)

Laboratory Hazard Designations

Hazard Designations of laboratories 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:

- Low Risk (HD-1)** Minimal or no known risk to employees, the general public, or the environment. Ability to work safely with all necessary materials on open benches. No special protection or enclosures are needed for the equipment or operations.
- Moderate Risk (HD-2)** Involves materials, practices, or equipment such that improper use could pose some danger to employees, the general public, or the environment. Materials generally have an NFPA 704 rating of 2 or less in all categories. Work in chemical hoods with small quantities (2 liters or less) of higher rated materials possible; however, most operations (>75%) could be carried out on open work benches without unusual precautions. Carcinogens prohibited.
- Substantial Risk (HD-3)** Use of highly toxic, highly reactive, highly flammable or carcinogenic materials is likely. Continuous air monitoring devices with alarms may be necessary to evaluate engineering controls and environmental conditions during operations when using toxic or explosive gases. Monitoring/Alarm levels, if needed, must be set no higher than 50% of the level representing either the PEL or the lower explosion limit (LEL) of the most hazardous material in use.
- High Risk (HD-4)** Operations that pose an immediate and substantial danger to the occupant, the general public, or the environment if containment or engineering controls fail. Geographic/physical isolation of the lab/facility is generally a requirement. **At this time there are no HD-4 laboratories located on the campuses of the Claremont Colleges.**

Material Safety Data Sheets

MSDSs must be available in each laboratory stockroom. MSDSs should be kept in alphabetical order along with the chemical inventory of the department. The laboratories rely on the chemical manufacturers information to ascertain whether or not the chemical is hazardous.

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 bench tops or in fume hoods may increase the risk of fires or spills and should be 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.

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.

Cylinders of compressed gases are required to be tightly strapped or chained to a wall or bench top and the valve stem capped when not in use. Transport of cylinders must be done so as to assure stability of the cylinder and prevent accidental damage to the tank and valve assembly.

Labeling

All chemical containers that are stored or shipped must be properly labeled. Labels must not be removed or defaced. An MSDS attached to a container (e.g. a carboy) is acceptable in lieu of an actual label. For the purposes of storage, “properly labeled” means the label states:

- The identity of the chemical.
- Appropriate hazard warnings (flammable, toxic, corrosive, etc.)
- The name and address off the chemical manufacturer.

An example label is shown below:

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

Carcinogens & Toxics

Management programs for carcinogens and toxics are specific to the material(s) being used.

In general, environmental and personal monitoring shall be conducted to determine in process and use base line levels for carcinogens and toxics. Toxics includes teratogens, mutagens, and materials that can, through biochemical means, 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** will not require additional monitoring unless there are material changes in the laboratory protocols.

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 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.

MSDSs or current OSHA tables can provide action level, PEL, and TWA data as required, Consultation with the CHO or the CUC Office of Environmental Health and Safety is recommended to ensure appropriate regulatory compliance.

Cal-OSHA Regulated Carcinogens

Harvey Mudd College is exempt from 8 CCR 5209 (Carcinogens) except for Section 5209(c)(6) - Laboratory Activities by Section 5191(a)(2). Therefore, this section of the Plan does not address any other sections of 5209.

There are additional requirements that shall be observed for laboratories that handle Cal-OSHA Regulated Chemical Carcinogens. Note that Cal-OSHA allows exceptions to the carcinogen standard if the 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).

Cal-OSHA Regulated Chemical Carcinogens

	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 Cal-OSHA Regulated 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.

Safety Devices

- Eyewash fountains are inspected monthly
- Safety showers are inspected, tested and flushed annually.
- Fire Extinguishers are inspected monthly and tested annually.
- 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. Quality and quantity of ventilation are to be monitored and verified annually.
- Chemical Hygiene related equipment shall be recommended by the CHO and/or the CUC Office of Environmental Health and Safety, in conjunction with faculty needs.

