

Chemical Hygiene Plan **Introduction**

Workers exposed to hazardous substances are covered under the Hazard Communication standard. The Hazard Communication standard is intended to ensure employees are provided with Material Safety Data Sheets (MSDS), along with training and information regarding the proper use of the MSDS, and how to protect you when handling hazardous materials. Hazard Communication is broad based and applies to any type of operation that somehow uses hazardous substances.

Laboratories are unique since hazardous chemicals are used, stored, and/or handled. Due to the unique situation in laboratories, many health experts felt that Hazard Communication did not adequately cover occupational exposures to laboratory workers. Therefore, the “Occupational Exposure to Hazardous Chemicals in Laboratories” standard was enacted to ensure appropriate safeguards are available to protect the health and welfare of laboratory workers.

This standard will work in conjunction with Hazard Communication for all California employers engaged in the laboratory use of hazardous chemicals. The regulation shall apply only to those chemicals, which meet the definition of laboratory use. Chemicals or hazardous substances, which do not meet the definition of laboratory use even if they are used in a laboratory, will be regulated under the Hazard Communication standard.

Based on the definitions of laboratory, laboratory use, and laboratory scale Feather River Community College has identified the following as areas that will be included under the Chemical Hygiene Plan:

- Chemistry Lab
- Biological Science Labs

POLICY

Feather River College is committed to providing a safe and healthful workplace for all laboratory occupants. To fulfill its obligation, the College will incorporate a formal Chemical Hygiene Plan as part of the overall Injury & Illness Prevention Program. The College’s Board and Administration pledge to support this plan, to assure that it remains a viable method of protecting all laboratory occupants.

The Chemical Hygiene Plan has been designed with major emphasis on the health and safety of all College laboratory occupants, with the following considerations:

- The Plan is designed to protect laboratory occupants from the health hazards associated with the hazardous chemicals in each laboratory.
- The Plan is designed to keep exposures below the Permissible Exposure Limits and/or

Action Levels as identified in Title 8, Section 5155.

- The Plan remains viable and effective.
- The Plan promotes health and safety, while striving to meet the educational goals of the College, departments, and instructors.
- The Plan enables the College to meet compliance with state, federal, and local regulations as regards to hazardous substances.

All College administrators, managers, employees, and laboratory occupants will be required to adhere to the policies and procedures set forth under this Plan. The College encourages all personnel affected by this Plan to provide constructive criticism to ensure the Plan remains viable and effective, while meeting its intended goals.

PLAN AVAILABILITY

The Chemical Hygiene Plan will be readily available to all College laboratory employees covered under this Plan and identified in the introduction. The Plan will also be readily available when requested by authorized employee representatives and the California Division of Occupational Safety and Health. Copies of this Plan will be kept in the safety binder

PLAN REVIEW

The Safety Officer will review the Plan within 12 months of implementation, then annually thereafter. The Plan review is to determine whether or not all aspects of the Plan are still viable and effective.

CHEMICAL HYGIENE RESPONSIBLE PERSONNEL

The Campus Safety Officer is responsible for implementation of the Plan as described in this document.

The College offers its full support to the Safety Officer and pledges to provide Chemical Hygiene personnel with the time and resources necessary to fulfill their responsibilities.

STANDARD OPERATING PROCEDURES FOR WORKING WITH LABORATORY CHEMICALS

Storage and use of hazardous substances are necessary for the continued operation of any school laboratory. Hazardous materials are generally necessary for their educational value in science labs. Since hazardous substances are necessary to operate a laboratory, it is important that the users of these substances practice safe storage, handling, and use procedures to ensure the loss potential is minimized.

Injury or illness to employees, students, or visitors, damage to College owned or leased properties, and damage to the property of others, are all examples of the loss potential resulting from the misuse of hazardous substances. Proper storage, handling, use procedures, and techniques will decrease the probability of loss both in terms of frequency and severity. With this in mind, the following general principles for safe and healthy lab work are given:

- It is prudent to minimize all chemical exposures. Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals should be adopted, rather than specific guidelines for particular chemicals. Skin contact with chemicals should be avoided as a cardinal rule.
- Avoid underestimation of risk. Even for substances of no known significant hazard, exposure should be minimized. For work with substances that present special hazards, special precautions should be taken. One should assume that any mixture will be more toxic than its most toxic component, and that all substances of unknown toxicity are toxic.
- All containers supplied by manufacturers or suppliers, and holding hazardous materials, should have labeling that provides at least the chemical identity, a list of hazardous ingredients, hazard warnings, and the name and address of the manufacturer or supplier. Portable containers, into which hazardous substances have been transferred to from properly labeled, larger containers, must have labels that provide at least the chemical identity and hazard warnings. Employees should follow guidelines provided by the manufacturer or supplier for storage, handling, and use. Employees should not use chemical substances from unlabeled or improperly labeled containers.
- A Material Safety Data Sheet (MSDS) is a document prepared by the manufacturer or supplier of hazardous substances. This document contains pertinent information regarding health hazards and safety precautions necessary for use with a given substance. The MSDS contains information on storage patterns, storage conditions, incompatibles, personal protective equipment, and other precautions necessary for safe use of the substance. Employees should be familiar with the contents of the MSDS for the hazardous materials that they work with and where the MSDS is kept. Employees should be encouraged to review the MSDS before using a hazardous material.
- Although container labels may have safety precaution information, the MSDS is generally more comprehensive in the scope and amount of information provided. Therefore, the MSDS should be considered an extremely important tool for obtaining information regarding safe storage, handling, and use procedures.
- The MSDS provides information on routes of entry (or how one may be exposed to a hazardous material), personal protective equipment, and other methods of protection from over exposure. Once the user of a hazardous material knows the health hazards associated with the use of the material and how exposures occur, the next step is to take appropriate action to prevent over exposure and the resulting health effect.

