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3.0 Chemical Hygiene Plan

1 Purpose

The Criminalistics Laboratory uses chemicals and substances considered hazardous, and is committed to providing each employee with a safe work environment. The purpose of the Chemical Hygiene Plan is to implement the provisions of and maintain compliance with Title 8 California Code of Regulations, Section 5191, and "Occupational Exposure to Hazardous Chemicals in Laboratories." Per Cal/OSHA regulations the Criminalistics Laboratory maintains a written and implemented Chemical Hygiene Plan, and makes the plan readily available to all employees.

The Criminalistics Laboratory Chemical Hygiene Plan is intended to:

- Protect employees from health hazards associated with hazardous chemicals in the laboratory
- Ensure that laboratory employee's exposures to hazardous substances does not exceed the exposure limits specified in 8 CCR 5139
- Promote safe and effective work practice
- Reduce exposure to hazardous substances

2 Scope

The Criminalistics Laboratory Chemical Hygiene Plan applies to all Criminalistics Laboratory personnel who handle and may be exposed to hazardous chemicals while working in or around laboratory areas in any capacity.

3 Exclusions

The Chemical Hygiene Plan does not cover work performed with biological agents. Procedures for working with biohazardous materials are addressed in the Section 2 – Bloodborne Pathogens Exposure Control Plan of the Laboratory Safety Manual.

3.1 Responsibility

3.1.1 Chemical Hygiene Officer

The Quality Manager has the responsibility of the Chemical Hygiene Officer. The Quality Manager may utilize the training and experience of other laboratory staff to advise and execute certain duties designated by the Chemical Hygiene Officer. The duties of the Chemical Hygiene Officer include:

- Identifying hazardous conditions or operations in the laboratory, determining safe procedures and controls, and implementing and enforcing standard safety procedures
- Developing and updating the Chemical Hygiene Plan and corresponding appropriate policies and procedures
- Providing technical assistance in complying with the Chemical Hygiene Plan
- Maintaining a chemical inventory for the laboratory
- Answering safety questions for employees
- Assisting employees in developing appropriate safety precautions for new procedures and projects
- Remaining current on regulations concerning chemicals used in the Criminalistics Laboratory
- Ensuring employees are complying with the Chemical Hygiene Plan
- Monitoring and maintaining the functional working order of workplace engineering controls (e.g., fume hoods) and safety equipment (e.g., emergency showers/eyewashes, fire extinguishers)
- Administering laboratory safety training for employees on the safe handling of hazardous chemicals

- Reviewing and evaluating the effectiveness of the Chemical Hygiene Plan at least annually and updating it as appropriate

3.1.2 Laboratory Personnel

All laboratory personnel who work with hazardous chemicals in the laboratory are responsible for:

- Following the Chemical Hygiene Plan and the Laboratory Safety Manual
- Following written laboratory safety rules, regulations, Test Methods and Work Instructions
- Keeping the work areas safe and uncluttered
- Reviewing and understanding the hazards of materials and processes prior to conducting work
- Utilizing appropriate measures to control identified hazards, including consistent and proper use of engineering controls, personal protective equipment and work practice controls
- Understanding the capabilities and limitations of personal protective equipment

3.1.3 Occupational Safety and Health Division

The City of Los Angeles Personnel Department – Occupational Safety and Health Division is responsible for the following:

- Assisting the Chemical Hygiene Officer in the selection of appropriate safety control requirements, which include laboratory practices, personal protective equipment, engineering controls, and training
- Provide employee exposure monitoring, upon request
- Performing hazard assessment, upon request
- Maintaining area and personal exposure-monitoring records

- Providing collaboration and support regarding safety concerns involving laboratory test methods, upon request
- Helping to determine medical surveillance requirements for laboratory personnel, upon request
- Coordinating with Medical Services Division when laboratory personnel are exposed to hazard chemicals, injured, or request review of medical records
- Conduct on-site safety inspections for hazard identification and exposure assessments regarding engineering controls and new laboratory construction/renovation, upon request
- Provide technical consultation and investigations, as appropriate, for laboratory accidents and injuries

3.2 General Classes of Hazardous Chemicals

Chemicals have inherent physical, chemical, and toxicological properties that require laboratory personnel to have a good understanding of the related health and safety hazards. The main types of chemical hazards that lab personnel should be aware of are:

- Flammability
- Corrosivity
- Reactivity/ Unstable (including explosivity)
- Toxicity (including irritation, sensitization, carcinogenicity, reproductive toxicity)

Additionally, compressed gases and cryogenic liquids are used in the laboratory and present unique hazards.

The following hazardous chemical class descriptions include general handling information. The unit manuals shall describe specific handling procedures and safety precautions for hazardous chemicals used in the Test Methods and Work Instructions.

