

## Purpose & General Principles

The Rancho Santiago Community College District has developed a Chemical Hygiene Plan to explain the policies and procedures that will promote the safe use and storage of hazardous materials. In addition, the Chemical Hygiene Plan is intended to satisfy the requirements of the U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1910. 1450, Occupational Exposures to Hazardous Chemicals in Laboratories (Appendix). This regulation is known as the “Laboratory Standard”; the objective of the “Laboratory Standard” is to protect employees from health hazards associated with hazardous chemicals in the laboratory.

“The Laboratory Standard” is a regulation developed for the protection of employees. Since students are not employees, they are not officially covered by provisions of the “Laboratory Standard”. However, the District intends that the provisions of the Chemical Hygiene Plan extend to students as well as to employees.

The Chemical Hygiene Plan provides specific laboratory practices designed to minimize the exposure of employees to hazardous substances. Employees should follow the practices specified in the Chemical Hygiene Plan and any other appropriate practices to minimize their health and safety risks. The Chemical Hygiene Plan is not intended to be the only source of safety policies and practices or information. Many policies and practices may not be part of the Chemical Hygiene Plan, but the policies and practices may be crucial to maintaining a safe environment for employees and students in a laboratory environment. The proper handling of live animals in a lab is an example of a policy that affects the establishment of a safe environment but is not required by the “Laboratory Standard” to be included in the Chemical Hygiene Plan.

The permissible exposure limit (PEL) and threshold limit value (TLV) of chemicals used in the laboratory are available on the MSDS and other sources for that chemical. Employee exposure to hazardous chemicals should not exceed these limits and it is the goal of the District that exposure to hazardous chemicals be well below these limits.

## 1. Responsibilities

### District Chemical Hygiene Officer

The Director of District Safety/ Emergency Services is designated as the “Chemical Hygiene Officer” for Rancho Santiago Community College District. This position will carry out the responsibilities outlined in the Chemical Hygiene Plan by working in concert with the Division Deans, Department Chairs, Faculty and Laboratory Staff.

The Chemical Hygiene Officer has the responsibility to:

- a. Develop and implement the Chemical Hygiene Plan and the safety plan for the district, including training, reporting, and other functions.
- b. Work with administrators and faculty to develop and implement the safety program.
- c. Assure that inspections in the laboratory are performed when appropriate and that records of inspections are maintained.
- d. Monitor the disposal of chemicals used in the laboratory programs.
- e. Assure that the Chemical Hygiene Plan is reviewed annually and revised as needed, so that it is always in compliance with current legal requirements.
- f. Implement appropriate training with regard to chemical hygiene for all district employees whose normal work locations include laboratory areas.
- g. Ensure that employees have received appropriate training and access to the Chemical Hygiene Plan, MSDSs, and other suitable reference materials.
- h. Monitor regular laboratory inspections on a timely basis to ensure compliance with existing standard operating procedures.

### Division Deans

The Division Deans are responsible for chemical hygiene programs within their divisions. Division Deans should work with Department Chairs and laboratory staff to ensure compliance with the Chemical Hygiene Plan.

### Department Chairs

The Department Chairs are responsible for chemical hygiene programs within their departments. The Department Chairs shall monitor compliance with the Chemical Hygiene Plan within the departments and is responsible for enforcement of all federal

state, and local health, safety, and environmental regulations and policies as applicable to their department.

### **Faculty**

The primary responsibility of faculty is to ensure compliance with the Chemical Hygiene Plan and standard operating procedures in their respective labs. This includes ensuring that students receive instruction and training in safe laboratory procedures, use of safety equipment and proper procedures in dealing with accidents.

### **Laboratory Staff**

Laboratory staff is responsible for complying with the Chemical Hygiene Plan and the standard operating procedures applicable to their positions. Laboratory staff should understand and comply with training and direction provided by the district or their department and report in writing to the Division Dean and Department Chair any significant problems arising from the implementation of standard operating procedures or compliance with the Chemical Hygiene Plan.

### **District Employees**

1. All district employees, who normally work in a laboratory, are responsible for:
  - a. Participating in training programs provided by the district.
  - b. Maintaining an awareness of health and safety hazards.
  - c. Planning and conducting each operation in accordance with district's Chemical Hygiene Plan procedures and consulting reference materials, including MSDSs, related to chemical safety where appropriate.
  - d. Using and modeling good personal chemical hygiene habits.
  - e. Reporting accidents, injuries, unsafe practices, and unsafe conditions to their immediate supervisors.

### **Students**

Students should practice good personal hygiene habits. They should report accidents to instructors or staff and maintain an awareness of health and safety hazards. Students should conduct all activities according to the Chemical Hygiene Plan procedures.