Hazardous Waste: Storage & Disposal

Laboratory Waste Accumulation Area (LWAA)

Laboratories may accumulate hazardous wastes in a similar manor as satellite accumulation is performed in an industrial setting provided the following criteria are met:

- Cannot accumulate more than fifty-five gallons of a hazardous waste or more than one quart of any single extremely or acutely hazardous waste.
- College operational maximum accumulation time even if quantity limits are not reached is nine months. Wastes must then be staged or lab packed and removed from the site within ninety days.
- 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) This training is also required for unsupervised access to the hazardous waste area within a lab.
- Establish protocols to prevent the accidental mixing of incompatible chemical wastes. (See mixing for treatment exception California Health & Safety Code 25200.3.1 (c))
- Storage space is adequate for the quantities and types of wastes present.
- Waste containers are appropriately labeled. (See California Department of Toxic Substances Control Accumulation Fact Sheet – January, 2002) 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.

IMPORTANT: When stock chemicals are no longer needed and are “designated” a waste, removal must occur within ninety days, as laboratory/satellite accumulation rules do not apply. 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.

Waste Stream Analysis

Processes that create waste streams that are potentially hazardous must be evaluated by process knowledge and/or laboratory analysis. In general chemicals may **NOT** be disposed of via the sanitary sewer systems or as ordinary unregulated waste unless it is verified (pursuant to regulatory requirements) that the material being discharged is not a hazardous waste. Evaluation parameters are:

- Ignitable
- Corrosive
- Toxic (by aquatic bioassay)
- Reactive

More “Safe for Sanitary Sewer Disposal” information is provided in Appendix H.

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.

Administrative Controls

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, the department chairperson, or the CUC Office of Environmental Health & Safety 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 which requires monitoring or if there is reason to believe that exposure levels for that substance may exceed the action level or exposure limit. Examples where personal monitoring may be conducted include when (1) chemicals are not used in a fumehood and/or (2) personnel develop signs or symptoms associated with hazardous chemicals.

- If the action level or exposure limit 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 exposure limit) 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 a 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 MSDS for the chemical(s) involved.

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

- Any recommendation 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 Hygiene Plan – Designations

Chemical Hygiene Officer

Chemical Hygiene responsibilities rest with the Chemical Hygiene Officer. The CHO:

- 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.
- Assists in the annual review and revision of the Chemical Hygiene Plan.

Laboratory Supervisor

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

- Implementation of the Chemical Hygiene Plan in their lab(s).
- Training of other laboratory personal.
- Providing regular oversight of proper chemical hygiene and housekeeping practices.
- Inspections of safety equipment such as eye wash stations and safety showers.
- Knowledge of current legal requirements concerning regulated substances used in their labs.
- Directing the use of the required levels of protective apparel and equipment.

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.
- Becoming knowledgeable about the hazard potential of each raw material used in the laboratory and the safe handling thereof.

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.

Training

Training is a necessary and important part of the Chemical Hygiene Plan. All employees receive Hazard Communication training 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 annually. The Laboratory Supervisor, the Chemical Hygiene Officer, or the CUC Office of Environmental Health & Safety may conduct training. All training must be documented according to attendance, date provided, subject matter and name of the person providing the training.

A general training outline is provided in Appendix J.

Housekeeping

Floors are to be cleaned regularly by housekeeping. All affected employees of the housekeeping department must be formally introduced to and trained in the risks associated with cleaning laboratory areas.

The housekeeping 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 are reported and addressed according to established protocols.
4. Proper storage of housekeeping materials is accomplished to minimize clutter.

Record Keeping

- 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 Environmental Health & Safety Office.
- The department supervisor and/or the Environmental Health & Safety Office conduct accident investigations.
- Issues regarding Worker's Compensation should be directed to the HMC Worker's Compensation Administrator in Human Resources, Kingston Hall.
- Questions regarding high-risk substances (presently there are no high risk laboratories, HD-4, on the campuses of the Claremont Colleges) should be directed to the Environmental Health & Safety Office.
- Training attendance records shall be maintained in each department.
- 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, Chemical Hygiene Officer, and the Office of Environmental Health & Safety (EH&S) 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: Hal Van Ryswyk
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Appendix B: Peroxides in Ether

Concerning Peroxides in Ether, The following is a quotation from the Chemical Technician's Ready Reference Handbook, McGraw Hill, Inc., 3rd Edition, 1990

“ethers tend to be chemically stable; however, aliphatic ethers react slowly with air to produce peroxides. All ether containers should be dated when received. Ethers should be purchased only in iron containers to reduce production of peroxides, and the excess discarded properly after opening the containers. Ethers tend to be volatile, have low solubility in water, and have very low flashpoints.”

