



# Chemical Hygiene Plan

## CONTENTS

- 1.0 *PURPOSE*
- 2.0 *APPLICABILITY AND SCOPE*
- 3.0 *REGULATIONS AND STANDARDS*
- 4.0 *DEFINITIONS*
- 5.0 *RESPONSIBILITIES*
  - 5.1 *Employee, Volunteer, or Student Responsibilities*
  - 5.2 *Supervisor Responsibilities*
  - 5.3 *Career and Protective Services Responsibilities*
- 6.0 *LABORATORY FACILITY*
  - 6.1 *Fume Hoods*
    - 6.1.1 *Fume Hood Inspection*
- 7.0 *GOOD LABORATORY PRACTICES*
  - 7.1 *Procedures*
  - 7.2 *Chemical Procurement, Inventory, Storage, and Transportation*
    - 7.2.1 *Chemical Inventory*
    - 7.2.2 *Storage*
      - 7.2.2.1 *Highly Reactive Substances*
    - 7.2.3 *Transportation*
  - 7.3 *Environmental Monitoring*
  - 7.4 *Housekeeping, Maintenance, and Inspections*
  - 7.5 *Medical Program*
    - 7.5.1 *Worker's Compensation*
  - 7.6 *Personal Protective Apparel and Equipment*
  - 7.7 *Recordkeeping*
  - 7.8 *Signs and Labels*
  - 7.9 *Chemical Spills and Accidents*
    - 7.9.1 *Chemical Spill Clean-Up*
      - 7.9.1.1 *Corrosive Liquids*
      - 7.9.1.2 *Other Hazardous Liquids*
      - 7.9.1.3 *Solids*
    - 7.9.2 *Chemical Exposure*
      - 7.9.2.1 *Eye/Skin Contact*
      - 7.9.2.2 *Inhalation*
      - 7.9.2.3 *Ingestion*
      - 7.9.2.4 *Injection*
  - 7.10 *Training and Communication*
    - 7.10.1 *Laboratory Safety Course*
    - 7.10.2 *Standard Operating Procedures*
    - 7.10.3 *Laboratory Refresher Training*

- 7.11 *Hazardous Waste Management and Disposal*
- 8.0 *WORKING WITH HAZARDOUS CHEMICALS*
- 9.0 *SAFETY RECOMMENDATIONS*
  - 9.1 *Fire Safety*
  - 9.2 *Electrical Safety*
- 10.0 *MATERIAL SAFETY DATA SHEETS (MSDS)*
- 11.0 *EMERGENCY PREPAREDNESS*
- 12.0 *PROGRAM APPROVAL AND REVIEW*

- Appendix A Compressed Gas Cylinder Program*
- Appendix B Hazardous Waste Management and Disposal*
- Appendix C Medical Surveillance Program*
- Appendix D Personal Protective Equipment Evaluation*
- Appendix E Laboratory Design Specifications*
- Appendix F Respiratory Protection Program*
- Appendix G Environmental Management System*
- Appendix H Injury and Illness Prevention Program*
- Appendix I Chemical Inventory Program*
- Appendix J Carcinogen Program*
- Appendix K SOP Corrosives*
- Appendix L SOP Cryogenic Liquids*
- Appendix M SOP Flammables*
- Appendix N SOP Oxidizers*
- Appendix O SOP Reactive and Explosive Materials*
- Appendix P SOP Toxics*

## **1.0 PURPOSE**

The purpose of the Chemical Hygiene Plan (CHP) is to provide procedural guidelines for prudent work practices in the handling, storage, and use of chemicals in the laboratory and to protect laboratory workers from the potential health hazards of the chemicals they encounter in the workplace.

## **2.0 APPLICABILITY AND SCOPE**

This program applies to all employees and volunteers who routinely handle hazardous chemicals in USC-owned laboratories.

