CHEMICAL HYGIENE PLAN

GUIDE TO CHEMICAL SAFETY FOR LABORATORY WORKERS

FOR

CALIFORNIA STATE UNIVERSITY, LOS ANGELES

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PROGRAM APPROVAL AND AUTHORIZATION

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1.0. PURPOSE:

The purpose of this Chemical Hygiene Plan is to set forth procedures, equipment, personal protective equipment and work practices that are capable of protecting California State University Los Angeles (CSULA) laboratory personnel from health hazards presented by the use of hazardous chemicals at CSULA. It identifies the ways in which California State University, Los Angeles is complying with the California Occupational Safety and Health Administration (OSHA) Laboratory Standard.

The Chemical Hygiene Plan is designed to identify the safety practices that should be implemented when working with hazardous chemicals commonly found in the laboratory. There may be instances when the physical and chemical properties, the proposed use, the quantity used or the toxicity of a substance will be such that these controls may need to be modified. Professional judgment is essential in the interpretation and application of these procedures. Laboratories may modify or enhance the procedures to meet specific uses and operational needs.

2.0. ORGANIZATIONS AFFECTED:

The policies and procedures set forth in this Chemical Hygiene Plan are applicable to all CSULA laboratory personnel.

3.0. REFERENCES:

3.1. Occupational Safety and Health Administration (OSHA) Laboratory Standard - 29 Code of Federal Regulations (CFR) 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories."

3.2. Title 8 of the California Code of Regulations (CCR) Section 5191.

4.0. POLICY:

4.1. Minimize Chemical Exposures – Use engineering controls and personnel protective equipment to avoid inhalation and skin contact with laboratory chemicals. Use minimal amounts of chemicals and choose less hazardous materials whenever feasible.

4.2. Ensure protective equipment is functioning properly – Safety equipment must be functioning properly in order to provide adequate protection. Laboratory personnel must check equipment prior to use. Do not use protective equipment that is not functioning properly.

4.3. Avoid Underestimation of Risk – Efforts to minimize chemical exposure should not be disregarded even when dealing with substances of no known significant hazard. For work with particularly hazardous substances,

special precautions must be taken. All substances of unknown toxicity should be considered toxic.

4.4. Observe Exposure Limits – Permissible Exposure Limits (PELs) of OSHA and Threshold Limit Values (TLVs) of the American Conference of Governmental Industrial Hygienists shall not be exceeded.

4.5. Follow the Chemical Hygiene Plan – Implement the procedures and practices described in this Chemical Hygiene Plan.

5.0. DEFINITIONS:

5.1. Acutely Toxic Chemical – A chemical capable of causing a harmful effect after a single exposure.

5.2. Action Level – A concentration for a specific substance, calculated as an eight-hour time-weighted average, which initiates certain activities such as exposure monitoring and medical surveillance.

5.3. Carcinogen – Any substance that is capable of causing or producing cancer.

5.4. Chemical Hygiene Officer – A designated employee who is qualified by training or experience to provide technical guidance in the development and implementation of the Chemical Hygiene Plan.

5.5. Chemical Hygiene Plan (CHP)– A written program that describes chemical handling procedures, laboratory equipment, personal protective equipment, safety rules and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in the laboratory.

5.6. Combustible Liquid – Any liquid having a flash point at or above 100 degrees F, but below 200 degrees F, except any mixture having components with flash points of 200 degrees F, or higher, the total volume of which make up 99 % or more of the total volume of the mixture.

5.7. Compressed Gas – A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 degrees F; or a gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 degrees F regardless of the pressure at 70 degrees F; or a liquid having a vapor pressure exceeding 40 psi at 100 degrees F.

5.8. Corrosive Chemical – A chemical that causes destruction of living tissue by chemical action at the site of contact.

5.9. Chronic Toxins – materials that cause health effects long after exposures, often from repeated or long time exposures. These effects may include organ damage, decreased lung function, kidney failure or cancer.

5.10. Designated Area – An area that may be used for work with carcinogens, reproductive toxins or substances that have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory fume hood.

5.11. Emergency – An occurrence such as but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

5.12. Explosive – A chemical that causes a sudden almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

5.13. Flammable – a chemical that falls into one of the following categories:

5.13.1. Flammable aerosol – an aerosol when tested yields a flame projection exceeding 18 inches at full back opening, or flashback (a flame extending back to the valve) at any degree of valve opening.

5.13.2. Flammable gas – 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 gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air greater than 12% by volume, regardless of lower explosive limit.

5.13.3. Flammable liquid – Any liquid having a flashpoint below 100 degrees F, except any mixture having components with flashpoints of 100 degrees F or higher, the total of which make up 99% or more of the total volume of the mixture.

5.13.4. Flammable solid – A solid, other than a blasting agent or explosive 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 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.

5.14. Flashpoint – The minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested.

5.15. Fume Hood – A laboratory device enclosed on 5 sides with a movable sash or fixed partial enclosure on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allow chemical manipulations to be conducted in the enclosure without insertion of any portion of the laboratory worker's body other than hands and arms.

5.16. Hazardous Chemical – A chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed laboratory personnel.

5.17. Incidental Spill – A small chemical spill that does not spread rapidly, does not endanger people or property and does not threaten the environment.

5.18. Laboratory – A facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used in reactions, transfers, etc. on a non-production basis.