## 2. Standard Operating Procedures

### General

1. Staff and students should follow the Chemical Hygiene Plan to minimize their health and safety risks by following general precautions for handling all laboratory chemicals.
2. The laboratory facilities and stockrooms will provide sufficient space for safe work by the number or persons scheduled to be in the area.
3. Laboratory facilities and stockrooms will be used only by persons with proper qualifications and training. The number of students assigned to the laboratory shall not exceed the number of laboratory stations available.
4. In order to permit a quick, safe escape in an emergency, exit doors will be clearly marked and free of obstructions.
5. Employees should not underestimate risk (most laboratory chemical present hazards of one type or another) and exposure to hazardous substances should be minimized. The decision to use a particular substance will be based on the best available knowledge of each chemical's particular hazard and the availability of proper handling facilities and equipment. Substitutions, either of chemicals or experiments, will be made by the instructor where appropriate to reduce hazards without sacrificing instructional objectives. When the risk outweighs the benefit and no substitute is available, then the experiment, procedure, or chemical should be eliminated.
6. Science Department employees should be trained to read and use the information found on MSDSs. Specific guidelines for some chemicals, such as those found in the appropriate MSDSs, will also be followed.
7. Generally, textbooks, laboratory manuals, and other instructional materials designate the safety precautions needed for a particular laboratory activity. However, total reliance on such publications to provide complete and accurate information is not advisable. Employees should consult additional references, including Material Safety Data Sheets, before undertaking an unfamiliar activity.

### Laboratory Procedures

1. Individuals in laboratories (district employees and students)
  - a. Individuals will always conduct themselves in a responsible and professional manner at all times in the laboratory areas.

- b. Eating, drinking, smoking, gum chewing, application of cosmetics, manipulation of contact lenses, or other such activities are not permitted in the laboratory.
  - c. Employees should not work with, or transport, hazardous materials while alone in the lab or chemical storage areas.
  - d. Chemicals should never be tasted.
  - e. “Wafting” to test chemical odors should only be done with extreme caution and only when specifically directed to do so in the written experimental procedure.
  - f. Proper Bunsen burner procedures shall be followed. Flames should never be left unattended.
  - g. Individuals should dress appropriately for laboratory work. (See section 3.)
  - h. Should the need for evacuation of the building occur, turn off all Bunsen burners and electrical equipment and then leave the room immediately as directed.
  - i. Careful storage and handling procedures of glassware should be used to avoid breakage. Broken glass should be separated from other waste by placing it in a special container marked “Broken Glass.” Broken glass contaminated with chemicals must be processed as hazardous waste, labeled with chemical content noted and disposed of through a hazardous waste company.
  - j. The quantities of chemicals placed in the laboratories shall not exceed the amount that can be consumed in one day.
2. Students in the laboratory:
- a. Must read lab directions ahead of time and follow all verbal and written instructions.
  - b. Shall perform only authorized experiments.
  - c. Shall report all accidents or injuries to the instructor.
  - d. Shall only work in a laboratory or chemical storage area under the supervision of district faculty or staff.

### Housekeeping Practices

#### 1. Individuals in the laboratory

- a. All laboratory areas must be kept clean and orderly and contain only those items needed for the task at hand.
- b. All wastes must be placed in appropriate, segregated receptacles that are properly labeled.
- c. Sinks are to be used only for disposal of water and those solutions designated by the instructor. Other solutions must be placed in the appropriate labeled waste container.
- d. Tabletops are to be cleaned at the end of the lab activity.
- e. Clean up all chemical spills as soon as they occur. Chemicals and cleanup materials should be disposed of correctly.
- f. Never block access to emergency equipment, showers, eyewashes, or exits.
- g. Store chemicals and equipment properly.
- h. Before leaving the laboratory, turn off services (gas, electricity, water).
- i. Floors should be cleaned weekly.

#### Chemical Procurement

1. The purchasing of chemicals should be based on the philosophy that less is better. The lower the chemical inventory, the fewer the problems associated with storage. Chemicals should be ordered in quantities that are likely to be consumed in one year and should be purchased only in the quantity sufficient for the declared use.
2. All chemicals should be received in tightly closed, sturdy, and appropriate containers.
3. A chemical should not be accepted without the material safety data sheet and adequate identifying labeling. The MSDS Sheet should be immediately placed in the MSDS Book.
4. When a chemical is received, proper handling, storage, and disposal should be known.
5. The chemical inventory list should be updated each time a chemical is received.
6. Donated chemicals should be accepted only after approval is obtained from the Chair of the department receiving the material. It should be established that the donated chemical is in excellent condition, that an appropriate MSDS is available, and that there is a specific use for the donated material.