- By knowing the route of entry (such as through inhalation, skin contact, or ingestion), the users of hazardous materials can protect themselves by following the manufacturer's recommended procedures, using appropriate personal protective equipment, practicing good personal hygiene, and having other protective devices available as specified by the manufacturer.
- Ventilation is an engineering control that is an important consideration in controlling exposures to hazardous materials. The ventilation requirements will be detailed on the MSDS, and may also be listed on the container label. All employees should be instructed to adhere to manufacturer's guidelines regarding the use of hazardous materials and the ventilation required for safe use. If engineering controls are not feasible, or do not reduce exposure to an appropriate level, then exposures should be reduced by limiting the amount of time of exposure (both frequency and duration), or by requiring the use of personal protective equipment.
- Personal protective equipment includes such items as respiratory protective equipment, eye goggles, face shields, gloves, aprons, and boots. The MSDS will list all equipment that should be available when using a given hazardous substance. Personnel should not be using hazardous materials unless the appropriate personal protective equipment has been provided, and they have been trained in the proper use of such equipment.
- Other protective measures that can reduce the loss potential include the use or installations of appropriate fire extinguishers, eyewash stations, deluge or quick drench showers, spill kits, and proper storage facilities.
- Employees should not be required to work with or use hazardous substances for prolonged periods or have repeated exposures, unless proper precautions have been taken to keep exposures to safe levels.
- Provide adequate ventilation. The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of hoods and other ventilation devices.
- Institute a Chemical Hygiene Plan. A mandatory Chemical Hygiene Plan designed to minimize exposures is needed and should be a regular, continuing effort, not merely a standby or short-term activity. The Plan's recommendations should be followed in academic teaching laboratories, as well as by full-time laboratory workers.
- Observe the exposure limits and Threshold Limit Values (TLV). The exposure limits of Cal-OSHA and the TLV of the American Conference of Governmental Industrial Hygienists should not be exceeded.

LABORATORY FACILITY/ENGINEERING CONTROLS

GENERAL

The design of chemical storage or laboratory areas poses unique problems due to the presence and use of hazardous materials. Materials such as flammables, corrosives, toxics, and compressed gases require special considerations to protect the integrity of the building, and the safety and welfare of the building occupants.

VENTILATION

Ventilation is provided for two basic considerations: 1) for the comfort of the building occupants; and 2) for health and safety considerations for those working in laboratories, preparation, and chemical storage areas. Often the two areas conflict with one another when viewing ventilation from a standpoint of efficiency. The health and safety considerations should always be the primary concern. Comfort ventilation provides for tempered air and odor elimination. Health and safety ventilation provides for the dilution and removal of potential harmful air contaminants.

LOCAL VENTILATION

Local ventilation for laboratories may be divided into two categories:

- Localized exhausts.
- Fume hoods.

Local ventilation is used for the removal of air contaminants from the workplace atmosphere.

Local pickups exhausting through flexible hoses may be used effectively to remove fumes from well-defined sources of fumes, but their effectiveness may be limited due to the following:

- Air movement toward the nozzle is reduced to less than 10% of the original value once the nozzle is moved a distance equal to its diameter from the source.
- The exhausting ductwork poses problems if one or more exhaust fans fail.

Unless specific requirements dictate a specific chemical or biological hood, a general purpose hood may be used. The chosen hoods should offer the following features:

- Positive velocity sensors with visual and audible alarms.
- Corrosion resistance.
- Easily decontaminated.
- The ability to safely handle flammable materials.

A ventilation engineer, especially with regard to the blower motor requirements, should configure each hood installation.

Hoods should be selected with movable sashes, preferably a vertical sliding type. Laminated safety glass is probably considered the best material for sashes.

Fume hoods should be evaluated before initial use and at periodic regular intervals to ensure an average face velocity of at least 100 linear feet per minute (lfm) with a minimum of 70 lfm at any point, and with the absence of excessive turbulence.

Fume hoods are not intended primarily for the storage of chemicals; therefore, material storage in hoods should be kept to a minimum. Stored chemicals should never block vents or alter airflow patterns.

Hood ventilation shall remain in operation during all times hoods are in use, and for a sufficient time thereafter, to ensure all airborne contaminants have been removed. When mechanical ventilation is not in operation, hazardous substances in the hood must be covered.

EVALUATION OF FUME HOOD PERFORMANCE

All fume hoods should be evaluated for performance when they are installed, and any time there is a change in any aspect of the ventilation system (e.g., change in total volume of supply air, changes in locations of supply air ports, or the addition of other auxiliary local ventilation devices). Performance evaluation should include comparison of evaluation results to design specifications for uniform airflow across the hood face and for the total exhaust air volume.

VENTILATION MAINTENANCE

Local and general ventilation systems supplying laboratories will be on a preventive maintenance plan to ensure continued proper operation. The Director of Maintenance and Operations or the Director of Facilities will review design specification and manufacturer's recommendations, to determine an appropriate frequency for preventive or routine maintenance. At a minimum, the preventive maintenance should include:

- Inspection of air intakes and exhausts.
- Inspection of belts or other moving components.
- Inspection of all motors and fans.
- Lubrication of all appropriate items such as bearings, gears, etc.
- Cleaning and/or replacement of filters.

CHEMICAL STORAGE

Chemical storage should generally be limited to only those rooms designed and designated for chemical storage. Laboratories should only be used for short-term storage and for only the reagents necessary for the current project. Chemical storage facilities should consider the following:

- Control of access.
- Adequate space for safe storage.
- Segregation of incompatibles.
- Flammable Liquid storage.
- Corrosives storage.
- Toxics storage.
- Compressed gases storage.
- General chemical storage.
- Hazardous Waste storage.

EGRESS/LIFE SAFETY

Science building operations increase the potential of emergency situations that may require building evacuation. Events such as fires, explosions, and spills may require or cause alarms to be activated followed by the evacuation of the building. The means of egress will follow the local and State of California regulations, which involve building occupancy.

EMERGENCY EQUIPMENT

Due to the nature of the operations conducted, and the inherent hazards of the chemicals stored in science buildings, consideration should be given to designing stations for emergency equipment. Proper planning before construction or remodeling can ensure that appropriate equipment is installed in easily accessible and clearly visible areas. The following emergency equipment will be provided:

- Eyewash stations.
- Deluge or quick drench showers.
- Fire blankets.