## **3.0 REGULATIONS AND STANDARDS**

Federal: Title 29, CFR 1910.1450 Appendix A, Chemical Hygiene Plan

## **4.0 DEFINITIONS**

**CHP** – Chemical Hygiene Plan

**Corrosive** - a chemical that causes visible destruction of or irreversible alterations in living tissue by chemical action at the site of contact. For example, a chemical is considered to be corrosive if, when tested on the intact skin of albino rabbits by the method described by the U.S. Department of Transportation in appendix A to 49 CFR part 173, it destroys or changes irreversibly the structure of the

tissue at the site of contact following an exposure period of four hours.

**Flammable** - a chemical that falls into one of the following categories:

1. Aerosol, flammable means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;
2. Gas, flammable means: A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or
  - a. A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit.
3. Liquid, flammable means any liquid having a flashpoint below 100 deg F (37.8 deg. C), except any mixture having components with flashpoints of 100 deg. C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.
4. Solid, flammable means a solid, other than a blasting agent or explosive as defined in § 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

**Employee** - a research staff member, technician, or student worker working with hazardous materials who is employed by the University and in a position below the supervisor.

**Organic peroxide formers** – materials that react with oxygen to form peroxy compounds (usually hydroperoxides) that are very unstable and decompose continuously. These organic peroxides are sensitive to light, heat, friction, and impact, as well as to strong oxidizing and reducing agents, and they are extremely flammable. There are four main groups of peroxide formers:

- a. Ethers with primary and/or secondary alkyl groups attached to the oxygen, including open chain and cyclic ethers, acetals, and ketals.
- b. Hydrocarbons with allylic, benzylic, or propargylic hydrogens.
- c. Conjugated dienes, enynes, and diynes.
- d. Saturated hydrocarbons with exposed tertiary hydrogens.

**Oxidizer** - a chemical other than a blasting agent or explosive as defined in § 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases. In chemistry terms, it is an agent that receives electrons from a reducing agent during an oxidation-reduction reaction.

**Prop 65** - The Safe Drinking Water and Toxic Enforcement Act of 1986 (Prop 65) requires the Governor of the State of California to revise and republish the list of chemicals known to the State to cause cancer or reproductive toxicity. The list is available at <http://www.oehha.ca.gov/prop65.html>.

**Reactive (unstable)** - a chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

**Supervisor** - a University principal investigator, lab manager, senior researcher, administrative officer, or associate in charge of a laboratory, school unit, operation, or clinic where hazardous materials are used and/or stored.

**Toxic** - a chemical falling within any of the following categories:

1. A chemical that has a median lethal dose (LD<sub>50</sub>) of more than 50 milligrams per kilogram but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD<sub>50</sub>) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.

A chemical that has a median lethal concentration (LD<sub>50</sub>) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than two milligrams per liter but not more than 20 milligrams per liter of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

**University** - University of Southern California

**Volunteer** - an individual that provides services related to hazardous materials use to the University without remuneration or compensation.

## **5.0 RESPONSIBILITIES**

**Chemical Hygiene Officer:** Alfred M. Bouziane

### **5.1 Employee, Volunteer, or Student Responsibilities**

It is the responsibility of the employee, student, or volunteer to:

1. Understand and comply with all provisions set forth in this CHP;
2. Attend initial safety training provided by Career and Protective Services;
3. Attend annual refresher training provided by the supervisor;
4. Attend safety meetings regularly; and
5. Comply with all University safety policies.

### **5.2 Supervisor Responsibilities**

It is the responsibility of the supervisor to:

1. Ensure that all staff under the supervisor's purview understand and comply with this CHP;
2. Ensure initial training of hazardous materials users through the Laboratory Safety Course;
3. Provide annual laboratory safety refresher training to all staff working with hazardous materials (chemicals, biological agents, and radioisotopes);
4. Create a chemical inventory for each laboratory;
5. Provide easy access to Material Safety Data Sheets (MSDSs);

6. Prepare Standard Operating Procedures (SOP) including Safe Work Practices for all routine processes involving hazardous materials conducted in the facility;
7. Ensure that all hazardous materials storage and use areas are posted with accurate warning labels;
8. Hold safety meetings regularly;
9. Determine and document the personal protective equipment (PPE) needed for each procedure; and
10. Comply with all University safety policies.