### Storage and Distribution

1. All chemicals should be stored in the tightly closed, sturdy, and appropriate containers.
2. If the chemical has been transferred to a secondary container, the new container must be appropriately labeled.
3. Chemicals should be stored based on the class and compatibility, of the chemical.
4. Large containers and containers with reactive chemicals, such as acids and bases, should be on low shelves.
5. The classification system used for the storage of chemicals should be displayed in the principal storage area.
6. Flammable chemicals shall be stored in approved storage containers and in approved flammable chemical storage cabinets.
7. Combustible material should not be stored near flammable chemical storage cabinets.
8. Chemicals should not be distributed to other areas of the college or district without the prior approval of the District Chemical Hygiene Officer. Chemicals should not be transferred to another location without the simultaneous transfer of a copy of the appropriate material data safety sheet, nor should they be transferred without the person receiving the chemicals having had appropriate training in their use, storage, and disposal.
9. Household refrigerators are not to be used to store chemicals.
10. Refrigerators used to store chemicals shall be labeled and shall be of explosion proof or of lab safe design. (NFPA 45)
11. OSHA standards and NFPA Guidelines or local fire regulations should be consulted on the proper use of flammable chemicals in the laboratory.
12. Compressed Gases
  - a. Gas cylinders should only be moved from one location to another with the protective cap securely in place.
  - b. Both full and empty cylinders should only be stored where they may be securely restrained by straps, chains, or a suitable stand.
  - c. A cylinder should be considered empty when there is still a slight positive pressure.

- d. An empty cylinder should be returned to the supplier as soon as possible after having been emptied or when it is no longer needed.
- e. Cylinders should not be exposed to temperatures above 50°C.

#### Waste Disposal

1. The District, the Chemical Hygiene Officer, Department Chairs and laboratory staff shall ensure that the disposal of laboratory chemicals is in compliance with appropriate rules and regulations as applied to a Small Quantity Generator of hazardous materials.
2. Guidelines for waste minimization:
  - a. Employees shall make minimizing generation of hazardous wastes a priority.
  - b. Chemicals should be ordered in quantities that are likely to be consumed in one year or less.
  - c. All employees shall avoid the accumulation of hazardous waste. Potential waste materials are surplus, old, and/ or unnecessary chemicals. Every attempt must be made to avoid accumulating such chemicals.
  - d. Prior to ordering new chemicals, or synthesizing new products from reactions, employees shall first determine if the material will need to be treated as hazardous waste.
3. Guidelines for hazardous waste disposal:
  - a. Flammable, combustible, water-immiscible materials, or water-soluble solutions of toxic substances shall not be disposed of by being poured down the drain.
  - b. Separate waste containers should be provided for heavy metal compounds, chlorinated hydrocarbons, non-chlorinated hydrocarbons, and any other categories recommended by the District's hazardous waste transporter company.
  - c. Waste chemicals should be stored in appropriately labeled containers, inside secondary containment.
  - d. Hazardous wastes should never be placed in the common solid trash container.
  - e. All waste containers should have an up-to-date log of the material that is in the container.

- f. Upon completion of laboratory activities, the waste containers shall be returned to the preparation room. Waste materials should not be stored in the laboratory. When the waste containers become full, the containers shall be transferred to a designated waste storage area.

### Spills

1. If the chemical involved in the spill is judged to present an immediate hazard, evacuation is to be absolute and immediate, and the area should be isolated until a HAZMAT team arrives.
2. If hazardous vapors are present, the area should be isolated. Only persons trained in the use of respirators may enter the area. This will usually mean waiting for the arrival of a HAZMAT team.
3. If a volatile, flammable material is spilled, immediately extinguish flames, turn off all electrical apparatus, and evacuate the area. Consult the MSDS for appropriate cleanup procedures. If the quantity exceeds the employee's ability or training to handle the spill, seal the area until appropriately trained personnel arrive.
4. If there is no immediate danger (flammability, toxicity, reactivity, corrosivity) to personnel, containment should be accomplished by use of spill pillows, towels, rolls, or other devices that will keep the spill from spreading.
5. If there is no immediate danger, cleanup procedures listed on the MSDS should be followed. Appropriate personal protective equipment shall be used.
6. A spill kit should be accessible for each science laboratory. The kit might include:
  - a. Spill control pillows and inert absorbents such as vermiculite, clay, sand, or kitty litter.
  - b. Neutralizing agents for acid spills such as sodium carbonate and sodium hydrogen carbonate.
  - c. Neutralizing agents for alkali spills such as sodium hydrogen sulfate and citric acid.
  - d. Quantities of cleanup materials sufficient for the largest anticipated spill.
  - e. Large plastic scoops and other equipment such as brooms, pails, bags, and dustpans.
  - f. Appropriate personal protective equipment.
7. If the spill material was a hazardous chemical, all of the materials involved in the cleanup will usually be considered to be hazardous waste and must be disposed of as such.

8. If a major spill occurs (cannot be cleaned-up safely by yourself), cleanup shall only be undertaken by individuals who are trained in HAZMAT procedures.