3.2.1 Flammable and Combustible Liquids

Flammable and combustible liquids are classified according to their flash point, with flammable liquids having flash point of less than 100°, and combustible liquids having a flash point between 100-200° F. Both flammable and combustible liquids are considered fire hazards. Examples of flammable chemicals are acetone, ethanol, methanol, and ether.

When working with flammable and combustible liquids the following general handling guidelines shall be followed:

- Do not heat flammable chemicals with an open flame
- For highly flammable chemicals, avoid static electricity or hot surfaces as they can serve as ignition sources
- Do not use electrical devices with cracked or frayed wiring
- Transfer flammable liquids from containers of five gallon-capacity or more inside a laboratory hood to prevent accumulation of flammable concentration of vapors

Flammable and combustible chemicals should be used in lab fume hoods whenever possible, especially when used in larger quantities, or when using above room temperature.

Where greater than 10 gallons of flammables are kept, such materials must be stored within a flammable storage cabinet.

3.2.2 Corrosive Materials

Corrosive materials cause destruction of tissue through chemical action at the point of contact. Corrosive materials can be liquids, solids, or gases. They can affect the skin, eyes, and respiratory tract. Examples of corrosive materials include: sodium hydroxide, hydrochloric acid, sodium hypochlorite, and phenol.

Handling processes should be designed to minimize the potential for splash, splatter, or other likely scenarios for accidental contact.

- Do not pour water into acid. Slowly add the acid to the water and stir.
- Never empty carboys or drums of chemicals by means of air pressure. Use a tilting rack, a safety siphon, or a liquid pump.

- Use a mechanical aid or a pipette bulb for pipetting.
- Open bottles or carboys slowly and carefully and wear protective equipment to guard hands, face, and body from splashes, vapors, gases and fumes.
- Wipe drips from containers and bench tops. Be especially careful to wipe up visible residues of sodium hydroxide and potassium hydroxide from all surfaces. Skin contact with dry residue will result in burns

Use a properly functioning lab fume hood when handling strong acids/ bases.

3.2.3 Highly Reactive/Unstable Materials

Highly reactive or unstable materials are those that have potential to vigorously polymerize, decompose, condense, or become self-reactive under conditions of shock, pressure, light, or contact with another material. Examples of highly reactive chemicals are peroxides (including hydrogen peroxide greater than 91%, and diethyl ether which may form peroxides), water-reactives (including sodium and lithium), and pyrophorics (including titanium dioxide and white phosphorus).

When working with highly reactive or unstable materials the following guidelines shall be followed to minimize risk:

- Minimize the quantity of reactive chemicals used or synthesized to the smallest amount needed.
- Handle reactive chemicals with caution. Appropriate chemical-specific precautions must be taken for mixing even small quantities with other chemicals.
- Chemical reactions conducted at temperatures or pressures above or below ambient conditions must be performed in a manner that minimizes risk of explosion or vigorous reaction.
- Provide a mechanism for adequate temperature control and heat dissipation.
- Utilize shields and barricades, and personal protective equipment (such as face shields with throat protectors and heavy gloves) whenever there is a possibility of explosion or vigorous chemical reaction.

- Glass equipment operated under vacuum or pressure must be shielded, wrapped with tape, or otherwise protected from shattering.

Many reactive materials release combustible and/or toxic gas when exposed to water vapor or air, and should be used in a lab hood to prevent hazardous buildup of gases.

3.2.4 Compressed Gases

Compressed gases can create pressure hazards and also create health hazards and/or flammable atmospheres. One special property of compressed gases is the substantial volume expansion when released to air, potentially depleting workplace oxygen content to hazardous levels.

When working with compressed gases the following guidelines shall be followed:

- Check connections and hoses regularly for leaks using a specific monitoring instrument or soapy water (or equivalent).
- When using highly flammable or toxic gas, check the delivery system using an inert gas prior to introducing the hazardous gas.
- Replace valve caps when cylinders are not in use or before moving.
- Remove damaged or defective cylinders from service (contact the cylinder vendor for assistance)

Special handling and transport of compressed gas cylinders must also be adhered to including the following:

- Compressed gas cylinders must be transported using hand-trucks or other appropriate means. Do not transport unsecured gas cylinders.
- Cylinders should be transported upright whenever possible (always transport acetylene in an upright (vertical) position).
- Secure compressed gas cylinders (>26" tall) to an anchored rack using.
- No more than two cylinders may be secured with one pair of chains.
- Empty cylinders will be clearly marked.

- Store compressed gas cylinders away from heat sources, and flammable and highly combustible materials (such as oil and greases).

- Segregate according to hazard class and chemical compatibility. Ensure to separate flammable and oxidizing gases.