- Fire extinguishers.
- First aid kits.
- Telephones.
- Miscellaneous emergency equipment:
 - ◆ Spill clean-up stations.
 - ◆ Eye protection equipment storage cabinets.
 - ◆ Respiratory equipment storage facilities.

STANDARD OPERATING PROCEDURES **FOR CHEMICAL STORAGE & USE**

As stated in prior sections, all hazardous substances should be stored, handled, and used in accordance with the information provided by the manufacturer through container labeling and the MSDS. In addition, technical references can provide general safety precautions for the storage and use of both specific chemicals and general categories of hazardous materials.

The following standard operating procedures are provided as basic procedures intended to ensure a safe and healthful workplace for laboratory personnel during the use of hazardous laboratory chemicals. These procedures are provided for basic “groups” or “families” of chemicals, and should be used in conjunction with appropriate MSDS to ensure specific operating procedures are known for individual chemicals.

FLAMMABLE/COMBUSTIBLE LIQUIDS

- Store in a well-ventilated area away from oxidizers, ordinary combustibles, and sources of heat or ignition.
- Always store in covered containers.
- Use approved safety cans for dispensing at the point of operation.
- Air pressure will never be used to remove liquids from a drum or tank.
- Provide spill containment for drum and bulk storage areas.
- Storerooms used for flammables must have either gravity or mechanical ventilation. Mechanical ventilation is required if Class I flammable liquids (flash point below 100° F) are dispensed.
- Flammable liquids stored in work areas or general-purpose storerooms in quantities exceeding 10 gallons, should be stored in approved flammable liquid storage cabinets.
- All flammable liquid storage areas should be clearly identified with signs or symbols.
- Flammables used at the point of operation should not be dispensed from containers larger than one (1) gallon, unless from an approved safety can. If an approved safety can is used to dispense flammables, then the can may be up to two (2) gallons in size.
- Strong consideration should be given to using only approved safety cans to dispense flammable liquids at the point of operation.
- 55-gallon drums used for dispensing flammable liquids should be bonded and connected to a suitable ground.

- Appropriate fire extinguishers for Class B (flammable or combustible liquid) fires should be available within 50 feet from where flammable liquids are stored or used.
- Flammable materials storage and use areas should be clearly marked “NO SMOKING OR OPEN FLAME”.

CHLORINATED HYDROCARBONS/SOLVENTS

- Use only in well-ventilated areas.
- Do NOT use from open containers unless ventilation is adequate to draw vapors from the work area.
- Keep away from open flames or excessive heat.
- Provide spill containment for drum or bulk storage areas.

OXIDIZERS

- Store in a well-ventilated area.
- Store away from combustibles, organic matter, reducing agents, and sources of heat or ignition.
- Keep oxygen cylinders free of oil, grease, dirt, or other contaminants.

COMPRESSED GASES/AEROSOLS

- Compressed gas cylinders will always be stored away from external heat sources, and located such that they will not be damaged by passing or falling objects. When possible, they will be stored upright with the cylinder secured.
- Cylinders not in use will be stored with valve protection caps in place.
- Oxygen cylinders in storage will be segregated from flammable gas cylinders (such as acetylene and hydrogen) by at least 20 feet or by a non-combustible wall at least 5 feet high.
- Oxygen cylinder storage areas will be clearly marked “OXIDIZER”.
- Flammable gas cylinder storage areas will be clearly marked “FLAMMABLE GAS” and “NO SMOKING OR OPEN FLAME”.
- Chlorine cylinders will be stored separate from any materials with which it may react

(such as hydrogen, ammonia, acetylene, fuel gases, most hydrocarbons, finely divided metals, and organic matter).

- Chlorine cylinder storage areas will be clearly marked “OXIDIZER” and “POISONOUS GAS”.
- All gas cylinders will be clearly marked either “FULL” or “EMPTY”.
- All compressed gas cylinders will be legibly marked with the chemical or trade name of the gas.
- Empty cylinders should not be refilled except by the supplier.
- All gas cylinder connecting hoses, couplings, and pressure regulators will be regularly inspected for defects.
- When appropriate, a check valve or trap will be installed in the discharge line to prevent hazardous back flow into the cylinder.
- Aerosols will not be stored in areas where the temperature may exceed 120°F.

CORROSIVES

Corrosives pose an immediate danger to personnel upon contact to any human tissue. Because of the acute health hazard and the potential for permanent injury, the following apply:

- Storage and use of corrosives will be in well-ventilated areas.
- When feasible, corrosives will be stored in cabinets dedicated to corrosive storage.
- Bulk storage areas will have spill containment barriers.
- Large bottles containing corrosives are to be transported in appropriate bottle carriers.
- Acids will be segregated from substances that they are reactive with (such as metals, metal oxides, hydroxides, amines, carbonates, and other alkaline materials).
- Acids will be segregated from chemicals that generate toxic gases upon contact (such as chlorides, cyanates, cyanides, fluorides, hydrides, and sulfides).
- Oxidizing acids will be segregated from organic acids and flammables.
- Nitric acid will be segregated from all other acids.

- Personnel using or handling corrosives should always wear splash-proof eye goggles.
- Personnel involved in any operation using corrosives with a high probability of splashing, should be required to wear face shields, rubber gloves, and rubber aprons in addition to the splash-proof eye goggles.
- Areas where corrosives are stored or used in one gallon containers (or larger) should be equipped with plumbed-in eyewash stations and deluge showers.
- Due to the potential for falls, spills, splashes, and personnel contamination from storage at high levels, corrosives should be stored at or below waist level.
- Corrosives in laboratories should be stored in approved corrosive storage cabinets. Small quantities may be stored on shelves in polyethylene or ceramic trays to contain spills or leaks.
- Personnel using corrosives should be aware of the potential for permanent eye damage should a corrosive contact the eye. Therefore, persons using corrosives should be familiar with the sources in their workplace for eye flushing and the proper technique (eyelids must be rolled during flushing and the eye should be flushed for at least 15 minutes). Emergency procedures for eye contact with a corrosive should always include contacting a physician.