### 3. Control Measures

#### Personal Protective Equipment

1. It is the responsibility of the district to provide appropriate safety and emergency equipment for employees and students.
2. Protective apparel shall be compatible with the required degree of protection for the substances being handled.
3. Laboratory aprons or coats, eye protection, and non-permeable gloves are considered standard equipment for academic laboratory programs and should be readily available to employees and students. Lab coats or aprons worn in the laboratory should offer protection from splashes and spills, and should be easy to remove in case of an accident, and should be fire resistant.
4. Chemical splash safety goggles should be used as the standard protective eyewear even over normal prescription glasses. Such goggles should fit the face surrounding the eyes snugly to protect the eyes from a variety of hazards. All eye protection devices should conform to ANSI Standard Z87.1-1989. Safety glasses, even with side shields, are not acceptable protection against chemical splashes. Contact lenses are not necessarily prohibited in the laboratory. If contact lenses are worn, chemical splash goggles must also be worn at all times.
5. Full-face shields protect the face and throat. They must be worn for protection when there is a greater risk of injury from flying particles and harmful chemical splashes. A full-face shield should also be worn when an operation involves a pressurized system that may explode or an evacuated system that may implode. For full protection, safety goggles must be worn with the face shield.
6. A standing shield should be used for group protection from chemical splash and impact. Standing shields should be used when there is a potential for explosions, implosions, or splashes, or when corrosive liquids are used.
7. When gloves are required, it should be remembered that no one kind of glove is suitable for all situations. The MSDS should be consulted for information regarding the proper type of gloves to be used.

## Administrative Controls

### 1. Inventory Control

- a. A chemical inventory should be updated each time a chemical is received or consumed. The list should be audited for accuracy on at least an annual basis.
- b. The chemical inventory list should contain the following information about each chemical found in storage: the chemical name, location, the date purchased, the amount present, the CAS number, and the examination date for possible disposal.
- c. Every area in which chemicals are used or stored should have an up-to-date inventory.
- d. A printed copy of the most recent inventory should be kept by the Department Chair, laboratory coordinator and the Chemical Hygiene Officer.

### 2. Hazard Identification and Labels

- a. Labels on incoming containers of hazardous chemicals are not to be removed or in anyway defaced.
- b. Laboratory chemicals should be properly labeled to identify any hazards associated with them for the employee's information and protection.
- c. If a chemical is stored in its original bottle, it should have the manufacturer's original label identifying potential hazards, and the date received, the date opened, and the initials of the person who opened the container.
- d. If a chemical has been transferred to a secondary container, the new container should be appropriately labeled with the chemical name, formula, concentration (if in solution), solvent (if in solution), hazard warnings, name or initials of the person responsible for the transfer.
- e. Unlabeled bottles should not be opened, and such materials should be disposed of promptly, as outlined in the section on disposal procedures.

### 3. Signs and Posters

- a. Emergency telephone numbers shall be posted in all laboratory areas.
- b. Signs shall be used to indicate the location of exits, evacuation routes, safety showers, eyewash stations, fire extinguishers, fire blankets, first aid kits, fume hoods, and other safety equipment.

- c. Warnings will be posted at areas or equipment where special or unusual hazards exist.
  - d. Signs and/ or posters to reinforce laboratory safety procedures should be displayed in the laboratory and preparation areas.
4. Material Safety Data Sheets (MSDSs)
- a. Each MSDS received with incoming shipments of chemicals should be maintained and made readily available to laboratory employees and to students.
  - b. The material safety data sheets for each chemical in the laboratory usually give recommended limits or OSHA – mandated limits, or both, as guidelines to exposure limits. Typical limits are expressed as threshold limit values (TLVs), permissible exposure limits (PELs), or action levels. When such limits are stated, that limit, along with any other information about the hazardous characteristics of the chemical, should be used to set laboratory guidelines. These laboratory guidelines may be used in determining the safety precautions, control measures, and personal protective equipment that apply when working with the toxic chemical.
  - c. A material safety data sheet for each compound on the chemical inventory should be available in the department. Material safety data sheets can often be obtained by requesting them from companies that currently sell the chemicals. Chemical manufacturers and suppliers are required to supply one copy of a material safety data sheet the first time the chemical is purchased by the or institution.
5. Records
- 1. Permanent records will be maintained by the Chemical Hygiene Officer and the Risk Management Office and will included:
    - a. Inspection Records – Reports must be completed and retained by the Chemical Hygiene Officer. Safety equipment should be tagged to indicate the date and the results of the last inspection. Records indicating the dates of repairs and regular maintenance of safety equipment should be maintained.
    - b. Training Records – The district should maintain records of employee training for at least 30 years, and they should be made available to employees.
    - c. Incident Report – Accident reports must be completed for all incidents.
    - d. Medical and Exposure Records – Records of air concentration monitoring, exposure assessments, medical consultations, and medical examinations

must be kept by the risk management office for at least 30 years after the employee ceases employment with the district.

- e. Waste Disposal Records – The district shall retain records of disposal of hazardous waste, as determined by the District Safety Office.