- Store flammable gases away from flammable solvents, combustible material, ignition sources (including unprotected electrical connections), and oxygen gas cylinders and liquid oxygen (at least 20 feet if possible).

3.2.5 Cryogenic Materials

Cryogenic liquids are materials with extremely low boiling points (i.e. less than – 150 °F). Common examples of cryogenic liquids are liquid nitrogen, helium, and argon. Dry ice is the common term for frozen carbon dioxide. One special property of both cryogenic liquids and dry ice is that they undergo substantial volume expansion when converted to a gas phase, which can potentially lead to an oxygen deficient atmosphere where ventilation is limited. Some cryogenic liquids can also pose additional hazards including toxicity and flammability (i.e. liquid carbon monoxide).

The following guidelines shall be followed during the use of cryogenic materials:

- Only work with cryogenic liquids in well-ventilated areas to avoid localized oxygen depletion or buildup of flammable or toxic gas.

- Handle objects that are in contact with cryogenic liquids with tongs or proper gloves.

- Transfers or pouring of cryogenic liquids should be done carefully to avoid splashing.

- Containers and systems containing cryogenic liquids should have pressure relief mechanisms.

- Cryogenic liquid cylinders and other containers (such as Dewar flasks) should be filled no more than 80% of capacity to protect against thermal expansion.

- Cryogenic liquid/dry ice baths should be open to the atmosphere to avoid pressure build up.

- Keep liquid oxygen away from organic materials and ignition sources.

- Transfer of liquid hydrogen can condense oxygen from the atmosphere in the liquid hydrogen, potentially creating an explosion hazard.

3.2.6 Toxic Substances (Carcinogens, Reproductive Toxins and Highly Toxic Chemicals)

Select carcinogens, reproductive toxins, and chemicals with high acute toxicity (highly toxic) are considered to be high risk materials and are treated by Cal/OSHA as "Particularly Hazardous Substances."

A highly toxic material is considered a chemical falling within any of the following categories:

- A chemical with a median lethal dose (LD50) of 50 mg or less per Kg of body weight when administered orally to albino rats weighing between 200 and 300 gm each.

- A chemical with a median lethal dose (LD50) of 200 mg or less per Kg of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 Kg each.

- A chemical that has a median lethal concentration (LC50) in air of 5000 ppm by volume or less of gas or vapor, or 50 mg per liter or less of mist, fume, or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 gm each.

The following General Guidelines are generally applicable for laboratory work involving highly toxic materials:

- Use the smallest amount of chemical that is consistent with the requirements of the work to be performed.

- Use containment devices (such as lab fume hoods or glove boxes) when: (i) volatilizing these substances, (ii) manipulating substances that may generate aerosols, and (iii) performing laboratory procedures that may result in uncontrolled release of the substance.

- Use high efficiency particulate air (HEPA) filters, carbon filters, or scrubber systems with containment devices to protect effluent and vacuum lines, pumps, and the environment whenever feasible.

- Use ventilated containment to weigh out highly toxic solid chemicals. Alternatively, the tare method can be used to prevent inhalation of the chemical. While working in a laboratory hood, the chemical is added to a pre-weighed container. The container is then sealed and can be re-weighed outside of the hood. If chemical needs to be added or removed, this manipulation is carried out in the hood. In this manner, all open chemical handling is conducted in the laboratory hoods.

Safety glasses, lab coat, and closed toed shoes are to be worn when entering laboratories having hazardous chemicals when contact with chemicals is unavoidable. Additionally:

- When handling hazardous chemicals or contacting potentially contaminated surfaces, protective gloves are to be worn. For proper selection of glove material, review chemical SDS[1].

- Goggles (not safety glasses) are appropriate for processes where splash or spray is foreseeable.

1 The Hazard Communication Standard (HCS) requires chemical manufacturers, distributors, or importers to provide Safety Data Sheets (SDSs) (formerly known as Material Safety Data Sheets or MSDSs) to communicate the hazards of hazardous chemical products.

- For hazardous chemicals that are toxic via skin contact/ absorption, additional protective clothing (i.e., faceshield, apron, sleeve protectors) is appropriate where chemical contact with body/skin is foreseeable.

Carcinogens

Carcinogens are chemicals or physical agents that cause cancer or tumor development, typically after repeated or chronic exposure. The effects may only become evidence after a long latency period and may cause not immediate harmful effects.

A carcinogen (defined as "select carcinogen" by Cal/OSHA) is a substance or agent that meets one of the following criteria:

- It is regulated by Cal/OSHA as a carcinogen.
- It is listed under the category, "known to be carcinogens" in the Annual Report on Carcinogens published by the National Toxicology Program (NTP)(latest edition); or
- It is listed under Group 1 (“carcinogenic to humans”) by the International Agency for Research on Cancer (IARC)
- It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
- After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m3;
- After repeated skin application of less than 300 mg/kg of body weight per week; or
- After oral dosages of less than 50 mg/kg of body weight per day.