TOXICS

- Storage will only be in containers clearly marked “POISON”.
- When feasible, storage containers will be kept in a dedicated cabinet, clearly labeled and kept locked.
- Toxics should only be used and stored in well-ventilated areas.
- Cyanides, chlorides, and sulfides will be segregated from acids.
- The cabinets or rooms used for the storage of highly toxic materials should have appropriate warnings, and poison control phone numbers posted.
- Access to the cabinets or rooms should be controlled with only authorized personnel permitted access.
- Highly toxic substances should be used in the classroom only after a review of health hazards, routes of entry, safety precautions, and first aid. And then, only used under the strict supervision of the instructor.

REACTIVES

- Storage should only be in cool, dry, well-ventilated areas.
- Reactives should be kept away from sources of heat and ignition.
- Purchase should only be in quantities that can be used during one school semester.
- Water reactive materials should not be stored in a room with an automatic water sprinkler system unless precautions have been taken to ensure that the materials can remain dry in the event of sprinkler activation.
- Pyrophoric materials such as sodium, potassium, lithium, and strontium should be segregated from halogenated hydrocarbons, oxidizers, and moisture. Storage should only be in containers with the materials completely covered with an oxygen free liquid (such as toluene, kerosene, or mineral oil).
- Phosphorous should only be stored in containers with the substance completely covered with water.

ORGANIC PEROXIDES

Organic peroxides have unusual stability problems, which make them among the most hazardous substances handled in laboratories. As a class, they are low-power explosives sensitive to shock, sparks, heat, friction, strong oxidizing agents, and reducing agents. The following types of compounds are known to form peroxides:

- Aldehydes
- Ethers
- Compounds containing benzylic hydrogen atoms (e.g., cumene)
- Alkenes
- Vinyl and vinylidene compounds

Some specific chemicals from the above categories commonly found in laboratories include Diisopropyl Ether, Ethyl Ether, Tetrahydrofuran, Tetrahydronaphthalene, Cyclohexene, P-Dioxane, and Dicahydronaphthalene.

Preventive measures for peroxides include:

- Quantities of peroxides should be limited to the minimum required.
- Unused peroxides should not be returned to the container.
- All spills should be cleaned up immediately; peroxide solutions can be absorbed on

vermiculite.

- The sensitivity of most peroxides to shock and heat can be reduced by dilution with an inert solvent. However, solutions of peroxides diluted in volatile solvents should not be used under conditions in which the solvent may be vaporized.
- Do NOT use metal utensils to handle peroxides. Ceramic or wooden utensils are acceptable. Smoking, open flames, friction, grinding, other heat sources, and all forms of impact should be avoided near peroxides.
- Do not use glass containers that have screw-cap lids or glass stoppers to store peroxides.
- Peroxides should be stored at the lowest possible, appropriate temperature.
- Never dispose pure peroxides directly. Peroxides must be diluted before disposal.

BASIC LABORATORY RULES

The Chemical Hygiene Plan requires that laboratory personnel know and follow basic rules and procedures for working with chemicals. The basic rules and procedures lay the foundation for laboratory safety, and better comprehension of specific procedures as identified on the MSDS and other sources for individual chemicals. The basic rules and procedures that should be used for essentially all laboratory work with chemicals include the following:

ACCIDENTS/SPILLS

- **Eye Contact:** Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention.
- **Ingestion:** Encourage the victim to drink large amounts of water and seek medical attention.
- **Skin Contact:** Promptly flush the affected area with water for at least 15 minutes and remove any contaminated clothing. If symptoms persist after washing, seek medical attention.
- **Leaks/Spills:** Promptly cleanup leaks/spills using appropriate protective apparel, and the proper equipment and disposal methods. Ventilate the area, if necessary, and keep unnecessary and unprotected persons away from the area. Further information and instructions on clean-up can be obtained for specific chemicals by reading the MSDS for that chemical.

AVOIDANCE OF “ROUTINE” EXPOSURE

- Develop and encourage safe habits.
- Avoid unnecessary exposure to chemicals by any route.
- Do not smell or taste chemicals.
- Vent any apparatus (vacuum pumps, distillation columns, etc.) that may discharge toxic chemicals into local exhaust devices.
- Inspect gloves and test glove boxes before use.
- Do NOT allow the release of toxic substances in cold rooms or hot rooms since they contain recirculated atmospheres.

CHOICE OF CHEMICALS

- Use only those chemicals for which the quality of the available ventilation system is appropriate.

EATING, SMOKING, ETC.

- Avoid eating, drinking, smoking, gum chewing, or application of cosmetics in areas where laboratory chemicals are present. Wash hands before conducting these activities. Avoid storage, handling, or consumption of food or beverages in storage areas, refrigerators, glassware, or utensils that are also used for laboratory operations.

EQUIPMENT & GLASSWARE

- Handle and store laboratory glassware with care to avoid damage.
- Do NOT use damaged glassware.
- Use extra care with Dewar flasks and other evacuated glass apparatus.
- Shield or wrap them to contain chemicals and fragments should implosion occur.
- Use equipment only for its designed purpose.

EXITING

- Wash areas of exposed skin well before leaving the laboratory.

HORSEPLAY

- Avoid practical jokes or other behavior that might confuse, startle, or distract another worker.

MOUTH SUCTION

- Do NOT use mouth suction for piping or starting a siphon.

PERSONAL APPAREL

- Confine long hair and loose clothing.
- Wear shoes at all times in the laboratory, but do not wear sandals, perforated shoes, or sneakers.

HOUSEKEEPING

- Keep the work area clean and uncluttered, with chemicals and equipment being properly labeled and stored.
- Clean up the work area upon completion of an operation or at the end of each day.