## 6. Exposure Monitoring

- a. If there is reason to believe that exposure levels for a regulated substance have exceeded the permissible exposure limit, the Chemical Hygiene Officer and the Risk Management Office should ensure that the employee or student exposure to that substance is measured.
- b. Factors which may raise the possibility of overexposure and therefore warrant an initial measurement of employee or student exposure include:
  - 1. The manner in which the chemical procedures or operations involving the particular substances are conducted.
  - 2. The existence of historical monitoring data that shows elevated exposures to the particular substance for similar operations.
  - 3. The use of procedure that involves significant quantities or is performed over an extended period of time.
  - 4. There is reasonable cause to believe that an exposure limit may be exceeded.
  - 5. Signs or symptoms of exposure (e.g., skin or eye irritation, shortness of breath, nausea, or headache), which are experienced by employees or students. (Some of these symptoms are very general and can be due to many other causes including emotional stress or hysteria.)
- c. If the substance in question does not have exposure monitoring or a medical surveillance requirement, exposure monitoring and medical surveillance shall be continued until exposure levels are determined to be below the PEL.
- d. If a substance has an exposure-monitoring requirement and if there is reason to believe that exposure levels for that substance routinely exceed the PEL, the district shall measure the employee or student exposure to the substance.
- e. If the initial monitoring (described in d. above) discloses employee exposure over the PEL, the district shall immediately comply with the exposure monitoring provisions of the relevant standard for that substance.
- f. The district shall, within 15 working days after the receipt of monitoring results, notify the employee or student of these results in writing either

individually or by posting the results in an appropriate location that is accessible to employees.

- g. The following substances are regulated by OSHA standards and require monitoring: lead, benzene, 1,2-dibromo-3-chloropropane, acrylonitrile, ethylene oxide, formaldehyde, asbestos, vinyl chloride, and inorganic arsenic.

#### **4. Safety/ Emergency Facilities and Equipment**

##### Equipment

1. The district should ensure that adequate emergency equipment is available in the laboratory and inspected periodically to ensure that it is functioning properly. All employees should be properly trained in the use of each item.
2. Emergency equipment items that should be available include: eyewash station, fire extinguisher of the appropriate type, safety shower, telephone for emergencies, fire blanket, and identification signs.
3. Each laboratory should have a standard first aid kit.
4. Multipurpose fire extinguishers should be available in the laboratory. A multipurpose, ABC, fire extinguisher, can be used on all fires EXCEPT for class D fires. Extinguishers should be visually checked monthly and inspected and tested annually.
5. Every eyewash station will be capable of supplying a continuous flow of aerated, tepid, potable water to both eyes for at least 15 minutes. The valve should remain in the open position without the need to hold the valve. (ANSI Z358.1-1990)
6. Safety showers should be capable of supplying a continuous flow of tepid potable water for at least 15 minutes. The shower should have a quick – opening valve requiring manual closing. (ANSI Z358.1-1990)
7. Eyewash stations and safety shower stations shall be located so they will be accessible within 10 seconds. (ANSI Z358.1-1998)
8. Safety equipment will be tagged following an inspection, showing the date, inspector, and results.
9. Laboratories in which hazardous substances are being used should have spill control kits available to deal with the potential risk associated with the materials being used. If there is no immediate danger to employees or students, containment should be accomplished by spill pillows, towels, rolls, inert absorbents, neutralizing agents, or other devices.

## Facilities

### 1. Fume hoods

- a. Laboratory fume hoods are the most important components used to protect laboratory employees and students from exposure to hazardous chemicals and agents used in the laboratory. Functionally, a standard fume hood is a fire and chemical resistant enclosure with one opening (face) in the front with a movable window (sash) to allow user access into interior. Large volumes of air are drawn through the face and out the top to contain and remove contaminants from the laboratory.
- b. Laboratory fume hoods are not meant for storage unless no other appropriate area is available. If a hood must be used for storage, in order to provide adequate ventilation for flammable chemicals, for example, it must not be used for laboratory work or transfer of chemicals. In that event, it must be used only for storage.
- c. Laboratory activities that may release airborne contaminants above the Permissible Exposure Limit (PEL) or Thresholds Limit Value (TLV) concentrations must be carried out in the fume hood. Also, if laboratory activities produce potentially hazardous vapors or gaseous substances, the laboratory activities should be conducted in the fume hood.
- d. In most cases, the recommended face velocity is between 80 and 100 feet per minute (fpm).
- e. Fume hoods should be positioned in the laboratory so that air currents do not draw fumes from the hood into the room.
- f. The exhaust stack from a fume hood shall be in a vertical-up direction at a minimum of 10 feet above the adjacent roofline and so located with respect to openings and air intakes of the laboratory or adjacent buildings to avoid reentry of the exhaust into the building. (ANSI/ AIHA Z9.5-1992)
- g. Fume hoods or other local ventilation devices should be used when working with any appreciably volatile substance with a TLV of less than 50 ppm.
- h. All biohazard and fume hoods shall be inspected annually and certified by a qualified Air-Balancing Company. Any hood not passing inspection must be taken out of service immediately and not be used until such time as the hood has passed inspection. It is the responsibility of the district to purchase the parts and replace the unit in a timely fashion so as not to endanger the health and well being of the employee or place the facility at risk.
- i. Fume hood air velocity should be tested 2 times per year by the colleges' maintenance staff or an outside contractor. The college maintenance staff is responsible for maintaining the fume hoods.