Examples of carcinogens that have been used in the Criminalistics Laboratory are:

- Benzene
- Formaldehyde
- Chloroform

- Ortho-tolidine

If questions arise regarding a substance's carcinogenic properties the SDS shall be consulted.

The general guidelines for laboratory work with toxic substances shall be adhered to for carcinogenic substances.

Reproductive Toxins

Reproductive toxins include substances that cause chromosomal damage (mutations) or lethal or malformation effects on fetuses (teratogensis). Many reproductive toxins cause damage after repeated low-level exposures. Effects become evident after long latency periods. Examples of reproductive toxins that have been used in the Criminalistics Laboratory are:

- Formaldehyde
- Formamide
- Chloroform
- Benzene
- Trichloroethylene
- Toluene
- Methyl ethyl ketone
- Lead

If questions arise regarding the reproductive toxicity of a material, the SDS shall be consulted.

The general guidelines for laboratory work with toxic substances shall be adhered to for carcinogenic substances.

Highly Toxic Chemicals

Chemicals with a high level of acute toxicity have the ability to cause harmful local and systemic effects after a single exposure. Many of these chemicals may also be

characterized as a toxic gas, CDC Select Agent Toxin (smallpox, ebola, ricin, and foot-and-mouth disease), corrosive, irritant, or sensitizer.

A highly toxic material is considered a chemical falling within any of the following categories:

- A chemical with a median lethal dose (LD50) of 50 mg or less per Kg of body weight when administered orally to albino rats weighing between 200 and 300 gm each.

- A chemical with a median lethal dose (LD50) of 200 mg or less per Kg of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 Kg each.

- A chemical that has a median lethal concentration (LC50) in air of 5000 ppm by volume or less of gas or vapor, or 50 mg per liter or less of mist, fume, or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 gm each.

The general guidelines for laboratory work with toxic substances shall be adhered to for highly toxic materials.

3.2.7 Sensitizers

A sensitizer is a substance that causes exposed people to develop and allergic reaction in normal tissues after repeated exposure to the substance. Breaking out in a skin rash, referred to as allergic dermatitis, is the most common response to sensitizers. The rash may resemble hive-like blisters or may cause patches of itchy and/or scaling skin. Examples of sensitizers used in the Criminalistics Laboratory include:

- Formaldehyde

- Phenol derivatives

- Latex proteins (commonly found in latex gloves)

Handling processes should be designed to minimize the potential for splash, splatter, or other likely scenarios for accidental contact.

Use a properly functioning lab fume hood when handling sensitizers that can be inhaled (via mist/fume/gas/vapor).

3.2.8 Irritants

Irritants are chemicals that cause reversible inflammatory effects on living tissues by chemical action at the site of contact. Irritants inflame mucous membranes, and exposure would typically result in an itchy, runny nose and itchy, watery eyes. The minor sensations can intensify to a stronger, burning sensation, if the degree of exposure is high enough. In addition, dermal exposure to an irritant can result in itchy, scaling, and/or blistered patches of skin. Common examples of laboratory irritants are:

- Hydrochloric acid
- Sulfuric Acid
- Nitric Acid
- Sodium Hydroxide
- Acetic Acid

A wide variety of organic and inorganic compounds are irritants, and skin contact with all laboratory chemicals should be avoided.

3.3 Minimizing Exposures to Hazardous Chemicals

For the general safety of laboratory personnel, all chemical usage must be conducted in adherence with general safe laboratory practices. The methods used to specifically control chemical exposures are categorized as follows: Engineering Controls, Workplace Controls, and Personal Protective Equipment.

3.3.1 Engineering Controls

General laboratory ventilation cannot be relied upon to protect personnel from localized exposures to hazardous levels of airborne chemicals. Engineering controls such as laboratory fume hoods, and other local exhaust systems (e.g., drop down flexible ducts or “snorkels”) are often necessary to provide additional exposure control. In general, laboratory fume hoods are recommended whenever using hazardous chemicals that:

- Are irritants

- Have high acute toxicity, or which are carcinogens, or reproductive toxins
- Are appreciably volatile or are easily dispersible in air (e.g., dust)

3.3.2 Fume Hoods

All chemicals should be handled in a laboratory hood whenever possible. Follow proper safety fume practices:

- Ensure the fume hood is labeled with a certification date of less than one-year prior. Verify sufficient inward airflow before using a hood by checking the hood's airflow indicator. Report any problems to the Unit Supervisor promptly.
- Maintain hood sash at or below the maximum height indicated by an arrow on the side of the fume hood. Close the hood sash when not working in the hood.
- Keep chemical sources and equipment at least six inches away from the face or rear of the hood.
- Minimize equipment and chemical storage placed in the hood to avoid dead air spaces or eddies and to prevent blocking back baffles.