PERSONAL PROTECTION

- Assure that appropriate eye protection is worn by all persons (including visitors), where chemicals are stored or handled.
- Wear appropriate gloves when the potential for contact with toxic materials exists, inspect the gloves before each use, wash them before removal, and replace them periodically. Information on ordering gloves can be obtained through Lab Safety Supply at (800) 356-0783. A table listing various types of gloves and their applications are listed below:

Glove Type	Applications
Rubber, Plastic, or Synthetic Rubber Gloves (Neoprene & Nitrile)	Should be used for tasks involving oils, greases, solvents, and other chemicals such as acids and caustics. This type of glove can be applied to cleaning tasks.
Leather	Resists sparks, moderate heat, cuts, and abrasions. This type of glove can be applied to welding activities.
Cotton & Fabric	Protect against dirt, chafing, and abrasions. This type of glove may not be strong enough to endure rough, sharp, or heavy materials.
Coated Fabric	Provides protection for moderately concentrated chemicals. This type of glove can be used in laboratory tasks, provided it offers protection for the specific chemical hazard associated with the task.
Aluminized	Provides reflective and insulated protection. This type of

	glove can be used in welding, furnace, and foundry work.
Kevlar	Provides protection against hot and cold. This type of glove can be used in a wide variety of industrial applications.

- Use appropriate respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls or when inspecting the respirator before use.
- Use any other protective and emergency apparel and equipment as appropriate.
- Avoid the use of contact lenses in the laboratory unless necessary. If they are used, inform supervisor so special precautions can be taken.
- Remove laboratory coats immediately on significant contamination.

PLANNING

- Seek information and advice about hazards.
- Plan appropriate protective procedures.
- Plan positioning of equipment before beginning any new operation.

UNATTENDED OPERATIONS

- Leave lights on.
- Place an appropriate sign on the door.
- Provide for containment of toxic substances in the event of failure of a utility service (such as cooling water) to an unattended operation.

USE OF HOOD

- Use the hood for operations that might result in the release of toxic chemical vapors or dust.
- As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substance with a TLV of less than 50 ppm.
- Confirm adequate hood performance before use.
- Keep hood closed at all times except when adjustments within the hood are being made.
- Keep materials stored in hoods to a minimum and do not allow them to block vents or

airflow.

- Leave the hood “ON” when it is not in active use if toxic substances are stored in it, or if it is uncertain whether an adequate general laboratory ventilator will be maintained when it is “OFF”.

VIGILANCE

- Be alert to unsafe conditions and see that they are corrected when detected.

WASTE DISPOSAL

- Ensure that the plan for each laboratory operation includes plans and training for waste disposal.
- Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the Chemical Hygiene Plan.
- Do NOT discharge to the sewer any concentrated acids or bases, highly toxic, malodorous, or lachrymatory substances, or any other substances which might interfere with the biological activity of waste water treatment plants, create fire or explosion hazards, cause structural damage, or obstruct flow.

WORKING ALONE

- Avoid working alone in a building.
- Do NOT work alone in a laboratory if the procedures being conducted are hazardous.
- If you are a woman of childbearing age, handle these substances only in a hood whose satisfactory performance has been confirmed, using appropriate protective apparel (especially gloves) to prevent skin contact.
- Review each use of the materials with the Research Supervisor and review continuing uses annually or whenever a procedural change is made.
- Store the substances, properly labeled, in an adequately ventilated area in an unbreakable secondary container.
- Notify supervisors of all incidents of exposure or spills. Consult a qualified physician when appropriate.

CRITERIA TO BE USED FOR IMPLEMENTATION OF MEASURES TO REDUCE EXPOSURES

ENGINEERING CONTROLS

Engineering controls consist of controls designed to physically separate, segregate, or remove exposures from laboratory personnel. Engineering controls may consist of items such as the following:

- General ventilation
- Local ventilation
 - ◆ Local pick-ups
 - ◆ Fume hoods
- Segregation

Ventilation, both general and local has been thoroughly covered in the Laboratory Facility section starting on Page 5 of this Plan.

Segregation may include:

- Segregating the chemicals from the user through the implementation of fume hoods and glove boxes.
- Segregation of incompatible chemicals in a well identified area with local exhaust ventilation.

PROTECTIVE APPAREL AND EQUIPMENT

Personal protective equipment and safety and emergency equipment are necessary to ensure that exposures to laboratory personnel are kept to a minimum and within safe levels.

Safety and emergency equipment has been discussed in the Laboratory Facility section, and will be briefly reviewed in this section. Safety and emergency equipment should be available and maintained in good operating conditions in all laboratories. All laboratory personnel should be aware of the equipment location and of its proper use. The following safety and emergency equipment should be considered as minimum standard requirements for all laboratories:

- **Telephones.** Telephones for emergency use should be readily available to laboratory personnel. Emergency phone numbers should be clearly identified.
- **Fire Alarms.** At a minimum, manual fire alarms should be located at or near each laboratory. Consideration should be given to installing automatic fire detection and alarm systems. The alarms should have both local and remote stations.

- **Fire Extinguishers.** Each chemical laboratory should be provided with either a carbon dioxide or dry chemical extinguisher, or both. Other extinguishers (such as Class D type) should be available if required by the work being done. Fire extinguisher locations should be clearly identified and near exits to ensure safe egress. Each fire extinguisher should be recharged and certified at least annually, with monthly inspections between annual recharging.
- **Fire Blankets.** Fire blankets should be available primarily as first aid for the prevention of shock. Fire blankets should be used only as a last resort to extinguish clothing fires, as the blankets tend to hold heat in and may increase the severity of burns.
- **Deluge or Quick Drench Showers.** Showers should be installed in or near laboratories, chemical preparation, or chemical storage areas, especially if corrosives or toxics are handled. Safety showers should be tested at periodic, regular intervals. All laboratory personnel should be trained in the proper use of the shower.
- **Eyewash Stations.** Each chemical laboratory and preparation area should be installed with an eyewash station. The station should provide at least 15 minutes of aerated water flow.

BASIC PERSONAL PROTECTIVE EQUIPMENT

In addition to safety and emergency equipment, certain personal protective equipment should be available for all laboratory personnel. All laboratory personnel who may use protective equipment should be trained in its proper use. Basic personal protective equipment should include:

- **Eye Protection.** Eye protection should be worn any time chemicals are used. Contact lenses should not be worn when working with chemicals as the lenses can concentrate gases and vapors and can make first aid difficult in the event of chemical splashes. Eye protection can include:
 - ◆ **Safety Glasses.** Safety glasses should comply with the American National Safety Institute (ANSI) standard Z87.1. Safety glasses, especially those fitted with side shields, can offer good protection from flying particles, but not from splashes. Therefore, if significant splash hazards exist, other protection should be employed.
 - ◆ **Goggles.** Splash-proof goggles should be used when protection from splashes is required. Impact-resistant goggles should be used when protection from flying particles is needed (such as when working with pressure or vacuum operations).