## 2. Ventilation

- a. General laboratory ventilation should not be relied on for protection from exposure to hazardous chemicals. A rate of 4-12 room air exchanges per hour should be the accepted standard when local exhaust systems, such as hoods, are used as the primary method of control. Laboratory airflow should not be turbulent and should flow continuously throughout the laboratory.
- b. Any alteration of the ventilation system should be made only if thorough testing indicates that employee and student protection from airborne toxic substance will continue to be adequate.
- c. Exhaust from the fume hoods should be vented directly to the outside.

## 3. Flammable Storage

- a. Chemicals with a flash point below 93.3 °C (200 °F) should be considered “fire hazard chemicals”. Any chemical whose MSDS or label states “Flammable” is in this category.
- b. Fire hazard chemicals in excess of 500 mL should be stored in a flammable solvent storage area, safety cans, or in storage cabinets designed for flammable materials. Large quantities of flammable chemicals stored outside cabinets should be in flameproof storage cans which conform to NFPA guidelines. NFPA 30, Flammable and Combustible Liquids code, and NFPA 45, Fire protection for Laboratories Using Chemicals, and/ or applicable local fire codes should be followed.

## 4. Electrical

- a. All electrical outlets should have a grounding connection accommodating three-prong plug.
- b. All laboratories should have circuit breakers readily accessible. Employees should know how to cut-off electricity to the laboratory in case of emergency.
- c. Laboratory lighting should be on a separate circuit from electrical outlets.

## 5. Training and information

### Training for Employees

1. General
  - a. The district shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area.
  - b. Such information shall be provided at the time of the employee's initial assignment to a work area where hazardous chemicals are present, and prior to assignments involving exposure situations. The frequency of refresher information and training shall be determined by the district.
2. The objective of the employee training and information program is to assure that all individuals at risk are adequately informed about: the physical and health hazards associated with hazardous chemicals present in the laboratory: the proper procedures to minimize risk of exposure: and the proper response to accidents.
3. The district shall provide training opportunities for all individuals at risk. These training opportunities should include information about the hazards of chemicals present in the laboratory and sources of information concerning hazards in the laboratory. In particular, the training program should cover the laboratory standard, material safety data sheets, the Chemical Hygiene Plan, and the responsibilities of the district and the employee.
4. Employees should be trained on the potential chemical hazards in the employees' work areas and on appropriate sections of the Chemical Hygiene Plan. This training should be provided to all employees who actually work in the laboratory as well as to other employees whose assignments may require that they enter a laboratory where exposure to hazardous chemicals might occur. Employees who are responsible for receiving and handling shipments of new chemicals or chemical wastes should also be informed of the potential hazards and appropriate protective measures for chemicals they may receive.
5. Laboratory employees should be trained on the applicable details of the Chemical Hygiene Plan, including a review of the general rules of laboratory safety. The training program should describe appropriate sections of the standard operating procedures, particularly those procedures that require prior approval of the Chemical Hygiene Officer.
6. The training an employee receives should be determined by the nature of the work assignment in the laboratory.
7. Employees should be trained in measures they may take to protect themselves from exposure to hazardous chemicals, including the location and proper use of protective equipment and emergency equipment. In addition, the training must

also include a discussion of inventory procedures to be followed, proper storage and ordering rules, and district hazardous waste disposal procedures.

8. All laboratory employees will be trained to read and understand MSDSs.
9. All employees shall be trained in labeling and storage practices as outlined in the Chemical Hygiene Plan.
10. All employees should be trained in the methods and observations that may be used to detect the presence or release of hazardous chemicals.

#### Training for Students

Instruction in laboratory safety shall be provided to all students involved in laboratory activities. At the beginning of the semester and prior to laboratory activities, class time shall be devoted to safe laboratory practices. The extent of student training should be based on the level of the class, the course of study, of the student, the laboratory facility used, department and district policies, the Chemical Hygiene Plan, and the level of chemical handling and potential exposure to hazardous chemicals.

#### Information

1. Employees shall be informed of the content of the "Laboratory Standard", 29 CFR Part 1910.
2. Employees shall be informed of the location and availability of the Chemical Hygiene Plan.
3. Employees shall be informed of the permissible exposure limits for OSHA regulated substances on site or recommended exposure limits for other hazardous chemicals on site where there is no applicable OSHA standard.
4. Employees shall be informed of the location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals where there is no applicable OSHA standard.
5. Employees shall be informed of the location of material safety data sheets.
6. Employees shall be informed of the location of personal protective equipment and of emergency equipment as outlined in the Chemical Hygiene Plan.
7. Employees shall be informed of the signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.