3.3.3 Work Practice Controls

In addition to the engineering controls to minimize exposure to hazardous chemicals, prudent work practice controls may be necessary to further reduce exposure. Work practice controls for hazardous chemicals include:

- Establishing designated areas for work with chemicals
- Proper use of appropriate personal protective equipment
- Use of containment devices such as fume hoods
- Following procedures for the safe removal of contaminated waste
- Decontamination/clean-up procedures

3.4 Personal Protective Equipment

Personal Protective Equipment (PPE) is a necessary part of laboratory safety in addition to engineering controls and good work practices. When properly selected and used, personal protective equipment can be effective in minimizing individual exposure. Always inspect personal protective equipment prior to use, and if found to be defective, replace gear as appropriate.

Prior to working, review the Test Methods (TM), relevant Safety Data Sheets (SDSs,) and other hazard information to determine appropriate PPE to wear based on chemical hazards.

3.4.1 Safety Glasses

Safety glasses are required if contact with chemicals is unavoidable.

- Safety glasses must have side shields and meet ANSI Z87.1 standards.

Prescriptions glasses are not considered a form of eye protection.

- Contact lenses may be worn if appropriate protective eyewear is also worn.

Contact lenses are not considered a form of eye protection.

- ANSI Z87.1 chemical goggles must be worn during chemical transfer/handling operations or during any other operations having any likelihood for chemical splash or spray may occur.

- In addition to safety eyewear, an ANSI Z87.1 face shield is to be worn when working with highly corrosive chemicals, where there is any likelihood for chemical splash/spray, or where flying fragments/particles are generated.

3.4.2 Gloves

Plan your work to minimize hand (glove) contact with chemicals. Handle chemicals in closed containers whenever possible, use care when pouring, and use tools that minimize glove contact with the chemical. Where contact with chemicals is unavoidable, select gloves that are impermeable to that chemical.

Selecting the correct glove for the hazard must be considered when working with chemicals or hazardous materials. No single material can protect against all chemical,

physical (e.g., cuts, abrasions, burns), or biological hazards. Incorrect selections may result in a false sense of security and increased exposure.

- Gloves should be inspected before use.
- Torn or damaged gloves should be replaced immediately.
- For disposable gloves, replace when chemical contact occurs, or when damage is suspected.
- Wash hands after removing gloves.
- Remove gloves before leaving the lab or handling objects such as doorknobs, telephones, or computer keyboards.
- Dispose of contaminated gloves in the proper hazardous waste container.

3.4.3 Laboratory Coats

Lab coats should be worn in laboratory areas when handling chemicals. Laboratory coats must be removed immediately upon discovery of significant contamination.

- Wear appropriate chemical-protective clothing (i.e. aprons, sleeve-protectors) when chemical contact to the body is anticipated or when extremely toxic or corrosive chemicals are handled.

3.4.4 Respiratory Protection

Respiratory protection is not usually required during normal laboratory operations where work can be performed in a laboratory fume hood. When it is not feasible to conduct operations within a fume hood, or where there otherwise may be a need for respiratory protection, contact the Laboratory Safety Officer for initial exposure assessment and approval. If respirator use is required, users must receive medical evaluation, fit testing and training for respirator use prior to using respiratory protection. For more information, see section 4 of the Safety Manual: Respiratory Protection Plan.

3.5 Test Methods

New laboratory procedures using hazardous chemicals shall be evaluated by Laboratory Safety Officer to ensure the appropriate safety controls are considered and described.

3.5.1 Procedures Involving Highly Hazardous Chemicals

When highly hazardous chemicals are proposed as part of a new test method or work instruction, the method, proposed chemicals, and safety considerations shall be evaluated and approved by the Laboratory Safety Officer prior to any validation or use of the chemical in the laboratory. When such a procedure is proposed, the methods shall be submitted in writing by the Unit Supervisor to the Laboratory Safety Officer and if approval is granted, notification of the approval will also be submitted in writing. When highly hazardous chemicals are proposed as part of a new test method, work instruction or validation plan, the proposed chemicals and safety considerations shall be evaluated by the Laboratory Safety Officer. The Laboratory Safety Officer shall document this evaluation on the *Laboratory Safety Officer-Safety Inspection Checklist* form.