- ◆ **Face Shields.** Face shields can be used in conjunction with safety glasses or goggles to provide protection for the face and neck.

- **Skin Protection.** Skin contact is a potential source of exposure to hazardous materials. Protective apparel that can protect the skin includes:
 - ◆ **Gloves.** Hands have a great potential for skin exposure; therefore, gloves should be worn whenever it is necessary to handle corrosive materials, sharp-edged objects, very hot or very cold materials, or toxics. When using gloves, the following should be considered:
 - Gloves should be selected on the basis of the material being handled, the hazard involved, and their suitability for the operation being conducted.
 - Gloves should be inspected for discolorations, punctures, and tears before each use.
 - Information should be obtained from glove manufacturers regarding uses for specific types of gloves. The manufacturer's data (such as permeation rate and thickness) should be used to determine safe time limits for specific uses.

 - ◆ **Laboratory Coats.** Laboratory coats do not significantly resist penetration by organic liquids. However, the coats do provide protection to clothing from dirt and minor chemical splashes.

 - ◆ **Aprons.** Plastic or rubber aprons provide good protection from corrosive liquids, but may complicate injuries in the event of fire. Plastic aprons can accumulate a charge of static electricity; therefore, plastic aprons should be avoided when handling flammables.

HYGIENE PRACTICES

The three most common routes of entry of hazardous chemicals into the body are inhalation, ingestion, and skin contact. All exposures to hazardous chemicals that may result in harmful effects on the body can be reduced by implementing and enforcing good personal hygiene practices.

Basic rules for good hygiene in chemical and biological laboratories include:

- Minimize all chemical exposures.

- Work with chemicals should only be done in well-ventilated areas.
- Promptly flush any area of the skin, which has become contaminated with any laboratory chemical.
- Do NOT smell or taste any laboratory chemical.
- Inspect all personal protective equipment (such as gloves, goggles, and respirators) before use.
- Do NOT release chemicals into the atmospheres of rooms supplied by recirculated air.

- Avoid eating, drinking, smoking, gum chewing, and the application of cosmetics in areas where laboratory chemicals are stored, used, or otherwise handled.
- Avoid storage, handling, preparation, or consumption of food or beverages in chemical storage or preparation areas.
- Always wash hands after chemical handling and before eating, drinking, smoking, or the applying of cosmetics.

CONTROL MEASURES FOR EXTREMELY HAZARDOUS SUBSTANCES

General precautions to be followed when working with any chemical that has been identified in the Standard Operating Procedures section (pages 9-14) of this Plan. These general rules, procedures, and precautions should be reviewed and followed, as the basic foundation for safety when working with the following:

- Substances of moderate, chronic, or high acute toxicity.
- Substances of high known high chronic toxicity.
- Cal-OSHA or Federal OSHA listed carcinogens.

Additional control measures are appropriate when working with any substance falling into one of the above categories. Following is an identification of appropriate, additional safety procedures for each group:

SUBSTANCES OF MODERATE, CHRONIC, OR HIGH ACUTE TOXICITY

- Follow all general rules, procedures, and precautions as discussed throughout this Plan.

- Review the MSDS or consult a reference resource, which identifies toxic properties to learn or refresh what is known about the substance(s) that will be used.
- Maintain records of the material, amounts used, and laboratory personnel involved.
- Procedures involving volatile toxic substances or those that may generate aerosols should be conducted in a hood or other suitable containment device.
- Plan to contain accidental spills in the hood by storing containers of chemicals in this group in polyethylene pans or trays, or fit the hood with a removable liner of absorbent plastic backed paper.
- If special toxicity hazards exist, the work area should be posted “RESTRICTED ACCESS”.
- Whenever cyanides are used or stored in hoods, warning or no admittance signs should be posted on doors to fan lofts and roofs (where the hood exhausts).
- A hydrogen cyanide gas (HCN) first aid kit, and an oxygen cylinder equipped with pressure gauge and needle valve, should be available on any floor of a building on which work with cyanides is in progress. The oxygen cylinder should be clearly marked for emergency HCN first aid. The HCN first aid kit should contain a box of amyl nitrate pearls, a face piece, rubber tubing for administering oxygen, and a bottle of 1% sodium thiosulfate solution.

Note: Only trained and qualified emergency response personnel are authorized to use an HCN first aid kit.

- Wastes of chemicals in this category should be placed in closed impervious containers. The containers should be labeled with the contents, type of hazard, and the date in which accumulation began.
- Only personnel wearing appropriate, personal protective equipment and that has proper training should clean up spills.
- If work is to be done with highly or extremely toxic materials, at least two people should be present at all times.

SUBSTANCES OF KNOWN HIGH CHRONIC TOXICITY

- Follow all rules, procedures, and precautions identified above.
- Experimental work and disposal procedures for waste should be approved by the laboratory supervisor.

- Consultation with the department or site safety coordinator may be appropriate.
- All chemical containers should be clearly labeled with appropriate hazard warnings (e.g. “WARNING! HIGH CHRONIC TOXICITY” or “WARNING! CANCER SUSPECT AGENT”).
- All work of this nature should be done in a controlled area (such as a laboratory, portion of a laboratory, exhaust hood, or glove box designed and designated for use with highly toxic materials).
- Controlled areas should be clearly marked with signs such as the following:
 - ◆ WARNING! TOXIC SUBSTANCE IN USE: AUTHORIZED PERSONNEL ONLY.
 - ◆ WARNING! CANCER SUSPECT AGENT: AUTHORIZED PERSONNEL ONLY.
- Appropriate personal protective apparel should be worn when transferring or handling substances of high chronic toxicity.
- Laboratory personnel should remove any protective apparel when leaving the controlled area, and thoroughly wash hands, forearms, face, and neck.
- Disposable apparel or absorbent paper liners should be placed in closed, impervious containers that are properly labeled. Non-disposable apparel should be thoroughly washed.
- Normal laboratory work should not be resumed in an area that has been used as a controlled area, until it has been adequately decontaminated.