## 6. Prior approval

1. Prior approval should be obtained from the Department Chair whenever a new laboratory experiment or test is to be carried out. This prior approval should also be sought for experiments that have not been performed recently or for which the potential for harm is present. The potential for harm may be affected by a change in the amounts of materials being used, the conditions under which the experiment is to be conducted, or the substitution, deletion, or addition of a chemical.
2. Prior approval before doing any procedure should be obtained where one or more of the following conditions exist:
  - a. Potential for a rapid rise in temperature
  - b. Potential for a rapid increase in pressure
  - c. Use of a flammable solvent
  - d. Potential for a chemical explosion
  - e. Potential for spontaneous combustion
  - f. Potential for the emission of toxic gasses that could produce concentrations in the air that exceed toxic limits.
  - g. Change in procedure, even if the change is quite small.
  - h. Involves the use of highly toxic substances.
3. A list of acceptable reagents should be developed for use. An employee who desires to use a substance that is not on the acceptable list must seek the permission of the Department Chair. The decision to use the chemical will be based on the best available knowledge of the hazards of the substance and the availability of proper handling facilities and equipment. The request should consider the following information.
  - a. Use of the chemical is pedagogically sound.
  - b. Use of the substance is an effective method to illustrate an important process, property, or concept.
  - c. Adequate safeguards are in place to assure proper use of the substance.
  - d. Exposure time of the employees and students to the substance.
  - e. Permissible exposure limit and threshold limit value of the substance.

---

## 7. Medical consultation and medical examinations

1. District employees do not regularly handle significant quantities of materials that are acutely or chronically toxic. Therefore, regular medical surveillance is not required.
2. In the event that an employee is exposed to levels of a hazardous chemical exceeding the established PEL or TLV, or should the employee exhibit signs or symptoms of such exposure, the employee shall be provided on opportunity to receive an appropriate medical examination.
3. All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place. The Risk Manager will determine the procedures to follow in these cases.
4. The district shall provide the following information to the physician conducting the examination.
  - a. The identity of the hazardous chemical(s) to which the employee may have been exposed.
  - b. A description of the conditions under which the exposure occurred, including quantitative exposure data if available.
  - c. A description of the signs and symptoms of exposure that the employee is experiencing.
  - d. A copy of the MSDSs for the chemical(s) involved.
5. A written opinion from the examining physician for any consultations or examinations performed under this standard should include:
  - a. Any recommendation for further medical attention.
  - b. The results of the medical examination and any associated tests.
  - c. Any medical condition revealed during the examination which might compromise employee safety during, or as a result of, exposure to hazardous chemicals found in the workplace.
  - d. A statement that the employee has been informed by the physician of the results of the consultation or examination and any medical condition that may require further examination or treatment.
  - e. A copy of the physician's report, to be retained by the district.

- f. The written opinion from the physician should not reveal specific diagnoses unrelated to the occupational exposure.

## 8. Particular hazardous substances (phs)

### General

1. This section of the plan describes the specific and general control measures that are designed to reduce the exposure of instructors, aides, students, and other employees to especially hazardous substances. Employees should read and understand these practices before commencing procedure using particularly hazardous substances.
2. PHSs include highly toxic chemicals, reproductive toxins, and select carcinogens. In addition, our district includes highly flammable chemicals, highly reactive chemicals, and highly corrosive chemicals.
3. The use of these substances requires prior approval of the Department Chair.
4. PHSs shall be used in designated areas and in fume hoods.
5. The use of PHSs shall require removal of contaminated waste and the decontamination of contaminated areas.

### Highly Toxic Chemicals

1. When a PEL or TLV value is less than 50 ppm or 100 mg/m<sup>3</sup>, the user should use it in an operating fume hood, glove box, vacuum line, or other device equipped with appropriate traps. If none is available, no work should be performed using the chemical.
2. If a PEL, TLV, or comparable value is not available, the animal or human median inhalation lethal concentration information, LC 50, should be used as a guideline. If that value is less than 200 ppm or 2000 mg/m<sup>3</sup> when administered continuously for one hour or less, then the chemical should be used in an operating fume hood, glove box, vacuum line, or other device equipped with appropriate traps. If none are available, no work should be performed using that chemical.
3. Examples of highly toxic chemicals (acute or chronic) that were commonly used in the past are benzene, chloroform, formaldehyde, bromine, carbon disulfide, carbon tetrachloride, cyanide salts, and hydrofluoric acid.

### Highly Flammable Chemicals

1. The district will define class 1A liquids as highly flammable chemicals. Class 1A liquids have a flashpoint of less than 73°C and boiling point of less than 100 °C.

2. Examples of highly flammable chemicals are diethyl ether, acetone, pentane, petroleum ether, acetaldehyde, and ligroines.