### **5.3 Career and Protective Services Responsibilities**

It is the responsibility of the Division of Career and Protective Services to:

1. Institute and maintain the Chemical Hygiene Plan;
2. Review this program annually and notify constituents of any changes;
3. Provide initial safety training to hazardous materials users and maintain records of attendance;
4. Audit performance of hazardous materials users in implementing provisions of the program; and
5. Provide and maintain an on-line chemical inventory database.

## **6.0 LABORATORY FACILITY**

For laboratory design, usage, maintenance, and ventilation, consult Appendix E Laboratory Design Specifications.

### **6.1 Fume Hoods**

A properly designed and operated fume hood reduces exposure to hazardous fumes, vapors, gases and dusts. It also serves to shield the worker from a runaway reaction.

1. The fume hood must be operational 24 hours a day, 7 days a week, and must be uninterrupted by the fire alarm system according to NFPA 45;
2. Verify that the exhaust system is operating before working in the hood. Taping a strip of paper, tissue, or ribbon at the face of the hood will indicate the direction of air flow;
3. Keep the sash between 12 and 16 inches when setting up, running, or dismantling an experiment;
4. Set up equipment at least six (6) inches from the sash within the fume hood;
5. Elevate hot plates, ovens, and other large objects one or two inches above the work surface to allow air to flow underneath them;
6. Keep your head outside the fume hood;
7. Containers placed in fume hoods to collect hazardous liquid waste must be capped after each use;
8. Use perchloric acid only in fume hoods designed and labeled for perchloric acid work;
9. If a fire occurs in the fume hood during a process or experiment, quickly shut the sash if it is safe to do so and contact DPS;
10. **DO NOT** overcrowd or clutter the fume hood. Overcrowding creates vortices and dead spots. Vortices may cause hazardous material to flow back out of the fume hood thus exposing the employee; dead spots may allow ignitable concentrations of flammable and combustible materials to accumulate;
11. **DO NOT** erect shelves in a fume hood for chemical or equipment storage;
12. **DO NOT** place electrical receptacles, power strips, or other spark producing sources inside the hood;
13. **DO NOT** store chemicals inside the fume hood. Fume hoods should contain only working volumes of chemicals;
14. **DO NOT** use fume hoods to vent or dispose of hazardous materials through air dilution. This is in violation of the EPA Clean Air Act.

### **6.1.1 Fume Hood Inspection**

1. EH&S and Laboratory Safety inspect and certify fume hoods annually (every six months for those designated for radioactive work). The inspection determines if the fume hood is operating properly and drawing air at the required velocity. Measurements are taken with the sash height between 12 and 16 inches;
2. The average face velocity must be between 100 and 125 feet per minute (fpm) for normal use; between 125 and 150 fpm for work involving volatile radioactive, carcinogenic, or highly toxic materials. If these specifications cannot be met, Facilities Management Services (FMS) will adjust the air flow; and
3. Immediately report any fume hood that is not working properly to EH&S or Laboratory Safety. FMS will repair the hood and it will be re-inspected to ensure proper operation.

## **7.0 GOOD LABORATORY PRACTICES**

### **7.1 Procedures**

1. **Always plan experiments with SAFETY as the first priority;**
2. Ensure that proper safety equipment is close and accessible (e.g. fire extinguisher, spill kits, safety showers, etc.);
3. Inform co-workers of hazardous work being conducted;
4. Coordinate with research staff to ensure active surveillance of employees working alone in the laboratory after business hours;
5. Never leave equipment running unattended or overnight without having some fail-safe mechanism to prevent disaster;
6. Place warning labels by hot surfaces;
7. When setting up lattices, ensure that mounts to the lab bench are secured properly;
8. Glass reaction vessels attached to lattices should be equipped with protective pans to contain spillage in the event the vessel breaks;
9. High vacuum systems should be assembled with due care. Sample vessels or ampoules should be wrapped with cloth or electrical tape in the event of an implosion/explosion. Blast shields or windows constructed of polycarbonate or Plexiglas should be mounted directly in front of the sample vessel being used;
10. Equipment and/or chemicals stored on open shelves should have Plexiglas lips to prevent "walk-off" during an earthquake or spillage from accidental contact when removing other containers;
11. Ensure that vacuum pumps are equipped with proper and functional guards for safe operation. Guards should be placed over belts;
12. Use digital or non-mercury thermometers for laboratory use;
13. For work involving radioactive, carcinogenic, or highly toxic materials, designate a specific area and label accordingly;
14. **NEVER** throw chemicals into the trash; and
15. **Report all safety hazards to the supervisor.**