WORKING WITH CARCINOGENS OR SUSPECTED CARCINOGENS

- Obtain written approval from both Management and CHO prior to using.
- Use only in a designated area with suitable warning signs to alert other workers, e.g., Danger, Cancer Hazard.
- Wear protective clothing and use the approved fume hood or other engineering controls.
- Use and store materials in a chemically resistant container in an appropriately ventilated limited-access area.
- Decontaminate the designated area and all equipment in the hood before removing them.

- Use a wet method to clean up liquids. For dry materials, use a vacuum with a HEPA filter vented into the hood.
- All waste must be stored in a closed, labeled, and impervious container.

CHEMICAL PROCUREMENT

An effective Hazardous Materials Management Plan begins with appropriate purchasing guidelines and controls. The disposal of hazardous materials is becoming increasingly difficult with rapidly escalating costs. Inadequate purchasing procedures will only complicate disposal problems. Basic procurement guidelines include:

- Before a substance is procured, information on proper handling, storage, and disposal should be known by all personnel involved in storage, handling, use, and disposal.
- No chemical container (including gas cylinders) should be accepted without adequate identifying labels.
- Preferably, all substances should be received in a central location.
- Donated substances and substances purchased outside of normal purchasing procedures are strictly prohibited, unless prior written approval is given by the supervisor or department head. Personnel bringing unauthorized substances into the work area may be held responsible for all removal and disposal costs incurred by the College.
- Hazardous materials should only be purchased which can be used in a school year.
- Extremely hazardous materials should only be purchased in quantities necessary for a designated procedure, and should not exceed an amount that can be used in a single semester.
- General categories of materials to avoid are:
 - ◆ Carcinogens
 - ◆ Explosives
 - ◆ Highly or extremely toxic substances

Many chemicals have significant hazards that must be compared to their educational value. If the hazards are deemed to exceed the educational value, then the substances may be purchased in small quantities within the following procedures:

- With written approval by the Supervisor or Manager.

- A written statement issued by the intended user showing demonstrated need.
- A written safety plan which at a minimum identifies:
 - ◆ Amounts to be purchased.
 - ◆ Storage precautions.
 - ◆ Persons authorized to use the materials.
 - ◆ Where the materials will be used.
 - ◆ Precautions to prevent unauthorized use.
 - ◆ Personal protective equipment necessary.
 - ◆ Emergency procedures.
 - ◆ Shelf life.
 - ◆ Disposal procedures.

HOUSEKEEPING, MAINTENANCE, AND INSPECTIONS

Housekeeping, maintenance, and inspections are important functions that support a clean and safe work area, and help to reduce exposures to laboratory personnel. Following are minimum guidelines for these functions.

HOUSEKEEPING

- Floors in laboratories, stockrooms, preparation rooms, and storerooms should be cleaned regularly (at least daily in laboratories and prep rooms).
- Stairways, hallways, and passageways should not be used as storage areas.
- Stairways, hallways, passageways, exits, and any other means of emergency egress should always be kept clear and in good repair.
- Trash should be removed daily.
- Chemical containers should not be stored on floors.
- Waste should be placed in appropriate receptacles.
- Chemical spills should be cleaned up immediately and the waste properly disposed. Unlabeled containers and chemical waste should be properly disposed within the

regulatory mandated time frame.

- Chemical inventories should be updated at least annually. All chemicals found to no longer be needed should be removed and properly disposed.
- Access to utility controls and emergency equipment should be kept free and clear at all times.

MAINTENANCE

- Every mechanical ventilation system used to prevent harmful exposures should have the ventilation rate tested by means of a pivot traverse of the exhaust duct or equivalent measures as follows:
 - ◆ After initial installation.
 - ◆ After alteration or maintenance.
 - ◆ At least annually.
- All emergency and safety equipment should be inspected and tested at regular periodic intervals. At a minimum, this should include preventive maintenance for:
 - ◆ Eyewash stations.
 - ◆ Deluge showers.
 - ◆ Respiratory equipment.
 - ◆ Fire extinguishers.
 - ◆ Fire alarms.

INSPECTIONS

Formal housekeeping and chemical hygiene inspections should be conducted at least quarterly. The inspection checklists provided in Appendix D should be used and completed for each laboratory inspection. The completed checklist should be submitted to the Chemical Hygiene Officer. A comprehensive laboratory safety, housekeeping, chemical hygiene, and life safety inspection should be done at least annually.

SIGNS & LABELS

One way of reducing exposures to laboratory personnel is to ensure that appropriate warnings are provided prior to exposure. All posted signs and labels should be clearly visible and maintained in good condition. Signs and labels should include:

- Emergency information:
 - ◆ Important telephone numbers.
 - ◆ Names and numbers of supervisors (emergency response personnel).
- Location signs:
 - ◆ Eyewash stations.
 - ◆ Deluge showers.
 - ◆ First aid equipment.
 - ◆ Fire extinguishers.
 - ◆ Exits.
- Warnings for areas or equipment which pose special hazards:
 - ◆ Flammable storage areas.
 - ◆ Oxidizer storage areas.
 - ◆ Bulk corrosives storage areas.
 - ◆ Compressed gas storage.
 - ◆ Toxic storage.
 - ◆ Radioactives.
 - ◆ Biohazards.
 - ◆ Automatic starting equipment.
 - ◆ Extremely hot or cold equipment.
- Miscellaneous signs:
 - ◆ Identify where food and beverage storage and/or consumption are not permitted.
 - ◆ Identify “NO SMOKING” areas.

- ◆ Identify non-potable water supplies.
- Container labeling:
 - ◆ Labels on incoming containers should not be removed or defaced.
 - ◆ All chemical containers should be labeled with at least the chemical identity or contents and hazard warnings.
 - ◆ Carcinogens should be clearly labeled as such.
 - ◆ Hazardous waste containers should be labeled “HAZARDOUS WASTE”, the waste type identified, and the date accumulation began noted on the label.