3.6 Chemical Exposure Assessment

General safe laboratory practices in conjunction with appropriate use of exposure controls are expected to keep laboratory chemical exposures to a safe level. Exposure risk is more likely to increase when handling hazardous chemicals outside of a fume hood. For any concern involving hazardous chemicals usage and exposure assessment, the City of Los Angeles Personnel Department - Occupational Safety and Health Division (OSHD) can provide chemical exposure assessment to help verify adequate controls. The Laboratory Safety Officer will contact the Safety Administrator in the OSHD if chemical exposure assessment is requested by laboratory personnel.

3.6.1 Personal Exposure Monitoring

Personal monitoring is conducted by OSHD if there is reason to believe that exposure levels for a substance exceeds the action level or permissible exposure limit. The initiation, frequency, and termination of personal monitoring are done in accordance with the relevant regulation. Monitoring results will be provided by OSHD and/or Medical Services Division (MSD) as required by regulation.

3.7 Chemical Labeling and Storage

Hazardous chemicals must be stored, labeled and inventoried properly to avoid confusion or mistaken identity of a chemical, to provide separation of incompatible materials, and to provide information for emergency response personnel.

3.7.1 Labeling

All hazardous chemicals must be stored and labeled properly – this includes all stock bottles and any smaller working bottles. For reagent labeling requirements, see Quality

Manual section 5.9.2. All chemicals within the laboratory shall be clearly labeled with the chemical identity and the hazard warning label. Cal/OSHA requires that manufacturers provide labels with the following information:

- contents of the container
- hazard warning label
- name, address, and emergency phone number of the manufacturer or other responsible party

Original manufacturer labels must not be removed or defaced.

Safety Data Sheets (SDSs) must be accessible, near the area where the chemical is used, and available to anyone working with these chemicals. The manufacturer labels shall be used and preserved when available. The requirements for labeling reagents prepared in the laboratory can be found in the Quality Manual and individual Unit Manuals.

3.7.2 Basic Storage Requirements

The following basic storage requirements apply to all hazardous chemicals:

- Label storage areas according to the type of chemical family or hazard classification.
- Storage areas shall be inspected at least annually.
- Keep aisles, hallways, doorways, exits, and entryways clear.
- Keep storage areas well lit, appropriately ventilated, and at a consistent, cool temperature.
- Eliminate ignition sources such as open flames, heat sources, or direct sunlight.
- Keep emergency equipment such as fire extinguishers handy and in good working order.
- Confine chemical storage areas so that leaks or spills are controlled. Clean up spills and drips immediately.

- Prevent chemicals from running down sink, floor or storm drains.
- Don't store chemicals in a sink or fume hood, except for toxic gases that are so dangerous they can only be stored in a gas cabinet or fume hood.
- Don't store chemicals on the floor.

3.7.3 Storage Cabinets, Shelves, and Containers

Use only approved storage cabinets. Never alter a flammable storage cabinet unless directed to do so by the Fire Department. Label cabinets with the hazard class of the chemicals.

Shelves should be level, stable, and secured to the wall or another stable surface. In case of an earthquake, shelves should have raised edges or rim guards to prevent containers from falling. Use bungee cords for added security if necessary. Shelves should be kept free of chemical contamination and dust. Shelves should be located away from direct sun, flame, and heat sources. Containers should not protrude over shelf edges. Keep containers closed unless dispensing a chemical or adding it to the container. Never store a container open with a funnel in it. Provide secondary containment for liquids in large container. Dishpans or polyethylene trays work well. Use approved containers for flammable solvents.

3.7.4 Chemical Storage Compatibility

Materials should always be segregated and stored according to their chemical family or hazard classification. To prevent a fire, an explosion, the formation of highly toxic and/or flammable substances, or other potentially harmful reactions:

- Oxidizers mixed with flammable solvents can cause a fire.
- Acids mixed with metal dust can produce flammable hydrogen gas.
- Do not store chemicals alphabetically unless they are compatible.
- Store flammable liquids in approved safety containers in flammable storage cabinets. Do not store anything but flammable or combustible liquids in these cabinets.
- Segregate acids from bases.

- Segregate most organic acids from mineral acids.
- Keep oxidizers away from other chemicals, especially flammables or combustibles.
- Keep corrosives away from substances that they may react with and release corrosive, toxic, or flammable vapors.

The chart below details some common chemical incompatibilities.