### **7.2 Chemical Procurement, Inventory, Storage, and Transportation**

The procurement of chemicals by University research groups may be coordinated through the following:

1. Directly through USC's contract vendor (VWR at SGM 105) UPC;
2. Letters, Arts, and Sciences business center (UPC); and

### 3. Purchasing Services (HSC & UPC).

#### 7.2.1 *Chemical Inventory*

An inventory must be maintained for all areas storing hazardous materials including compressed gas cylinders. Each research group will be assigned an on-line chemical inventory account by Laboratory Safety. Researchers must input their chemical inventories into their account and provide annual updates. Instructions for setting up the inventory and a quick-start guide are available in Appendix I.

#### 7.2.2 *Storage*

Proper segregation of stored chemicals is essential to reduce or eliminate hazardous chemical reactions. Consult chemical labels, material safety data sheets, or standard operating procedures to determine the best storage practices. The Chemical Incompatibility Chart is included below.

1. Segregate chemicals into organic and inorganic families;
2. **Within each family, separate each chemical into its hazard class e.g. flammables, corrosives, etc.** Once in their respective hazard classes, chemicals may be stored alphabetically. Store each hazard class in a different location;
3. Store corrosive liquid containers in secondary containment such as a high density polyethylene tub. The secondary containment volume must exceed the combined volume of stored containers by at least 10 %;
4. Store chemicals inside a closeable cabinet or on a shelf that has a lip restraint to prevent the containers from sliding off in the event of an earthquake;
5. Store corrosive liquids below shoulder height;
6. Store chemicals away from heat or direct sunlight;
7. Flammable and combustible liquids that exceed an aggregate volume of ten gallons must be stored in grounded flammable storage cabinets. It is recommended that flammable cabinets be ventilated to reduce exposure to employees. NOTE: Flammable and combustible liquids that require refrigeration must be stored in a UL listed "explosion-proof" refrigerator;
8. Ensure that chemical storage does not obstruct access to safety showers, eyewashes, exit doors, fire extinguishers and other safety equipment; and
9. **Contact EH&S to remove excess inventory.**

##### 7.2.2.1 *Highly Reactive Substances*

1. Segregate strong oxidizing agents from reducing agents and combustibles;
2. Segregate pyrophoric compounds from flammables;
3. Store highly reactive liquids in secondary containers such as high density polyethylene tubs;
4. Store peroxidizable materials away from heat and light;
5. Protect and store water-reactive materials away from possible contact with water;
6. Store thermally unstable materials in an explosion-proof refrigerator; and

Consult Appendix O SOP Reactive and Explosive Materials for more information.

**Chemical Incompatibility Chart**

<b>THIS CHEMICAL</b>	<b>IS INCOMPATIBLE WITH</b>
Acetic acid	Chromic acid, ethylene glycol, hydroxyl-containing compounds, nitric acid, perchloric acid, permanganates, peroxides
Acetone	Concentrated sulfuric and nitric acids and mixtures
Acetylene	Copper, mercury, silver, chlorine, bromine, fluorine
Alkali and Alkaline earth metals (such as powdered Al or Mg, Ca, Li, Na, K)	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia (anhydrous)	Bromine, chlorine, iodine
Ammonium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrites, sulfur, finely divided organic materials
Aniline	Hydrogen peroxide, nitric acid
Arsenical materials	Any reducing agent
Azides	Acids
Bromine and Chlorine	Ammonia, benzene, turpentine
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chromic acid, Chromium dioxide	Acetic acid, alcohol, ethyl acetate, glycerol, naphthalene, camphor, flammable liquids in general
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic and inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens

THIS CHEMICAL	IS INCOMPATIBLE WITH
Fluorine	All other chemicals
Formic acid	Oxidizing agents
Hydrazine	Oxidizing agents
Hydrocarbons (such as butane propane, benzene)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali
Hydrofluoric acid	Ammonia (aqueous or anhydrous), hydrogen
Hydrogen peroxide	Acetone, alcohols, aniline, chromium, combustible materials, copper, iron, nitromethane, organic materials, most metals or their salts
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia, (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, greases, hydrogen, flammable liquids, solids or gases
Perchloric acid	Acetic anhydride, alcohol, bismuth and its alloys, grease, oils, paper, wood
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorous (white)	Air, alkalis, oxygen, reducing agents
Picric acid	Oxidizers, reducers, bases, copper, lead, zinc, other metals, plaster, salts, concrete
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids

THIS CHEMICAL	IS INCOMPATIBLE WITH
Potassium perchlorate	Sulfuric and other acids (see also chlorates)
Potassium permanganate	Benzaldehyde, ethylene glycol, glycerol, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Chlorates, perchlorates, permanganates
Tellurides	Reducing agents
Water	Alkali metals, sulfuric acid, thionyl chloride

### 7.2.3 Transportation

University staff may be required to transport small quantities of chemicals from one laboratory to another or from one of the on-campus stockrooms to the location where they will ultimately be used. Observing safe work-practices is essential when performing this task in order to prevent accidental releases or exposures.

The following guidelines serve as the minimum acceptable practices for transporting toxic, flammable, reactive, or corrosive chemicals on campus. However, individual academic or administrative departments may establish more stringent requirements for transportation of such materials. Note: These guidelines do not apply to radioactive materials or gas cylinders. For information on transporting these items contact EH&S.

1. Use bottle carriers for transporting chemicals which are in glass containers and ensure that the caps are securely tightened. **NOTE: Never transport in-compatible chemicals in the same secondary containment.**
2. While being transported, chemicals should be placed in a basin or tray and moved on carts to contain any spill.
3. If available, a freight elevator should be used to transport chemicals between floors. If chemicals are being transported in a passenger elevator, ensure that the car is unoccupied.
4. For off-campus relocation or over-the-road transportation, contact EH&S for assistance. **NOTE: The use of personal vehicles to transport chemicals is strictly prohibited.**

5. Containers must be labeled with the material's chemical name and its hazards and attended at all times while being transported.
6. Individuals transporting chemicals must be familiar with the material's hazards and know what to do in the event of a release or spill.
7. Wear appropriate Personal Protective Equipment (PPE) such as safety glasses, lab coats, and impermeable gloves.
8. Immediately update the chemical inventory to reflect the relocation of chemicals.

### **7.3 Environmental Monitoring**

See Appendix G Environmental Management System

### **7.4 Housekeeping, Maintenance, and Inspections**

1. Clean work areas regularly and properly label and store all chemicals. Remember "A Clean Lab is a Safe Lab." Accidents are reduced in laboratories where good housekeeping practices are followed;
2. Never obstruct access to exits and emergency equipment;
3. Do not use floors, stairways, or hallways as storage areas;
4. Secure all compressed gas cylinders to walls or benches. Note: Review Appendix A Compressed Gas Cylinder Program for detailed information on gas cylinder safety;
5. Do not store chemical containers on the floor; and
6. Return chemicals to proper storage area after use.
7. It is recommended that the supervisor and/or laboratory staff conduct periodic self inspections of their laboratory and storage spaces. The inspections shall not coincide with EH&S audits and shall be scheduled according to the level of hazards for the given area. High hazard areas shall be inspected at least biannually; all other areas annually. Use inspection forms available in Appendix H Injury and Illness Prevention Program.

### **7.5 Medical Program**

Medical surveillance (See Appendix C Medical Surveillance Program) and exposure monitoring are required for employees working with or exposed to Prop 65 chemicals, highly toxic materials, or using respiratory protection in their work. Employees working with radioactive isotopes of iodine must be monitored through thyroid and urine bioassays. For more information, go to:

<http://capsnet.usc.edu/LabSafety/RAD/documents/COMBINE4.pdf>.