SPILLS & ACCIDENTS

Laboratories may be subject to a number of emergencies including chemical spills, fire, explosion, personnel contamination, broken glass, and loss of critical utility services. The chemical hygiene officer and all laboratory personnel should be prepared to react to any potential hazard.

MATERIAL SAFETY DATA SHEET

The purpose of the Material Safety Data Sheet (MSDS) is to provide readily accessible information regarding the characteristics of hazardous materials and appropriate safe work procedures. Since all work conditions involving the use and handling of a product cannot be covered, conservative measures are generally described.

The MSDS is a valuable guide in developing safeguards for employees who are or might be exposed to hazardous materials in the work place. The MSDS defines the health, physical, and chemical properties of a particular hazardous material. It includes recommendations to protect employees, property, and the environment through the proper use of personal protective equipment, methods of transportation, and storage of the material. State and federal OSHA regulations require the use of the MSDS for providing hazardous material information and training.

A MSDS can serve as another reference for the specific hazards of a material. While the MSDS may not give all the information on a hazardous material, it can be a starting point for answering questions about chemical handling, safety procedures, fire protection, and safe disposal. Always refer to the product label and the MSDS when working with a hazardous material.

The MSDS will be readily available to each laboratory employee during the work shift.

HAZARDOUS WASTE DISPOSAL

Disposal of hazardous waste is a major concern for all laboratories. The goal of the Hazardous Waste Disposal Plan is to ensure minimal harm to laboratory occupants, other site occupants,

other organisms, and the environment while complying with governmental regulations in a cost efficient manner. The section on each individual MSDS that references disposal should be followed. All hazardous waste is to be placed in clearly labeled containers with the date accumulation began. The containers are to be kept sealed.

MEDICAL CONSULTATION & MEDICAL EXAMINATIONS

The College is implementing a Chemical Hygiene Plan, which is designed to keep exposures below permissible exposure limits and to protect laboratory employees from health hazards associated with the hazardous chemicals stored, used, or handled in any College laboratory. Although precautions and procedures are designed to protect employees, the College realizes there may be times when medical attention would be appropriate for laboratory employees working with hazardous chemicals. To ensure employees have an adequate opportunity to receive medical attention, including medical consultation and/or medical examinations, the College will implement the following:

- The College will provide an opportunity to any laboratory employee to receive an appropriate medical examination, whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory.
- The College will implement medical surveillance as designated by Cal-OSHA standards for regulated substances, when exposure monitoring reveals exposure levels above the action level (or exposure limit when no action level is stipulated), for any Cal-OSHA regulated substance having exposure monitoring or medical surveillance requirements.
- The College will provide an opportunity to any laboratory employee for medical consultation as a means of determining the need for a medical examination, whenever an event (such as a spill or leak) occurs in a laboratory that results in a strong possibility of a hazardous exposure.

If medical examinations or medical consultations are required, the College will ensure the following conditions:

- They are performed by or under the supervision of a licensed physician.
- They are provided at no cost to the employee.
- They are provided at a reasonable time and place without loss of pay to the employee.

The College will take reasonable and appropriate action to obtain and provide the physician with information regarding the exposure. At a minimum, the College will provide the following information:

- The identity of the hazardous chemicals causing the exposure.
- A description of the conditions under which the exposure occurred.
- Quantitative exposure data, if available.
- A description of any signs or symptoms of exposure that the employee may have experienced.

The College will obtain a physician's written opinion from the examining or consulting physician for any medical examinations or consultation provided under this Plan. The physician shall be notified that the written opinion is not to reveal any findings or diagnoses unrelated to occupational exposure. However, the opinion shall include the following:

- Any recommendations for further medical follow-up.
- The results of the examination and associated tests, if requested.
- Disclosure of any medical condition revealed by the examination, which may place the employee at increased risk if exposed to a hazardous chemical in the laboratory.
- A statement that the employee has been informed by the physician of the results of the examination or consultation.
- A statement that the employee has been informed by the physician of any medical condition which may require further treatment.

EMPLOYEE INFORMATION & TRAINING

GOAL

The College will make available an information and training program to all laboratory employees. The goal of this program is to ensure that all laboratory personnel are adequately informed about laboratory work, appraisal of the hazards of chemicals present in the laboratory, and that they are knowledgeable in what to do if an accident occurs.

FREQUENCY

The College will take appropriate action to provide initial employee training and information at the inception of the Chemical Hygiene Plan, or at the time of an employee's initial assignment to a laboratory covered under this Plan. Employees will also receive appropriate training prior to assignments involving new exposure situations. The College believes that training should be a regular, continuing activity; therefore, refresher training will be provided at periodic, regular intervals. The basic rule is to provide refresher training once per year. This frequency may be adjusted up or down depending on needs and assessments done by the chemical hygiene officer and/or the chemical hygiene committee.

CONTENT

The College will provide an education program, which will give employees adequate information and training to work safely around hazardous chemicals and laboratory equipment. At a minimum, the employee education program will consist of the following:

- Information employees will be informed of:
 - ◆ The contents of Title 8, Section 5191, “Occupational Exposure to Hazardous Chemicals in Laboratories”.
 - ◆ The location and availability of the Chemical Hygiene Plan.
 - ◆ Exposure limits and action levels for Cal-OSHA regulated substances or recommended exposure limits for other hazardous chemicals not covered by an applicable Cal-OSHA regulation.
 - ◆ Signs and symptoms associated with exposures to hazardous chemicals.
 - ◆ The location and availability of the MSDS.
 - ◆ The location and availability of additional reference materials relating, but not limited to, safe laboratory practices, chemical handling, chemical storage, chemical disposal, and emergency procedures. Employees will be trained in:
 - ◆ Methods and observations which may be used to detect the presence or release of a hazardous chemical.
 - ◆ The physical and health hazards of chemicals in the laboratory work areas.
 - ◆ Measures which can be taken to protect oneself from health and physical hazards.
 - ◆ The applicable details of the College’s written Chemical Hygiene Plan.

This minimum defined training will be supplemented, as necessary, with training as identified in the following Plans:

- Hazard Communication Plan.
- Hazardous Materials Business Plan.
- Respiratory Protection Plan.
- Injury & Illness Prevention Program.