5.19. Laboratory Scale – Work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials,

5.20. Laboratory Personnel – Individuals who may be exposed to hazardous chemicals in the course of their work or assignments in the laboratory. Laboratory personnel includes faculty, staff, research associates and assistants, principal investigators, technicians, graduate students and undergraduate students. Office workers, custodians, maintenance and repair personnel, and others who spend part of their time within a laboratory environment are also considered laboratory personnel.

5.21. Laboratory Use of Hazardous Chemicals – Handling or use of such chemicals in which all of the following conditions are met:

- Chemical manipulations are carried out on a "laboratory scale"
- Multiple chemical procedures or chemicals are used
- The procedures involved are not part of a production process, nor in any way simulate a production process
- "Protective laboratory practices and equipment" are available and in common use industry–wide to minimize the potential for employee exposure to hazardous chemicals.

5.22. Medical Consultation – A consultation which takes place between laboratory personnel and a licensed physician for purposes of determining

what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

5.23. Oxidizer – A chemical other than a blasting agent or explosive that igniters or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

5.24. PEL (Permissible Exposure Limit) – The legal limit set by OSHA for work-place exposures.

5.25. Peroxide Compounds – Chemicals that tend to absorb and react with oxygen from the air to form unstable peroxides which can explode with impact, heat or friction.

5.26. Physical Hazard – A chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, reactive or water-reactive.

5.27. Protective Laboratory Practices and Equipment – Those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that can be shown to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

5.28. Reactive Chemical – A chemical that will vigorously polymerize, decompose, condense or become self-reactive due to shock, pressure, or temperature. Included in this definition are explosive materials, organic peroxides, pressure generating materials and water reactive materials.

5.29. Reproductive Toxins – Chemicals which affect the reproductive capabilities including those that result in chromosomal damage (mutations) and those which affect the developing fetus (teratogens).

5.30. Select Carcinogens – Substances strongly implicated as a potential cause of cancer in humans. A select carcinogen typically meets the following specific 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).
- It is listed under Group 1 by the International Agency for Research on Cancer Monographs (IARM).
- It is listed in either Group 2A of 2B by IARC or under the category "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals.

5.31. Standard Operating Procedures (SOPs) – Written protocols that describe how to perform a laboratory operation, and contain relevant safety and health information.

5.32. TLV (Threshold Limit Value) – The airborne concentration of material beyond which an individual should not be exposed without appropriate personal protective equipment. The TLV is set by the American Conference of Government and Industrial Hygienists (ACGIH).

5.33. Water Reactive – A chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

6.0. RESPONSIBILITIES:

The California State University, Los Angeles safety program is based on the premise that every member of the campus community shares the responsibility for safety. As part of the community, it is important for laboratory personnel to be familiar with the health and safety guidelines that apply to their work and to conduct that work in the safest possible manner. The Chemical Hygiene Plan is a resource to assist workers in fulfilling these responsibilities.

6.1. University President provides support for implementation and maintenance of a chemical hygiene plan and is ultimately responsible for chemical safety on campus. Administration of the plan is delegated to the Chemical Hygiene Officer and the RM/EHS Director. College and administrative departments have delegated responsibilities.

6.2. College and Department Administrators are responsible for incorporating provisions of the chemical hygiene plan in the laboratory areas that they oversee. These duties include:

6.2.1. Inspections – Conduct laboratory inspections to verify compliance with the CHP and implement corrective actions as needed.

6.2.2. Training – Ensure that all laboratory workers are properly trained. This must include training programs specific to their laboratories and laboratory procedures as well as the appropriate training provided by the RM/EHS office. Maintain records of department-initiated training.

6.3. Principle Investigator/Laboratory Supervisor is responsible for chemical hygiene in the laboratory or laboratories assigned to them.

Responsibilities include:

6.3.1. Chemical inventory - Maintain the chemical inventory in their laboratories.

6.3.2. Safety Data Sheets (SDS) – Provide SDS access to laboratory personnel for all chemicals in their laboratories.

6.3.3. Training – Ensure that all laboratory personnel under his/her supervision receive proper laboratory safety training. This must include training programs specific to their laboratories and laboratory procedures as well as the appropriate training provided by the RM/EHS office. Document and maintain records of such training.

6.3.4. Laboratory Procedures – Understand laboratory hazards and how to control chemical exposures through proper selection of laboratory techniques and engineering controls. Inform laboratory personnel of the hazards present, encourage safe analytical techniques, and provide procedures for dealing with accidental spills.

6.3.5. Specific Laboratory Practices – Laboratory Supervisors or Principal Investigators should develop additional safety procedures to protect laboratory personnel from specific chemical hazards that may be unique to their particular laboratory and not adequately accounted for in Chemical Hygiene Plan safety practices.

6.3.6. Laboratory Conditions - Assist in monitoring ventilation devices and laboratory air quality. Oversee laboratory waste accumulation and disposal.

6.4. Risk Management & Environmental Health and Safety (RM/EHS) Office
Promotes programs for compliance with safety and health regulations, and for protection of the health and safety of students, faculty, staff and visitors by:

6.4.1. Training – Provide laboratory safety training for laboratory personnel.

6.4.2. Inspections – Periodically inspect laboratory areas to identify hazards and recommend corrections.

6.4.3. Liaison – Serve as campus liaison with Cal/OSHA and other regulatory agencies.

6.5. Chemical Safety Officer – Is a member of the RM/EHS Office and is responsible for:

6.5.1. Chemical Hygiene Plan - Preparation, implementation and maintenance of the Chemical Hygiene Plan (CHP), as well as seeking ways to improve the chemical hygiene program.