#### **7.5.1 Worker's Compensation**

Employees who are injured while working must have the **Supervisor's Report of Injury and Worker's Compensation** forms completed and filed with the University's Worker's Compensation/Disability group. More information is available at <http://capsnet.usc.edu/WC/index.cfm>.

### **7.6 Personal Protective Apparel and Equipment**

See Appendix D Personal Protective Equipment Evaluation

### **7.7 Recordkeeping**

Supervisors will maintain the following records:

- Laboratory Refresher training: topic and attendance;
- Standard Operating Procedures (SOP) training attendance;

- Chemical Inventory;
- Safety Meeting minutes: topic and attendance;
- Safety audits; and
- Hazardous Waste Disposal Record prior to pick-up.

Career and Protective Services will maintain the following records:

- Laboratory Safety Course attendance;
- Hazardous Waste Disposal Record after pick-up. and
- Medical Surveillance pertaining to Prop 65 chemicals, HBV and TB vaccinations, and Respiratory Protection

### **7.8 Signs and Labels**

1. Personnel who use hazardous materials are responsible for properly labeling all containers including beakers, flasks, reaction vessels, and process equipment. Consult the University's Hazard Communication Standard for labeling requirements;
2. Food products used in experiments must be labeled accordingly; and
3. If collecting the chemical as waste, use the hazardous waste labels available through EH&S.

### **7.9 Chemical Spills and Accidents**

For all spill emergencies contact the Department of Public Safety (DPS).

In the event of a large chemical, biological, or radiation spill, follow these guidelines:

1. Notify everyone in the immediate area and the supervisor.
2. Evacuate personnel from the spill area.
3. Deny entry.
4. Alert other building occupants. NOTE: Evacuation of the building and its occupants may be necessary depending on the volume of chemical/biological material spilled and its relative hazard.
5. Notify DPS from a safe location and provide the following information:
  - a. Your name, telephone number, and location;
  - b. Type of incident, location, and time of occurrence;
  - c. Name and quantity of material involved, to the extent known;
  - d. If victims are involved, relay the victim(s)' name(s) and extent of injuries, if any;
  - e. If exposed to a hazardous spill, see 7.9.2 Chemical Exposure

#### **7.9.1 Chemical Spill Clean-Up**

Chemical spill clean-up must not be attempted if the employee does not have the proper training and experience, the necessary spill kit supplies, and personal protective equipment. Contact DPS for large chemical spill clean-up.

##### **7.9.1.1 Corrosive Liquids**

1. Neutralize the spill. Apply neutralizer from a spill clean-up kit to the perimeter of the spill. If a spill clean-up kit is not available, sodium bicarbonate can be used on acid spills and 2% hydrochloric acid or citric acid powder can be used to neutralize caustic spills.

2. Mix thoroughly until fizzing and evolution of gas ceases. NOTE: It may be necessary to add water to the mixture to complete the reaction. Neutralizer has a tendency to absorb acid before fully neutralizing it.
3. Check mixture with pH strips or pH paper. Ensure that the final pH is between 6 and 10.
4. Once the chemical is completely neutralized, cover with an absorbent material (e.g. paper towels, pads, etc.)
5. Collect the absorbent and place it in a Ziploc bag.
6. Label the bag, place it in the fume hood and call EH&S immediately.

#### **7.9.1.2 Other Hazardous Liquids**

1. Prevent the spill from spreading by depositing absorbent material such as Super Fine, sand, or vermiculite (paper towels do not control the vapor release as well as sand) at its outer edges.
2. Cover the entire spill with the absorbent by working from the edge toward the center in a circular motion.
3. Mix the absorbent until it has absorbed all of the flammable liquid.
4. Collect the absorbent and place it in a Ziploc bag.
5. Label the bag, place it in the fume hood, and call EH&S immediately.