Laboratory Material	**Incompatible with:**
Alkali Metals: calcium, potassium, sodium	Water, carbon dioxide, carbon tetrachloride, other chlorinated hydrocarbons
Acetic Acid	Chromic acid, nitric acid, hydroxyl-containing compounds, ethylene glycol, perchloric acid, peroxides, permanagates
Acetone	Concentrated sulfuric and nitric acid mixtures
Acetylene	Copper tubing, halogens, silver, mercury, and their compounds
Ammonia, Anhydrous	Mercury, halogens, calcium, hypochlorite, hydrogen fluoride
Ammonium Nitrate	Acids, metal powders, flammable liquids, chlorates, nitrates, sulfur, finely divided organics or combustible
Aniline	Nitric acids, hydrogen peroxide
Bromine	Ammonia, acetylene, butadiene, butane, hydrogen, sodium carbide, turpentine, finely divided metals
Chlorates	Ammonium salts, acids, metal powders, sulfur, carbon, finely divided organics, combustibles
Chromic Acid	Acetic acid, naphthalene, camphor, alcohol, glycerine, turpentine, other flammable liquids or combustible materials
Chlorine	Ammonia, acetylene, butadiene, benzene, other petroleum fractions, hydrogen, sodium carbide, turpentine, finely divided powdered metals
Cyanides	Acids
Hydrogen Peroxide	Copper, chromium, iron, most metals or their respective salts, flammable liquids or combustible materials, aniline, nitro-methane
Hydrogen Sulfide	Nitric acid, oxidizing gases
Hydrocarbons (general)	Halogens, chromic acid, sodium peroxide
Iodine	Acetylene, ammonia, chlorine
Mercury	Acetylene, ammonia, lithium
Nitric Acid	Acetic, chromic, and hydrocyanic acids, aniline,

Laboratory Material	Incompatible with:
	carbon, hydrogen sulfide, flammable material, readily nitrated substances
Oxygen	Oils, greases, hydrogen; flammable materials
Oxalic Acid	Silver, mercury, chlorites, strong oxidizers
Perchloric Acid	Acetic anyhydride, bismuth and its alloys, alcohol, paper, wood, other organic metals
Potassium Permanganate	Glycerine, ethylene glycol, benzaldehyde, sulfuric acid
Sodium Peroxide	Any oxidizable substances
Sulfuric Acid	Chlorates, perchlorates, permanaganates

3.7.5 Storage Precautions for Flammables and Combustibles

- Keep flammables away from all ignition sources: open flames, hot surfaces, direct sunlight, spark sources.

- Keep flammable liquids that require cold storage in laboratory-safe flammable material refrigerators or freezers to avoid ignition of the materials by sparks or static electricity.

- Store flammables separate from other hazard classes, especially oxidizers and toxics.

- Separate flammable gases from oxidizing gases with an approved non-combustible partition or by a distance of 20 feet.

- Store flammable liquids in approved safety containers or cabinets.

3.7.6 Storage requirements for Corrosives

- Segregate acids from bases.

- Segregate inorganic oxidizing acids (e.g., nitric acid) from organic acids (e.g., acetic acid), flammables, and combustibles.

- Segregate acids from chemicals that could generate toxic gases upon contact (e.g., sodium cyanide and iron sulfide).

- Segregate acids from water reactive metals such as sodium, potassium, and magnesium.
- Use safety glasses, gloves, and closed-toe shoes while handling corrosives.
- Store solutions of inorganic hydroxides in polyethylene containers.
- Store corrosives on lower shelves, at least below eye level and in compatible secondary containers.
- Although ventilation helps, chemicals will still corrode the shelves. Store containers in plastic tubs or trays as secondary containment.
- If you notice powder deposits, discoloration, and crystallization around the cap of a container, particularly an oxidizing acid. The material may be potentially explosive.
- Have spill control pillows or neutralizing agents available in case of a spill.

3.7.7 Storage Precautions for Toxics

- Segregate toxics from other hazard classes and store in a cool, well-ventilated area, away from light and heat.
- Containers should be tightly sealed to minimize exposure to personnel and contamination of other chemicals.

3.7.8 Storage Precautions for Highly Toxics

- Maintain the lowest possible quantities of highly toxics.
- Segregate highly toxic chemicals from other hazard classes and store in an area that is cool, well ventilated, and away from light and heat.
- Use highly toxic chemicals in a designated area or laboratory.
- Highly toxic chemicals that produce fumes or dust should always be handled within a chemical fume hood.

3.7.9 Storage Precautions for Oxidizers

- Segregate oxidizers from flammable and combustible materials (paper, wood).
- Segregate oxidizers from reducing agents (zinc, alkaline metals, formic acid).
- Segregate inorganic oxidizers from organic peroxides.
- Take care not to contaminate oxidizers. Some oxidizers, such as perchloric acid, can become explosive mixtures if contaminated with trace amounts of organic materials or metals.
- Store in a cool, dry place. Do not store under sink.
- Remember that perchloric acid, nitric acid, and hydrogen peroxide are oxidizers and must not be stored on wooden shelves or in cardboard boxes.