6.5.2. Chemical oversight - Monitoring the procurement, use, and disposal of laboratory chemicals. The Chemical Hygiene Officer reviews and gives signature approval on all hazardous material purchases.

6.5.3. Legal requirements – Stays current with legal requirements concerning regulated substances.

6.5.4. Audits and inspections – Sees that appropriate audits and inspections are conducted.

6.5.5. Laboratory support - Supports laboratory supervisors and department administrators in the development of safety procedures and adequate facilities.

6.6. Laboratory Personnel – Demonstrate an understanding of the Chemical Hygiene Plan by these actions:

6.6.1. Safety Practices – Follow safety guidelines and procedures identified in the Chemical Hygiene Plan.

6.6.2. Personal Protective Equipment – Use appropriate personal protective equipment and take necessary precautions to avoid chemical hazards and exposures.

6.6.3. Habits – Develop good personal chemical hygiene habits.

6.6.4. Unsafe conditions – Report unsafe conditions to the Laboratory Supervisor or EHS Office.

6.6.5. Training – Attend all training courses that are deemed appropriate by the Principal Investigator or the EHS office, and request training and/or information when unsure of how to handle a hazardous chemical or procedure.

7.0. STANDARD OPERATING PROCEDURES:

The following is a minimum set of guidelines for handling chemicals in the laboratories at CSULA. More stringent procedures should be followed when dealing with especially hazardous chemicals or special conditions in the laboratory. The RM/EHS office is available for consultations, if necessary.

7.1. General Safety Principles – The following guidelines establish the minimum standards to maintain basic safety in the laboratory:

7.1.1. Understand hazards – Examine the known hazards associated with the materials being used. Never assume all hazards have been identified. Carefully read the label before using an unfamiliar chemical. When appropriate, review the Safety Data Sheet (SDS) for special handling information. Determine the potential hazards and use appropriate safety precautions before beginning any new operation. If you have any questions regarding the usage or handling of the chemical, contact your laboratory supervisor.

7.1.2. Review emergency plans – Be familiar with the location and operation of emergency equipment, fire alarms, fire extinguishers, emergency eyewash and shower locations, and know the appropriate emergency response procedures.

7.1.3. Distractions – Avoid distracting or startling other laboratory workers while they are handling hazardous chemicals.

7.1.4. Unsafe conditions – Always be alert for unsafe conditions and actions and call attention to them so that corrective action can be taken as quickly as possible.

7.1.5. Personal Protective Equipment – Use eye and face protection and lab coats or aprons when appropriate. Substantial shoes are required in the laboratory. Wear suitable gloves when the potential for contact with toxic material exists.

7.1.6. Check Equipment – Always inspect equipment for leaks, tears and other damage before handling a hazardous chemical. This includes glassware, fume hoods, gloves, goggles, etc.

7.1.7. Inhaling or ingesting chemicals – Avoid tasting or smelling hazardous chemicals

7.1.8. Labels – Ensure that all chemical containers are properly labeled and never use unlabeled chemicals.

7.1.9. Cold rooms – Do not allow the release of toxic substances in cold rooms since these generally have contained, recirculated atmospheres.

7.1.10. Glassware – Handle and store laboratory glassware with care to avoid damage. Do not use damaged glassware. Shield or wrap evacuated or vacuum glassware to contain chemicals and fragments should an implosion occur.

7.1.11. Globally Harmonized System (GHS)– is a system for standardizing and harmonizing the classification and labelling of chemicals. It is a logical and comprehensive approach to: defining health, physical and environmental hazards of chemicals; creating classification processes that use available data on chemicals for comparison with the defined hazard criteria; and communicating hazard information, as well as protective measures, on labels and Safety Data Sheets (SDS).

The GHS physical hazards are briefly described below. For many of the physical hazards the GHS Document contains Guidance Sections with practical information to assist in applying the criteria. Figure 1 illustrates the GHS chemical classification system

Figure 1- Physical Hazards (GHS)

Explosives
Flammable Gases
Flammable Aerosols
Oxidizing Gases
Gases Under Pressure
Flammable Liquids
Flammable Solids
Self-Reactive Substances
Pyrophoric Liquids
Pyrophoric Solids
Self-Heating Substances
Substances which, in contact with water emit flammable gases
Oxidizing Liquids
Oxidizing Solids
Organic Peroxides
Corrosive to Metals

7.1.11a. Explosives -An explosive substance (or mixture) is a solid or liquid which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. Pyrotechnic substances are included even when they do not evolve gases. A pyrotechnic substance (or mixture) is designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative, self-sustaining, exothermic chemical reactions. Substances, mixtures and articles are assigned to one of six divisions, 1.1 to 1.6, depending on the type of hazard they present.

Table 1 Explosives

Division	Characteristics
1.1	Mass explosion hazard
1.2	Projection hazard
1.3	Fire hazard or minor projection hazard
1.4	No significant hazard
1.5	Very insensitive substances with mass explosion hazard
1.6	Extremely insensitive articles with no mass explosion hazard

Explosive properties are associated with certain chemical groups that can react to give very rapid increases in temperature or pressure. The GHS provides a screening procedure that is aimed at identifying the presence of such reactive groups and the potential for rapid energy release. If the screening procedure identifies the substance or mixture to be a potential explosive, the acceptance procedure has to be performed.

7.1.11b. Flammable Gases -Flammable gas means a gas having a flammable range in air at 20°C and a standard pressure of 101.3 kPa. Substances and mixtures of this hazard class are assigned to one of two hazard categories on the basis of the outcome of the test or calculation method.

7.1.11c. Flammable Aerosols- Aerosols are any gas compressed, liquefied or dissolved under pressure within a non-refillable container made of metal, glass or plastic, with or without a liquid, paste or powder. The container is fitted with a release device allowing the contents to be ejected as solid or liquid particles in suspension in a gas, as a foam, paste or powder or in a liquid or

gaseous state.

7.1.11d. Oxidizing Gases - Oxidizing gas means any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does. Substances and mixtures of this hazard class are assigned to a single hazard category on the basis that, generally by providing oxygen, they cause or contribute to the combustion of other material more than air does.

7.1.11e. Gases under Pressure- Gases under pressure are gases that are contained in a receptacle at a pressure not less than 280 Pa at 20°C or as a refrigerated liquid. This endpoint covers four types of gases or gaseous mixtures to address the effects of sudden release of pressure or freezing which may lead to serious damage to people, property, or the environment independent of other hazards the gases may pose. For this group of gases, the following information is required: vapor pressure at 50°C, physical state at 20°C, at standard ambient pressure and critical temperature. Criteria that use the physical state or compressed gases will be a different classification basis for some workplace systems.

Table 2 Gases under Pressure

Group	Criteria
Compressed gas	Entirely gaseous at -50°C
Liquefied gas	Partially liquid at temperatures > -50°C
Refrigerated liquefied gas	Partially liquid because of its low temperature
Dissolved gas	Dissolved in a liquid phase solvent

7.1.11f. Flammable Liquids- Flammable liquid means a liquid having a flash point of not more than 93°C. Substances and mixtures of this hazard class are assigned to one of four hazard categories on the basis of the flash point and boiling point (See Table 3).

Table 3 Flammable Liquids

Category	Criteria
1	Flash point < 23°C and initial boiling point ≤ 35°C (95°F)
2	Flash point < 23°C and initial boiling point > 35°C (95°F)
3	Flash point ≥ 23°C and ≤ 60°C (140°F)
4	Flash point ≥ 60°C (140°F) and ≤ 93°C (200°F)

7.1.11g. Flammable Solids- Flammable solids are solids that are readily combustible, or may cause or contribute to fire through friction. Readily combustible solids are powdered, granular, or pasty substances which are dangerous if they can be easily ignited by brief contact with an ignition source, such as a burning match, and if the flame spreads rapidly.

Substances and mixtures of this hazard class are assigned to one of two hazard categories (Table 4).

Table 4 Flammable Solids

Category	Criteria
1	Metal Powders: burning time ≤ 5 minutes Others: wetted zone does not stop fire & burning time < 45 seconds or burning > 2.2 mm/second
2	Metal Powders: burning time > 5 and ≤ 10 minutes Others: wetted zone stop fire for at least 4 minutes & burning time < 45 seconds or burning rat > 2.2mm/second

7.1.11h. Self-Reactive Substances -Self-reactive substances are thermally unstable liquids or solids liable to undergo a strongly exothermic thermal decomposition even without participation of oxygen (air). This definition excludes materials classified under the GHS as explosive, organic peroxides or as oxidizing. These materials may have similar properties, but such hazards are addressed in their specific endpoints. There are exceptions to the self-reactive classification for material: (i) with heat of decomposition <300 J/g or (ii) with self-accelerating decomposition temperature (SADT) > 75°C for a 50 kg package.

Substances and mixtures of this hazard class are assigned to one of the seven 'Types', A to G (Table 5).

Table 5 Self-Reactive Substances

Type	Criteria
A	Can detonate or deflagrate rapidly, as packaged.
B	Possess explosive properties and which, as packaged, neither detonates nor deflagrates, but is liable to undergo a thermal explosion in that package.
C	Possess explosive properties when the substance or mixture as package cannot detonate or deflagrate rapidly or undergo a thermal explosion.
D	▪ Detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement; or ▪ Does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement; or ▪ Does not detonate or deflagrate at all and shows a medium effect when heated under confinement.
E	Neither detonates nor deflagrates at all and shows low or no effect when heated under confinement.
F	Neither detonates in the cavitated bubble state nor deflagrates at all and shows only a low or no effect when heated under confinement as well as low or no explosive power.
G	Neither detonates in the cavitated state nor deflagrates at all and shows non effect when heated under confinement nor any explosive power, provided that it is thermally stable (self-accelerating decomposition temperature is 60°C to 75°C for a 50 kg package), and, for liquid mixtures, a diluent having a boiling point not less than 150°C is used for desensitization.

7.1.11i. Pyrophoric Liquids- A pyrophoric liquid is a liquid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air. Substances and mixtures of this hazard class are assigned to a single hazard category.

7.1.11j. Pyrophoric Solids- A pyrophoric solid is a solid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air. Substances and mixtures of this hazard class are assigned to a single hazard category.

7.1.11k. Self-Heating Substances-A self-heating substance is a solid or liquid, other than a pyrophoric substance, which, by reaction with air and without energy supply, is liable to self-heat. This endpoint differs from a pyrophoric substance in that it will ignite only when in large amounts (kilograms) and after long

periods of time (hours or days). Substances and mixtures of this hazard class are assigned to two hazard categories.

7.1.11l. Substances which on Contact with Water Emit Flammable Gases-Substances that, in contact with water, emit flammable gases are solids or liquids which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities. Substances and mixtures of this hazard class are assigned to three hazard categories.

Table 6 Substances which on Contact with Water Emit Flammable Gases

Category	Criteria
1	≥10 L/kg/1 minute
2	≥20 L/kg/ 1 hour + < 10 L/kg/1 min
3	≥1 L/kg/1 hour + < 20 L/kg/1 hour
Not classified	< 1 L/kg/1 hour

7.1.11m. Oxidizing Liquids- An oxidizing liquid is a liquid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other material. Substances and mixtures of this hazard class are assigned to one of three hazard categories.

7.1.11n. Oxidizing Solids- An oxidizing solid is a solid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other material. Substances and mixtures of this hazard class are assigned to three hazard categories.

7.1.11o. Organic Peroxides- An organic peroxide is an organic liquid or solid which contains the dual oxide structure and may be considered a derivative of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. The term also includes organic peroxide formulations (mixtures). Such substances and mixtures may: be liable to explosive decomposition, burn rapidly, be sensitive to impact or friction and react dangerously with other substances. Substances and mixtures of this hazard class are assigned to one of seven 'Types', A to G (Table 7).

Table 7 Organic Peroxides

Type	Criteria
A	Can detonate or deflagrate rapidly, as packaged.
B	Possess explosive properties and which, as packaged, neither detonates nor deflagrates rapidly, but is liable to undergo a thermal explosion in that package.
C	Possess explosive properties when the substance or mixture as packaged cannot detonate or deflagrate rapidly or undergo a thermal explosion.
D	▪ Detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement; or ▪ Does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement; or ▪ Does not detonate or deflagrate at all and shows a medium effect when heated under confinement.
E	Neither detonates nor deflagrates at all and shows low or no effect when heated under confinement.
F	Neither detonates in the cavitated bubble state nor deflagrates at all and shows only a low or no effect when heated under confinements as well as low or non-explosive power.
G	Neither detonates in the cavitated state nor deflagrates at all and shows no effect when heated under confinement nor any explosive power, provided that it is thermally stable (self-accelerating decomposition temperature is 60°C to 75°C for a 50 kg package), and, for liquid mixtures, a diluent having a boiling point not less than 150°C is used for desensitization.

7.1.11p. Substances Corrosive to Metal- A substance or a mixture that by chemical action will materially damage, or even destroy, metals is termed 'corrosive to metal'. These substances or mixtures are classified in a single hazard category. The GHS criteria are a corrosion rate on steel or aluminum surfaces exceeding 6.25 mm per year at a test temperature of 55°C. The concern in this case is the protection of metal equipment or installations in case of leakage (e.g., plane, ship or tank), not material compatibility between the container/tank and the product. This hazard is not currently covered in all systems.

7.2. Health and Hygiene – The following practices protect laboratory workers from health risks associated with the use of hazardous chemicals:

7.2.1. Direct contact with chemicals – Avoid direct contact with any hazardous chemical. Know the types of protective equipment available and use the proper type for each job.

7.2.2. Laboratory apparel – Confine loose clothing and long hair. Always wear footwear that fully covers the feet. Shorts should not be worn when using corrosives or other chemicals that present a skin contact hazard.

7.2.3. Suction by mouth – Do not pipette by mouth.

7.2.4. Fume hoods – Use fume hoods whenever exposure to gases, vapors or aerosols is suspected. Ensure that ventilation equipment is working properly.

7.2.5. Hand washing - Wash hands thoroughly with soap and water after handling chemicals.

7.2.6. Exposure symptoms – Be familiar with the symptoms of exposure for the chemicals you work with and the precautions necessary to prevent exposure. Know the physical and sensory characteristics (odor and appearance) of these chemicals.

7.2.7. Food in the laboratory – There shall be no food, drink, smoking or applying cosmetics in laboratories where hazardous chemicals, radioactive materials or biohazardous materials are present. Do not store food or beverages in a laboratory or chemical refrigerator.

7.3. Housekeeping – Safety follows from good housekeeping practices. Use the following guidelines to maintain an orderly laboratory:

7.3.1. Clutter – Keep work areas clean and uncluttered. Clean up work areas upon completion of an operation or at the end of each workday.

7.3.2. Spills – Clean spills immediately and thoroughly. Use appropriate personal protective equipment and dispose of spill residues properly.

7.3.3. Waste disposal – Dispose of wastes properly. Follow the Hazardous Waste Management Procedures.

7.3.4. Access to emergency equipment – Do not block exits, emergency equipment or control panels. Do not use corridors and stairways as storage areas.

7.4. Chemical Handling and Storage – The use of a hazardous chemical should include a commitment to handle and use the chemical properly from initial receipt to disposal.

7.4.1. Access to information – Information on proper handling, storage and disposal of hazardous chemicals and access to related SDSs must be made available to all laboratory personnel prior to the use of the chemical.

7.4.2. Purchase only needed amounts – Purchase the minimum amount of hazardous chemicals necessary to maintain operations (even if you can get twice as much for the same price).

7.4.3. Use less hazardous substitutes – Substitute less hazardous chemicals for high hazard chemicals whenever possible.

7.4.4. Long-term storage – Avoid stockpiling and long-term storage (more than 1 year) of excess chemicals with the thought that you may need them sometime in the future. Discard chemicals that are no longer needed.

7.4.5. Chemical Inventories – Utilize the bar-coding capabilities of the *Chemical Inventory Management System* to maintain an accurate inventory of chemicals in each laboratory and stockroom. A copy of the chemical inventory should be available in each laboratory or area where chemicals are stored. Search inventories of existing chemicals in stock before purchasing new chemicals.

7.4.6. Labels – All chemical containers must be labeled. Immediately replace missing or defaced labels. Labels on stored chemicals should be easy to read.

7.4.7. Shelves – Do not store chemicals on hard-to-reach shelves. Chemicals must be stored in an earthquake safe manner on lipped shelves or shelves equipped with retaining wires.

7.4.8. Compatibility – Chemicals must be segregated by compatibility.

7.4.9. Hazard warning signs – Areas where chemicals are stored must have hazard-warning signs.

7.4.10. Laboratory benches – Storage of chemicals on laboratory benches or in other work areas must be kept to a minimum.

7.4.11. Corridors – Chemicals shall not be stored in corridors or aisle ways.

7.4.12. Chemical mixtures – Any chemical mixture shall be assumed to be as toxic as its most toxic component.

7.4.13. Unknown chemicals – Substances of unknown toxicity shall be assumed to be toxic.

7.4.14. Incidental spills – Immediately cleanup incidental chemical spills. Responsibility for cleanup of chemical spills rests with the laboratory causing the spill. The RM/EHS Office will provide assistance.

7.5. Emergency Procedures – The situation and seriousness of an emergency can vary considerably. The following are typical emergency response procedures:

7.5.1. Emergency equipment – Know where to find fire extinguishers, emergency eyewash/showers, exits, spill kits, and alarm systems.

7.5.2. Eye contact – Promptly flush eyes with water for 15 minutes.

7.5.3. Skin contact – Flush affected area and remove contaminated clothing. Use emergency shower if necessary.

7.5.4. Assistance – Call for emergency assistance – Dial 911 on a campus phone, or 323-343-3700 on a cell phone.

7.5.5. Alarm – Sound alarm and clear the area.

7.5.6. Spills - Contain spills if possible. Do not let the spill enter the storm drain or sanitary sewer systems.

7.5.7. Fires – Extinguish small fires.

7.5.8. First Aid – Render assistance and first aid.

7.5.9. Information – Provide emergency personnel with the identity and information on the chemical involved.

7.6. Personal Protective Equipment – Appropriate protective equipment and apparel must be worn where chemicals are stored or handled.

7.6.1. Eye protection – All persons, including visitors, in the laboratories, must wear proper eye protection.

7.6.2. Gloves – Wear appropriate gloves when the potential for contact with toxic materials exists. Inspect the gloves before each use, wash them before removal, and replace them periodically. Discard disposable gloves immediately following overt contamination with highly toxic materials. RM/EHS can provide assistance in the selection of proper glove type.

7.6.3. Lab coats – Wear a lab coat or apron when working with chemicals. Remove lab coats immediately on significant contamination.

7.6.4. Other equipment – Use any other protective equipment and emergency apparel as appropriate.

7.7. Transporting Chemicals – When transporting chemicals outside the laboratory, precautions should be taken to avoid dropping or spilling chemicals.

7.7.1. Glass containers – Carry glass containers in specifically designed bottle carriers or a leak resistant, unbreakable secondary container.

7.7.2. Carts – When transporting chemicals on a cart, use a cart that is suitable for the load and one that has high edges to contain leaks or spills.

7.7.3. Elevators – When possible, transport chemicals in freight elevators to avoid the possibility of exposing people on passenger elevators.

7.8. Flammable Chemicals – Information on a chemical's flammability, flashpoint, vapor pressure and explosive limit is provided on the SDS. The following precautions should be followed when working with flammable chemicals.

7.8.1. Storage – Quantities of flammable chemicals greater than necessary for one day's use shall be stored in flammable storage cabinets or flammable storage rooms.

7.8.2. Ignition sources – Eliminate ignition sources such as open flames, hot surfaces, sparks, electrical equipment and static electricity.

7.8.3. Bonding and grounding – Ensure that there is proper bonding and grounding when it is required, such as when transferring or dispensing a flammable liquid from a large container or drum.

7.8.4. Fire extinguishers – Assure that appropriate fire extinguishers are in the area.

7.9. Corrosive Materials – When working with corrosive or contact hazard chemicals, follow the safety precautions contained in the applicable SDS. As a general rule, the following rules are appropriate:

7.9.1. Personal Protective Equipment – Eye protection and appropriate gloves must be worn when handling corrosive materials. A face shield and rubber apron may also be appropriate.

7.9.2. Containers – Containers and equipment used for storage and processing of corrosive materials need to be corrosion resistant.

7.9.3. Mixing with water – Never add water to acid. When mixing concentrated acids with water, add the acid slowly to water.

7.9.4. Eyewash and safety showers – An eyewash and safety shower must be readily accessible to areas where corrosives are used and stored. In the event of skin or eye contact, immediately flush the area of contact with water for 15 minutes. Remove all affected clothing and obtain medical help.

7.10. Oxidizers – Oxidizers are materials that react with other substances by giving off electrons and undergoing reduction. This reaction may result in fire or explosion. The intensity of the reaction depends on the oxidizing/reducing potential of the materials involved. The following steps need to be followed:

7.10.1. Understand the hazard – Know the reactivity of the materials involved in the experiment or process. Ensure that there are no other materials in the area that could become involved in a reaction.

7.10.2. Violent reactions – If the reaction is expected to be violent or explosive, use shields or other methods for isolating the materials or process.

7.11. Peroxide Chemicals – Peroxide materials such as diethyl ether, tetrahydrofuran, etc. can form unstable peroxides upon exposure to air and become explosion hazards. These materials require the following safety precautions:

7.11.1. Dating of Containers – Date all peroxide material containers when received and when opened.

7.11.2. Storage Time Limits – Opened containers should be used up or discarded within 6 months of the time they were first opened. Unopened containers should be stored no longer than one year.

7.11.3. Crystals Present – Do not move or attempt to open a container if the liquid appears cloudy or if there is obvious solid formation around the lid.

7.12. Radioactive Materials – Use of radioactive materials at CSULA is strictly controlled. Contact the RM/EHS Office if you plan to use radioactive materials.

7.13. Biological Hazards – Biological hazards often require unique work environments. Contact the RM/EHS Office or refer to the documented program on biological hazard management for safety precautions.

7.14. Cryogens – Cryogenic liquids are substances that are normally in the gaseous state but are cooled to extremely low temperatures to form liquids. The following precautions should be taken when working with cryogens:

7.14.1. Personal Protective Equipment – Always wear goggles, gloves and an impervious apron. Potholders should also be used.

7.14.2. Pressure relief – Containers and systems containing cryogens must have pressure relief mechanisms.

7.14.3. Extreme cold – Containers and systems must be capable of withstanding extreme cold without becoming brittle.

7.14.4. Formation of flammable mixtures – Care should be taken to prevent the formation of flammable or explosive mixtures when working with flammable gases and cryogens that can condense oxygen from the air.

7.15. Compressed Gases – Special procedures are needed for handling materials under pressure. Compressed gas cylinders can pose mechanical, physical and health hazards.

7.15.1. Storage and handling - Firmly secure gas cylinders with suitable clamps, chains or belts to support cylinders against an immovable object, such as a wall or bench. Do not allow cylinders to fall or lean against one another. Secure cylinders to an appropriate handcart during transport. When storing or moving a cylinder, the valve protection cap must be securely in place to protect the valve. Always wear goggles when handling compressed gasses.

7.15.2. Compatible equipment – Always use Compressed Gas Association approved gauges, fittings, valves and other connections of the proper configuration for the gas being used.

7.15.3. Exhaust ventilation – Make sure adequate exhaust ventilation (like a fume hood) is available when using compressed gases. Be especially careful when using corrosive, reactive or particularly toxic gases.

7.16. Unattended Operations – If it is necessary to leave a laboratory operation unattended, adhere to the following basic guidelines:

7.16.1. Permission - Check with laboratory supervisor to determine if it is necessary to leave a laboratory operation unattended.

7.16.2. Develop a protocol – Develop a protocol with the laboratory supervisor for the unattended operation of potentially dangerous equipment or methods. Include a contingency plan for potential interruptions in electric power, water, inert gas and other services. Provide secondary containment for hazardous substances.

7.16.3. Warning sign – Post a warning sign in the vicinity of the unattended experiment.

7.17. Working Alone - Working alone in the laboratory is not advised.

7.17.1. Notify someone – If necessary, notify someone in a nearby laboratory or office of your intention to work in a laboratory. Ask for their cooperation and keep them apprised of your activity. The Public Safety Dispatch at ext. 3-3700 should also be considered as a notification if you are intending to work in a laboratory alone.

7.18. Hazardous Waste – For guidelines on the accumulation and disposal of hazardous wastes from laboratory operations, refer to the CSULA Hazardous Waste Management Procedures. Any questions about hazardous waste should be directed to the RM/EHS Office at extension 3-3546.

7.18.1. Accumulation – Store laboratory chemical wastes in closed, labeled containers in a designated satellite accumulation area.

7.18.2. Disposal – Do not put chemical waste materials down the sink or in the trash.

7.18.3. Waste Minimization – Implement measures to limit and reduce the volume and toxicity of laboratory hazardous waste whenever possible.

8.0. CONTROL MEASURES:

The exposure to hazardous chemicals in the laboratory shall be controlled through the use of good laboratory hygiene practices, standard operating procedures specific to an individual laboratory, engineering controls and personal protective equipment.

8.1. General Laboratory Practices – The RM/EHS Office and the Chemical Hygiene Plan provide laboratories with information about general laboratory work practices and rules that are recognized as effective control measures to minimize exposure to hazardous chemicals in the laboratory. These general procedures include guidelines in the handling of chemicals, accidents and spills, personal protection, use of fume hoods, and other good laboratory practice information.

8.2. Specific Laboratory Practices – Individual laboratories may need to develop additional written safety procedures when necessary to protect laboratory workers from specific chemical hazards that are unique to their particular area of research. Particular attention should be given to control measures for operations that involve the use of carcinogens or acutely toxic chemicals. The RM/EHS Office can assist in developing safety procedures for specific hazards.

8.3. Engineering Controls – There are a variety of engineering controls that can be used in the laboratory to control exposures to hazardous chemicals. Some of the engineering controls that are used in laboratories at CSULA include ventilation, fume hoods and proper storage facilities.

8.4. Personal Protective Equipment – Personal protective equipment must be used in the laboratory to reduce exposure to hazardous chemicals. Safety glasses, goggles, gloves, face shields, aprons and lab coats are commonly recommended for use with hazardous chemicals. The RM/EHS Office can assist in the selection and use of personal protective equipment.

8.5. Other Control Methods – Additional control methods used reduce exposure to hazardous chemicals in laboratories include emergency procedures, substituting with less hazardous chemicals and minimizing chemical inventories.

9.0. FUME HOODS AND OTHER PROTECTIVE EQUIPMENT:

All fume hoods at CSULA shall comply with California Code of Regulations Title 8 Section 5154.1

9.1. Fume Hood Procedures – A laboratory fume hood is an important safety device for protecting the laboratory worker from volatile or airborne contaminants. It must be used properly to be effective. The following work practices are required:

- Conduct all operations that may generate irritating or hazardous air contaminants inside the hood.
- Keep all apparatus and chemicals at least 6 inches back from the face of the hood and keep the slots in the hood baffle free of obstruction.
- Do not lean into the hood or put your head into the hood when contaminants are being generated
- Do not use the hood as a waste disposal method (i.e. to volatilize chemicals).
- Do not store apparatus or chemicals in the hood.
- Keep the hood sash closed when not in use. During use, position sash at or below the height indicated on the hood.
- Never use a laboratory hood that is not working properly.
- Minimize foot traffic and other forms of potential air disturbances past the face of the hood.
- Do not have sources of ignition inside the hood when flammable liquids or gases are present. No permanent electrical receptacles are permitted in the hood.
- Use an appropriate barricade or shield, if there is a chance of explosion or eruption.
- Do not store unsealed chemicals in a fume hood while not in use. All chemical containers should be closed at all times, except for the immediate dispensing of product, or collection of waste.

9.2. Fume Hood Inspections – All fume hoods at CSULA are inspected annually. Acceptable hood face velocities are confirmed and hoods are labeled with inspection stickers that include inspection date, average face

velocity and safe operating tips. Inspection information is recorded and kept on file in the RM/EHS Office. If a fume hood is found to be unacceptable, it is tagged out-of-service and appropriate personnel are contacted to have the hood repaired.

9.3. Other Protective Equipment – The proper functioning and maintenance of other protective equipment used in the laboratories is the responsibility of campus service groups. RM/EHS oversees the annual servicing of fire extinguishers. Facilities Services does monthly eyewash/emergency shower inspections and maintains ventilation equipment. These groups ensure the proper functioning and adequate performance on this equipment.

10.0. INFORMATION AND TRAINING:

All laboratory personnel must be provided with training and information to ensure that they are apprised of the hazards associated with the chemicals in their work area. They also need to be informed of actions to be taken to protect themselves during normal operations and emergency situations.

10.1. Initial Training – Laboratory safety training is to be provided at the time of initial assignment to an area where hazardous chemicals are present and prior to assignments involving new exposure situations. Initial training is provided to newly hired laboratory personnel by their supervisor. This training is documented on the CSULA Supervisor Orientation Checklist or equivalent document and is retained by the department. A copy must be forwarded to the Human Resource Management Office.

10.2. Annual/Refresher Training – Annual/refresher training is accomplished by attending a training session on Laboratory Safety provided by the RM/EHS office. All laboratory personnel are required to attend refresher training annually. The RM/EHS training schedule is available on the web (www.calstatela.edu/ehs/training-information).

10.3. SDS Training – SDS training is provided by RM/EHS as part of their University Hazard Communication training and includes physical and health hazards associated with chemicals in the work area, recommended measures that laboratory personnel can take to protect themselves from these hazards, exposure limits, signs and symptoms associated with hazardous chemical exposure, and emergency procedures.

10.4. Information Availability –The Chemical Hygiene Plan, the contents of the OSHA Laboratory Standard and other laboratory safety information including safety data sheets are available in the RM/EHS Office or on the RM/EHS website (www.calstatela.edu/ehs). Safety data sheets should also be available in the individual laboratories or chemical stockrooms.

12.4. Extra precautions – Consult the SDS and follow specific precautions and procedures. Wear appropriate safety apparel use appropriate engineering controls. Guard against spills and splashes.

12.5. Notifications – Notify laboratory supervisor of all incidents of exposure or spills.

12.6. Waste disposal – Prepare wastes from work with these chemicals for disposal according to guidelines in the Hazardous Waste Management Procedure.

13.0. MEDICAL CONSULTATION AND MEDICAL EXAMINATIONS:

Medical consultation and medical examinations will be made available to laboratory personnel who work with hazardous chemicals, as required. All medical examinations and consultations will be performed by or under the direct supervision of a licensed physician and will be provided through the Student Health Center and/or occupational clinic. The opportunity to receive medical attention will be provided to laboratory personnel under the following circumstances:

13.1. Signs or Symptoms - Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory.

13.2. Exposure Monitoring - Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the Permissible Exposure Limit) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements.

13.3. Spill or Leak - In the event of a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected person will be provided an opportunity for a medical consultation. The consultation shall be for the purpose of determining the need for a medical examination.

14.0. PERSONNEL RESPONSIBLE FOR THE CHEMICAL HYGIENE PLAN:

The RM/EHS Office will provide technical information and program support to assist in compliance with the OSHA Laboratory Standard. RM/EHS will maintain the Chemical Hygiene Plan, and Chemical Hygiene Officer responsibilities will reside within RM/EHS. However, it will be the responsibility of the individual laboratory supervisor and department administrator to comply with the components of the Chemical Hygiene Plan.