#### **7.9.1.3 Solids**

1. Solid material of low toxicity may be swept onto a dust pan and deposited into a Ziploc bag. Any powder clinging to the dust pan may be wiped with a lab tissue and the tissue disposed of in the Ziploc bag. Ensure that fine powder or dust from the spilled material does not become airborne.
2. Label the bag, place it in the fume hood and call EH&S immediately.
3. If the spilled material is highly toxic, contact EH&S or Laboratory Safety.

### **7.9.2 Chemical Exposure**

#### **7.9.2.1 Eye/Skin Contact**

1. Immediately go to the emergency shower/eye wash facility and remove all contaminated clothing.
2. Flush affected body area with water for at least **15 minutes**.
3. Do not use neutralizing chemicals, creams, abrasives, or lotions.
4. If the eyes have been contaminated, forcibly hold them open and flush for least **15 minutes**.
5. Resume flushing area with water if pain continues.

#### **7.9.2.2 Inhalation**

1. Move exposed person to fresh air if safe to do so.
2. If victim is breathing, loosen victim's clothing and maintain the airway.
  - a. Lay victim flat on their back.
  - b. Place one hand under the neck and lift.
  - c. With the heel of other hand on victim's forehead, rotate or tilt the head backward into maximum extension.
  - d. If additional airway opening is required, it can be achieved by thrusting the lower jaw into a jutting-out position.
3. If the victim is not breathing, contact DPS, and perform CPR (if certified) until medical assistance arrives. Be careful to avoid exposure to chemical poisoning via mouth-to-mouth resuscitation. If available, use a mouth-to-mask resuscitator.

### **7.9.2.3 Ingestion**

1. Contact DPS and request medical assistance.
2. If possible, determine what material was ingested by victim.
3. If victim begins to vomit, turn head or entire body to one side to avoid choking.
4. Do not induce the victim to vomit or drink any beverage unless instructed to by qualified medical personnel.
5. If victim stops breathing, see Inhalation, step 3.

### **7.9.2.4 Injection**

Contact DPS and request medical assistance.

## **7.10 Training and Communication**

Employees working with hazardous materials in laboratories must be provided training as mandated by the Occupational Health and Safety Administration (OSHA). The employer must ensure that training is provided in the following areas where appropriate:

- Laboratory safety;
- Annual laboratory safety refresher;
- Standard Operating Procedures for substances, processes, procedures and/or equipment; and
- Revised SOPs.

Employers must communicate safety hazards and protective measures to their employees. Safety meetings provide a forum to discuss safety issues in the laboratory. Discussion may include the following:

- Recent accidents and prevention methods;
- Potential hazards found in the laboratory;
- Review of recent safety inspection violations;
- Emergency procedures including evacuation sites; and
- Personal protective equipment needs.

### **7.10.1 Laboratory Safety Course**

All laboratory personnel working with hazardous materials, biological agents, bloodborne pathogens, radiation, and research animals must complete the Introduction to Laboratory Safety course prior to initial assignment. The course schedule is available at <http://srm.usc.edu/PDevReg/Courses/courses.htm> or in the Spring/Fall Professional Development Course List.

### **7.10.2 Standard Operating Procedures**

Laboratory personnel must be trained on lab-specific procedures and associated hazards by the Principal Investigator, Laboratory Manager, or designated person. Training is also required when procedures are revised. A record of the training must be available for inspection. Use the training form available in Appendix H Injury and Illness Prevention Program.

### **7.10.3 Laboratory Refresher Training**

Subsequent Laboratory Refresher Training will be provided annually by the Principal Investigator, Laboratory Manager, or other designee. Topics must cover lab specific hazards and precautions.

### **7.11 Hazardous Waste Management and Disposal**

See Appendix B Hazardous Waste Management and Disposal.