Note: Never discard excess ether down the drain! Consult your supervisor and/or material safety data sheet for proper disposal.

Appendix C: Chemical Incompatibility

Certain chemicals may react with each other and create a hazard. Separate storage areas **must** be provided for incompatible chemicals.

The following is provided as an example only.

Chemical	Keep out of contact with:
Acetic Acid	chromic acid, nitric acid, ethylene glychol, peroxides, permanganates
Ammonium Nitrate	acids, metals powders, flammable liquids, chlorates, nitrates, sulfur
Chlorine	ammonia, acetylene, butadiene, butane, methane, propane

Oxford University UK has a website with a more extensive list of incompatible chemicals.

- To access their website type in `physchem.ox.ac.uk` under search and click on find.
- Double click on `Other Safety Information from the Physical Chemistry Laboratory`.
- Choose `incompatible chemicals` from the list and double click.

Appendix D: Protective Gloves/Chemical Compatibility

The following is a guide to chemical protective gloves from the Oxford University, UK, website.

Material	Generally suitable for:
Butyl rubber	aldehydes, carboxylic acids, glycols and ethers, hydroxyl compounds and alcohols, peroxides
Latex	water soluble/misible substances, weak acids, weak alkalies
Natural Rubber	acetone, alcohols, alkalies and caustics, ammonium fluoride, dimethyl sulphoxide (DMSO), phenol, plating solutions
Neoprene	alcohol, alkalies and caustics, allosolve, degreasing solvents, mineral acids, oils, plating solutions
Nitrile rubber	alcohols, ammonium fluoride, freons, hexane, hydrofluoric and hydrochloric acid, perchloric acid, potassium and sodium hydroxide
Vinyl	General prevention of contamination, medical examination, nuisance materials

For more information access the Oxford University website at:
physchem.ox.ac.uk

Known suppliers of protective gloves such as Lab Safety Supply provide information in their product catalogs regarding chemical compatibility of various types of protective gloves (see Lab Safety Supply Catalog, 2005, pages 226 and 227).

Appendix E: Perchloric Acid Fume Hoods

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 duct work 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.

Appendix F: 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.

Appendix G: Chemical Inventories

Chemical Inventories are maintained by each Department.

- Biology Department: The Chemical inventory is maintained by Elaine Guerra/Laboratory Manager, Olin, Room 2343.
- Chemistry Department: The Chemical Inventory is maintained by Lillian McCollum/Laboratory Manager, Jacobs, Room 2310.
- Engineering Department: The Chemical Inventory is maintained by Daniel Pereira/Department Manager, Parsons, Room 2370.
- Physics Department: The Chemical Inventory is maintained by Annie Atiyeh, Laboratory Manager, Jacobs, Room B122.

Appendix H: Chemical Disposal-Sanitary Sewer

CCR Title 22 addresses characterizations of waste streams and looks at four parameters:

- Ignitable
- Corrosive
- Reactive
- Toxic (as determined by bioaquatic assay)

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

The Environmental Health and Safety Department at Stanford University has tested a number of chemicals that they have determined to be non-hazardous. A thirty-nine page list of chemicals which Stanford University has determined to be non-hazardous can be accessed by going to their website at www.stanford.edu/dept/ehs.

Note: This information is provided only as an example of how another California Campus deals with the issue of non-hazardous waste streams.

Appendix I: 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 carcinogens are involved in the process the Cal-OSHA action level (AL) must be evaluated. If the process remains constant each time and 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.

Appendix J: Training Outline/Basic Chemical Hygiene Program Orientation:

1. A general over view of the chemical hygiene program
2. A review of general laboratory safety procedures as outlined in chemical hygiene program
3. Identification of laboratory hazard levels and an explanation of the designations
4. Explanation of material safety data sheets and where to locate them
5. Identifying the Chemical Hygiene Officer by name and title
6. A review of program appendices and specialized information sections
7. Identification of personal protective clothing and PPE requirements.
8. Instructions on the proper use of PPE
9. A review of personal and environmental monitoring requirements

All introductory and in-service training will be documented and the training records for each HMC employee will be maintained by individual departments.