#### Highly Reactive Chemicals

1. Reactivity information may be given in a manufacturer's MSDSs and on labels. The most complete and reliable reference on chemical reactivity is the current edition of Bretherick's Handbook of Reactive Chemical Hazards.
2. A reactive chemical is one that:
  - a. Is described as such on the label, in the MSDSs, or by Bretherick.
  - b. Is ranked by the NFPA as 3 or 4 for reactivity.
  - c. Is identified by the Department of Transportation (DOT) as an oxidizer, an organic peroxide, or an explosive (Class A, B, or C).
  - d. Is known or found to be reactive with other substances.
3. Reactive chemicals should be handled with all proper safety precautions, including segregation in storage, and prohibition of mixing even small quantities with other chemicals without prior approval and appropriate personal protection and precautions.
4. Examples of commonly encountered highly reactive chemicals are ammonium dichromate, nitric acid, perchloric acid, hydrogen peroxide, and potassium chlorate, azides, organic nitrates, and acetylides.

#### Highly Corrosive Chemicals and Contact Hazard Chemicals

1. Corrosivity, allergen, and sensitizer information is provided in manufacturer's MSDSs and on labels.
2. A corrosive chemical is one that:
  - a. Fits the OSHA definition of corrosive in 29 CFR 1910.1200
  - b. Fits the EPA definition of corrosive in 40 CFR 262.22 (has a pH greater than 12 or a pH less than 2.5)
  - c. Is known to be reactive to living tissue, causing visible destruction, or irreversible alterations of the tissue at the site of contact.
3. A contact – hazard chemical is an allergen or sensitizer that:
  - a. Is so identified or described in the MSDS or on the label.
  - b. Is so identified or described in medical or industrial hygiene literature.

- c. Is known to be an allergen or sensitizer.
- 4. Corrosive and contact hazard chemicals will be handled with all proper safety precautions, including wearing safety goggles, using gloves tested for the absence of pinholes and known to be resistant to permeation or penetration by the chemical, and wearing a laboratory apron or laboratory coat.
- 5. Examples of highly corrosive chemicals are hydrochloric, sulfuric, nitric, phosphoric, and perchloric acids (all acids in greater than 1 molar concentration), and potassium hydroxide (either solid or in aqueous solution greater than 1 molar concentration).

#### Reproductive Toxins

- 1. A reproductive toxin refers to chemicals with affect reproductive capabilities including chromosomal damage (mutations) and which affect fetuses (teratogenesis).
- 2. A reproductive toxin is a compound that:
  - a. Is described as such in the applicable MSDS or label.
  - b. Is identified as such by the Oak Ridge Toxicology Information Resource Center (TIRC). (615) 576-1746.
- 3. No reproductive toxins should be used without written authorization from the Chemistry Department Chair.
- 4. If such chemicals are used,
  - a. They should be handled only in a hood and when satisfactory performance of the hood has been confirmed.
  - b. Skin contact should be avoided by using gloves and wearing protective apparel
  - c. Persons using such substances should always wash hands and arms immediately after working with these materials.
  - d. Unbreakable containers of these substances should be stored in a well-ventilated area and will be labeled properly.
- 5. Examples of reproductive toxins are organomercurial compounds and ethidium bromide, carbon disulfide, xylene, toluene, benzene, mercury, lead compounds, ethyl ethers, vinyl chloride.

### Select Carcinogens

1. Select carcinogen means any substance which meets one of the following criteria:
  - a. It is regulated by OSHA as a carcinogen.
  - b. It is listed under the category, “known to be carcinogens,” in the National Toxicology Program (NTP) Annual Reports on Carcinogens.
  - c. It is listed under Group 1 “carcinogenic to humans” by the International Agency for Research on Cancer Monographs (IARC).
  - d. It is listed in either Group 2A or 2B by IARC or under the category “reasonably anticipated to be carcinogens” and causes statistically significant tumor incident in experimental animals under set criteria of exposure.
2. All work with these substances should be conducted in a designated area, such as fume hood, glove box, or a portion of a laboratory designated for use of chronically toxic substances. Such a designated area should be clearly marked with warning and restricted access signs.
3. Any procedure that may result in a generation of aerosols or vapors should be performed in a hood whose performance is known to be satisfactory.
4. Skin contact should be avoided by using gloves and other protective apparel as appropriate. Any protective clothing should be removed before leaving the designated area and placed in a labeled container. Hands, arms, and neck should be washed after working with these materials.
5. Selective carcinogens should be stored in unbreakable containers in a ventilated area with controlled access. All containers should be labeled with the identity and hazard of the substance. Immediately upon completion of the project, all unused reproductive toxin should be disposed of following standard hazardous waste disposal procedures.
6. Examples of select carcinogens are benzene, nickel metal dust, vinyl chloride, and formaldehyde.

## APPENDIX

U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1910. 1450, Occupational Exposures to Hazardous Chemicals in Laboratories.