## **8.0 WORKING WITH HAZARDOUS CHEMICALS**

1. Consult the Standard Operating Procedure (or Material Safety Data Sheet) for a specific chemical before using it. General SOPs (e.g. corrosives, toxics, reactive materials, etc.) are available as cited in Appendices K through P. Refer to Appendix J Carcinogen Program if using this class of materials.
2. Minimize chemical exposure by reducing the amount of time working with them;
3. Substitute highly toxic chemicals for ones of low toxicity. This enhances personal safety and reduces impact to the environment in terms of waste disposal;
4. Employ universal precautions when working with substances of unknown toxicity (i.e. regard unknowns to be toxic). Also, any mixture of toxic compounds is presumed to have a synergistic effect, namely, the toxicity of the whole is greater than the sum of each component;
5. Use a ventilation device (e.g. chemical fume hood, snorkel, canopy, etc.) if exposure levels exceed recommended limits. The recommended limit for a specific material is published in the MSDS. Contact EH&S if it is believed that levels exceed recommended limits; and
6. Wear appropriate personal protective equipment (PPE). It is essential for each laboratory worker to wear the appropriate clothing and to use the proper eye, face, hand, and foot protection at all times when working with hazardous materials. Respiratory protection should only be used when effective engineering or administrative controls are not possible and users must follow the USC Respiratory Protection Program. See Appendix F Respiratory Protection Program.

## **9.0 SAFETY RECOMMENDATIONS**

### **9.1 Fire Safety**

1. Laboratory doors are fire-rated and cannot be propped, wedged, or blocked open unless they are equipped with automatic door closers that are integrated with the fire alarm system;
2. All egress isles and corridors must be kept clear and maintained according to the LAMC fire code;
3. No egress doors, entry or exit, are allowed to be blocked for any reason;
4. No storage is allowed closer than 18 inches from the ceiling;
5. All pressurized containers will be strapped at top and bottom to a wall (See Appendix A Compressed Gas Cylinder Program);
6. All wall penetrations will be sealed with fire caulk or fire putty; and
7. Dry chemical fire extinguishers are required in every lab and every 75 feet in exit hallways.

### **9.2 Electrical Safety**

1. All electrical equipment must be kept in good working order;
2. Multiple devices plugged into an outlet must be on surge protection;
3. Electrical wiring must comply with the National Electric Code;
4. Cube adaptors, multiple strip sockets, or "octopus" arrays at outlets are prohibited;
5. Power strips within fume hoods are prohibited;
6. Remove damaged wires (e.g. frayed, cut, spliced, etc.) from service;
7. Power cords running through walls are illegal;
8. Do not allow wires to lay in puddles of water or other liquids;
9. Keep electrical wires away from heat, flame, or oxidation;

10. Do not use plugs that are corroded or become hot when used;
11. When working close to water with electrical equipment, use ground fault circuit interruption protection for all circuits; and
12. Use grounding straps and mats as required by NFPA 30, Flammable and Combustible Liquids Code when transferring flammable liquids from bulk storage to NFPA approved containers.

### **10.0 MATERIAL SAFETY DATA SHEETS (MSDS)**

29 CFR 1920.1200 requires that copies of material safety data sheets for each hazardous chemical be available in the workplace and readily accessible to employees. Electronic access, microfiche, and other alternatives to maintaining paper copies are permitted as long as no barriers to immediate employee access are in place. Hard copy MSDSs are recommended for the laboratory as a back-up resource in the event that electronic access is interrupted.

The MSDS may be obtained from EH&S STO 101, Laboratory Safety CHP 148, the manufacturer, or the internet at the following URLs:

1. Vermont Safety Information Resources, Inc. <http://hazard.com/msds/index.php> ;
2. VWR <http://www.vwrsp.com/search/index.cgi?tmpl=msds> ;
3. Fisher Scientific  
[http://www.fishersci.ca/homepage4.nsf/\(waSearch\)?openagent&lang=E&DB=msds2.nsf](http://www.fishersci.ca/homepage4.nsf/(waSearch)?openagent&lang=E&DB=msds2.nsf) ;
4. NIOSH Pocket Guide to Chemical Hazards <http://www.cdc.gov/niosh/npg/npg.html> ;
5. Agency for Toxic Substances and Disease Registry <http://www.atsdr.cdc.gov/toxfaq.html> ;
6. Chemfinder <http://www.chemfinder.com>

### **11.0 EMERGENCY PREPAREDNESS**

See [Emergency Pamphlet](#).

### **12.0 PROGRAM APPROVAL AND REVIEW**

Date Reviewed: October 25, 2005

By: A. Bouziane