3.7.10 Storage Precautions for Compressed Gases

- Segregate incompatible gases as you would other incompatible chemicals.
- Limit the quantity of compressed gas cylinders on site to what will be used within a reasonable period of time.
- Store cylinders upright.
- Secure cylinders so they will not fall during an earthquake.
- Cylinders should be secured by using two non-combustible restraints, such as chains, one restraint located approximately one-third of the cylinder length from the top, and the other restraint one-third from the bottom.
- Keep cylinders away from heat and open flames.
- Leave the valve protection cap on the cylinder unless it is in use.

- Never store cylinders in walk-in freezers. The confined space with no ventilation poses a potential hazard.

- If you suspect that a cylinder is leaking, do not attempt to sniff the leak out. Apply a soap solution to the cylinder and locate the leak by noting where the bubbles appear.

3.7.11 Storage Precautions for Cryogens

- Store and handle in a well-ventilated area. When liquid cryogens are converted to the gaseous phase, they may create an oxygen deficiency. Do not use cryogens in small enclosed spaces.

- Non-approved vessels may explode.

- Secure containers so they will not tip over or obstruct an aisle, hallway, or corridor during an earthquake.

- Liquid nitrogen and liquid helium are capable of liquefying oxygen from air. This form of oxygen enrichment can become a strong fire or explosion hazard.

- Use appropriate protective equipment for handling cryogens: insulated holders for carrying vessels; eye protection, goggles, or face shields; and aprons. Use cryogenic gloves or leather gloves when handling supercold surfaces.

3.7.12 Storage Precautions for Pyrophorics

- Store in a cool, dry place. Prevent contact with air.

- Take extreme care to prevent containers of pyrophorics from leaking or breaking. For additional protection, consider keeping the chemicals in the manufacturer’s original shipping package (i.e., surrounded by vermiculite inside a metal can).

- Many pyrophorics are also water reactives.

3.7.13 Storage Precautions for Water Reactives

- Store in a cool, dry place.

- Keep away from water.
- In case of fire, do not use water. Use a dry chemical extinguisher.

3.8 Inventory

A chemical inventory must be maintained for all chemicals stored in the laboratory as required by the California Health and Safety Code – Section 25503.5. Each laboratory unit must update the chemical inventory at a minimum of every 12 months. The Laboratory Safety Officer performs an annual review of the chemical inventory. The annual review will be documented in the Laboratory Safety Officer- Safety Inspection Checklist. The review of the chemical inventory shall serve the following purposes:

- Identify unneeded materials that can be removed from laboratory storage, reducing the overall chemical laboratory risks.
- Avoid unnecessarily redundant purchases.
- Reduce compliance risks pertaining to the hazardous materials storage and reporting requirements.
- Aid in identification of the relative hazards of the chemicals in the inventory.

3.9 Laboratory Inspections

The laboratory will be inspected as detailed in the Safety Manual Section 1, General Safety, Laboratory Inspections

3.10 Chemical Waste Storage and Disposal Procedures

The Hazardous Chemical Team is responsible for the laboratory's chemical waste storage and disposal.

3.10.1 Collection and Storage of Chemical Waste

High density polyethylene (HDPE) screw top jars and bottles are to be used for collecting and storing most chemical waste. One gallon and five gallon buckets are also available. See a member of the Hazardous Chemicals Team (HCT) for these containers.

Containers must be properly labeled with the accumulation start date and a description of the contents. An example:

The container must also have a chemical hazard label that indicates if the contents are a poison, flammable, liquid, corrosive, etc. See a member of the HCT for these labels.

Chemical waste containers must be closed and stored just as with other chemical containers. Volatile liquids are not to be left to evaporate in a fume hood. Store waste containers in cabinets designed for chemical storage.

Properly segregate all chemical waste just as with all other chemical containers:

- Do not store strong acids and bases in the same cabinet
- Do not store strong acids and organics/flammable liquids in the same cabinet
- Do not store strong acids and cyanide, sulfide or arsenic compounds in the same cabinet
- Do not store alkali or alkali earth metals and aqueous material in the same cabinet
- Do not store mercury or silver and ammonium containing compounds in the same cabinet

3.10.2 Disposal of Chemical Waste

When a unit's chemical waste container is full, it should be brought to Room 113- Haz Mat lab for disposal. Contact a member of the HCT. The on-call member of the HCT can be found on the FSD Criminalistics Section Call Out Roster. The HCT maintains liason with a contracted Hazardous Waste Disposal company and will store the full container until the next laboratory wide waste disposal occurs. These waste disposals occur approximately every three months.

Section 3 Chemical Hygiene Plan

Bulk containers for lab trash that will be collected by the Hazardous Waste Disposal company will be labeled with the accumulation start date, a description of the contents as well as the Generator's Information. An example: