2019

CAL MARITIME

Chemical Hygiene Safety Plan

INJURY ILLNESS PREVENTION PROGRAM

This sheet should be completed each time the Chemical Hygiene Safety Plan (CHP) is reviewed and/or modified. The Director of Safety and Risk Management is delegated with the responsibility of administrative review and update of this program annually or more frequently as needed per CSU Chancellor's Executive Order 1039 Occupational Health and Safety Policy, 1069 Risk Management as well as Cal Maritime A&F Policy 09-004 IIPP.

Version	Date Approved	Author	Revision Notes:
1.0	09/01/2018	Marianne Spotorno, CSP Dir. Safety & Risk Management	New Program Draft Document
2.0	08/01/2019	Marianne Spotorno, CSP Dir. Safety & Risk Management	• Campus Emergency Response update. • TSGB component update

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1.0 Purpose & Scope

Purpose

The purpose of the Injury Illness Prevention Program (IIPP) is to outline Cal Maritime's environmental health and safety requirements, expectations, and responsibilities in order to achieve effective campus safety performance through Integrated Safety Management (ISM). The Chemical Hygiene Safety Plan (CHP) is a subject specific component the supports the overall University IIPP. The objective of the CHP is to provide specific guidance to individuals who work at or attend Cal Maritime for the control of potentially hazardous occupational exposures to chemical and physical agents in the laboratory environment. This CHP is a "living" document which will need to be updated from time to time to best reflect specific, current conditions and practices. The Department of Safety & Risk Management (SRM) will work with the key stakeholders to keep this document current so that the specific guidance provided herein is operationally accurate and useful.

Cal Maritime's management recognizes that unique chemical and physical hazards may be found in laboratories and shops throughout the Campus and the Training Ship Golden Bear. This CHP is designed to address those hazards by identifying laboratory or shop specific environmental health and safety (EHS) requirements and guidelines. It is a requirement that all instructors, students, laboratory or shop workers, contractors, and visitors who work in these areas be familiar with and follow the requirements of this document.

Scope

The CHP applies to personnel within a laboratory, shop or operating unit where hazardous chemicals are used or stored, or those whose work activities are research-related and involve hazardous chemicals. Use or storage of the hazardous chemicals must be consistent with "laboratory use" to be covered by *8 CCR §5191* and the CHP. "Laboratory use," means that:

1. Chemical manipulations are carried out on a "*laboratory scale*".
2. Multiple chemicals or chemical procedures are used.
3. Activities are not part of or simulating a production process.
4. Protective laboratory practices and equipment are available and in common use.

At a minimum, this definition includes employees who use chemicals in teaching and research laboratories or shops at Cal Maritime. Also, it is Cal Maritime policy that students in laboratories or shops, while not legally covered by this standard, are afforded the same level of protection as Cal Maritime employees.

The CHP does not apply to research involving exclusively radiological or biological materials

Cal Maritime has also established a Hazard Communication Program that complies with CCR, Title 8, Section 5194 (*8 CCR §5194*), which is directly applicable to personnel that may handle hazardous chemicals in most non-laboratory workplaces. Consult with the Department of Safety and Risk Management with questions regarding the applicability of the *Hazard Communication Program*. The information presented in the CHP represents best practices and provides a broad overview of the information necessary for the safe operation of laboratories that utilize hazardous chemicals. **It is not intended to be all inclusive.** Laboratories, technical areas, or other work units engaged in activities with hazardous chemicals possessing unusual characteristics, or are otherwise not sufficiently covered in the written CHP and supporting materials, must augment the CHP with a laboratory-specific Laboratory Safety Plan (LSP) addressing the hazards and how to mitigate their associated risks, as appropriate.

This Manual applies to all Cal Maritime operations, maintenance and construction activities under the supervision of Cal Maritime personnel. For activities associated with the Training Ship Golden Bear (TSGB) refer to the Vessel Operating Manual (VOM) and/or Shoreside Administrative Manual (SAM). The TSGB is a subject specific component that supports the overall University IIPP.

1.1 Regulatory Standards Reference

Cal Maritime and its subcontractors shall comply with the following requirements.
In case of conflict or overlap of the below references, the most stringent provision shall apply.

- *8 CCR §3203, "Injury and Illness Prevention Program"*
- *8 CCR §3380, "Personal Protective Devices"*
- *8 CCR §5143, "General Requirements of Mechanical Ventilation Systems"*
- *8 CCR §5154.1, "Ventilation Requirements for Laboratory-Type Hood Operations"*
- *8 CCR §5164, "Storage of Hazardous Substances"*
- *8 CCR §5191, "Occupational Exposures to Hazardous Chemicals in Laboratories"*
- *8 CCR §5194, "Hazard Communication"*
- *8 CCR Article 110, "Regulated Carcinogens"*

Other applicable regulations include those promulgated by the U.S. Department of Labor including *29 CFR 1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories* (the "Laboratory Standard"). These regulations require that the CHP be readily available wherever potentially hazardous chemicals are used, handled or stored. Also applicable is the *General Duty Clause* of the Occupational Safety and Health Act which states:

"Each employer:

1. Shall furnish to each of his employees employment and a place which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employee.
2. Shall comply with occupational safety and health standards promulgated under this Act.

Each employee shall comply with occupational safety and health standards and all rules, regulations, and orders issued pursuant to this Act which are applicable to his own actions and conduct."

1.2 CSU-System & Cal Maritime Specific Reference

For additional information on Cal Maritime environmental health and safety policies, refer to:

- CSU Executive Order 1039, 1056, 1069
- Cal Maritime Policy AF 09-003, AF 09-004

1.3 Other Resources

- U. S. Department of Transportation (*DOT)*
- National Fire Protection Association (*NFPA)*
- Hazardous Materials Identification System (*HMIS*)

2.0 Administrative Duties & Responsibilities

It is the policy of the Cal Maritime to maintain a safe and healthy work environment for each employee (including student and contract employees), and to comply with all applicable occupational health and safety regulations. This Injury and Illness Prevention Program (IIPP) is intended to establish a framework for identifying and correcting workplace hazards within the department, while addressing legal requirements for a formal, written IIPP.

To assist Cal Maritime in providing a safe, compliant, environmentally sound, and more sustainable operation, each department or operational unit is expected to review, understand, and follow the guidance provided in the Injury Illness Prevention Program components and the and the function of the integrated campus safety management system (ICSMS) as related to operations under their control.

In a proactive behavior based environmental health and safety model that entire campus community participation reflects a process that embraces the ability to;

- Eliminate adverse conditions which may result in injury or illness,
- Recommend the establishment of programs to raise safety consciousness in the community, and
- Achieve and maintain a beneficial relationship through continuing communication on issues relating to environmental health and occupational safety.

2.1 Employees (Including Student workers)

Employees and other personnel who work in University facilities have the right to be informed about the potential health hazards of the chemicals in their work areas and to be properly trained to work safely with these substances. This includes custodial staff and other personnel who work to clean and maintain laboratories. Employees have the right to file a complaint with California Occupational Safety and Health Administration (Cal/OSHA) if they feel they are being exposed to unsafe or unhealthy work conditions, and they cannot be discharged, suspended, or otherwise disciplined by their employer for filing a complaint or exercising these rights. All personnel working with hazardous chemicals are encouraged to report (anonymously, if preferred) any concerns about unsafe work conditions to SRM at (707) 654-1076 or by using the online hazard report; “Report a Safety Concern” on the SRM website.

It is the responsibility of all faculty and staff to proactively participate and subsequently comply with all applicable health and safety regulations, Cal Maritime policies, and established safe work practices. This includes, but is not limited to:

- Observing health and safety-related signs, posters, warning signals and directions.
- Learning about the potential hazards of assigned tasks and work areas.
- Taking part in appropriate health and safety training.
- Following all safe operating procedures and precautions.
- Participating in workplace safety inspections
- Using proper personal protective equipment.
- Inform coworkers and supervisors of defective equipment and other workplace hazards without fear of reprisal.
- Reviewing the building emergency plan and assembly area.
- Reporting unsafe conditions immediately to a supervisor, and stopping work if an imminent hazard is presented.

2.2 Department of Safety and Risk Management (SRM)

The Director of Safety and Risk Management (SRM), as delegated by the University President, is responsible for the implementation and administrative management for Cal Maritime’s Injury Illness Prevention Program (IIPP) that meets the requirements of California Code of Regulations (CCR), Title 8, section 3203) as well as other applicable California and Federal Occupational Safety and Health (Cal-OSHA) requirements.

Further responsibilities are outlined below:

- Provide advice and guidance to all university personnel concerning IIPP compliance requirements;
- Provide centralized monitoring of campus activities related to implementation of campus IIPP;
- Ensure scheduled periodic safety inspections are performed in compliance with regulatory requirements and assist management staff in identifying unsafe or unhealthful conditions;
- Ensure safety and health training programs comply with regulatory requirements and university policy;
- Oversee the maintenance of safety and health records consistent with the requirements of this document and regulatory mandates;

- Ensure program audits, both scheduled and as required by a process, equipment or personnel change, or by a safety program mandate, are performed;
- Interpret existing or pending safety and health legislation and recommend appropriate compliance strategies to university personnel;
- Maintain centralized environmental and employee monitoring records, allowing employee access as directed by law.
- Conduct at least an annual review of this document and make the current revision available on the SRM web site.

2.3 Deans, Directors, Department or Operating Unit Management

Campus Department or Operating Unit Head leadership have an integral campus role and shall have a thorough understanding of Injury Illness Prevention Program components and the function of the integrated campus safety management system (ICSMS) as related to operations under their control.

- The Department Head has primary authority and responsibility to ensure the health and safety of the department's faculty, staff and students through the implementation of the Injury Illness Prevention Program components. This is accomplished by communicating the Cal Maritime's campus emphasis on health and safety, analyzing work procedures for hazard identification and correction, ensuring regular workplace inspections, providing health and safety training, and encouraging prompt employee reporting of health and safety concerns without fear of reprisal.
- Specific areas include employee and student (both student employees and students in academic programs) education and training, identification and correction of unsafe conditions, and record keeping. It is recognized that a substantial amount of responsibility falls at this level.
- Colleges and Departments are encouraged to designate an individual as the College or department safety coordinator, to assist with specific operational environmental health and safety process management components.

2.4 Supervisors and Principal Investigators

Supervisors play a key role in the implementation of the Cal Maritime's Injury Illness Prevention Program components. Supervisors may be Management, Senior Research Associates, Department Chairs, Principal Investigators, or others who oversee a project and/or staff. They are responsible for but not limited to:

- Communicating to their staff and students about Cal Maritime campus's emphasis on health and safety.
- Ensuring periodic, documented inspection of workspaces under their authority.
- Promptly correcting identified hazards.
- Modeling and enforcing safe and healthful work practices.
- Providing appropriate safety training and personal protective equipment.
- Implementing measures to eliminate or control workplace hazards.
- Stopping any employee's work that poses an imminent hazard to either the employee or any other individual.
- Encouraging employees to report health and safety issues without fear of reprisal.

2.5 Academic Programming Faculty and Advisors

It is the responsibility of Faculty, Academic Programming Advisors other Cal Maritime related activities and student clubs to:

- Develop procedures to ensure effective compliance and support of the Injury and Illness Prevention Program components as it relates to operations under their control. Specific areas of responsibility include student education and training, identification and correction of unsafe conditions, and incident reporting.
- Develop and maintain written classroom, laboratory, and activity procedures which conform to regulatory, campus and departmental guidelines.
- Instruct students in the recognition, avoidance, and response to unsafe conditions, including hazards associated with non-routine tasks and emergency operations
- Permit only those persons qualified by education and training to operate potentially hazardous equipment or use hazardous materials, unless under close supervision.
- Supervise students in the performance of activities.

2.6 Students- Cadets

Students are expected to always adhere to safety practices presented by faculty, technical staff, student assistants, graduate assistants or other authorized individuals. They must also report potentially hazardous conditions that become known to them. These reports should be made to their supervisors, faculty advisers, Department of Safety and Risk Management, or other responsible parties.

2.7 Chemical Hygiene Officer

The Cal-OSHA standard requires a Chemical Hygiene Officer be designated for each laboratory facility. This officer is qualified either through training or experience to oversee the development and implementation of the CHP. This designated officer may hold another job title provided he or she is technically competent to fulfill the responsibilities of both job titles. The Chemical Hygiene Officer (CHO), is responsible for:

- Providing technical guidance and assisting the in the development and implementation of the Chemical Hygiene Plan.
- Assisting with the development and documentation of Safe Work Practices for the laboratory.
- Overseeing and arranging for the monitoring of worker exposures to hazardous materials as defined by the Laboratory Standard.
- Organizing the inspection of the laboratories for the purposes of identifying and facilitating necessary modifications/changes for continual compliance on an annual basis.
- Reviewing, the CHP annually with SRM Director and updating it as necessary to remain current.
- Work with the Department of Safety and Risk Management (SRM) to maintain current Material Safety Data Sheets for all chemicals and other hazardous materials inventory in Chemical Inventory System (CIS). And ensure related information is available to all employees and students at any time the lab is accessible.
- Coordinate the annual and periodic inventories of the chemical and hazardous materials storage area(s).
- Coordinate completion of the Laboratory Check-In and Checkout forms when personnel leave, or move into, a laboratory.
- Coordinate completion of the Laboratory Decommissioning Checklist when a laboratory space is decommissioned.
- Coordinate the completion and submission of the appropriate paperwork required for purchase, use, storage, and disposal of hazardous materials.
- Coordinate hazardous materials disposal and complete associated documentation

2.8 Facilities Management

The Facilities Department is responsible for:

- Reviewing and approving laboratory equipment installations for compliance with pertinent building codes and regulations.
- Maintaining and servicing facilities-related equipment which services laboratories including local exhaust ventilation systems and emergency/life safety equipment (e.g. building fire alarms and fire extinguishers).
- Providing guidance to Laboratory management, researchers, and the CHO regarding appropriate engineering control installations for chemical and physical hazards.
- Testing the performance of laboratory exhaust hoods annually.

2.10 Chemical Handlers

Responsibilities for all personnel who handle dangerous or potentially dangerous chemicals. All personnel in research or teaching laboratories that use, handle or store potentially hazardous chemicals are responsible for:

- Reviewing, understanding, and following requirements of the: CHP; all applicable Safety Manual(s), Programs, and Policies; and any applicable individual Laboratory Safety Plans.
- Following all required verbal and written workplace safety rules, regulations, and SOPs.
- Developing good personal chemical hygiene habits, including but not limited to, keeping work areas safe and uncluttered, cleaning up following work activities, and practicing good housekeeping in the workplace.
- Planning, reviewing, and understanding the hazards of materials and processes in their laboratory research or other work procedures prior to conducting work.
- Utilizing appropriate measures to control identified hazards, including consistent and proper use of engineering controls, administrative controls, and PPE.
- Understanding the capabilities and limitations of PPE issued to them, and properly maintaining this PPE.

- Being prepared for laboratory accidents and knowing emergency response procedures.
- Gaining prior approval from the PI/Laboratory Supervisor for the use of restricted chemicals and other materials or equipment.
- Gaining prior approval from the PI/Laboratory Supervisor for the purchase of any new chemicals for the laboratory or research activities.
- Consulting with PI/Laboratory Supervisor before using higher risk chemicals (*e.g.,* particularly hazardous substances, explosives and other highly reactive chemicals), or conducting certain higher risk experimental procedures. Notifying other laboratory members of the hazards posed by the chemicals/activities prior to beginning work.
- Immediately reporting all *accidents*, *incidents* (including *near-misses*), injuries, and unsafe laboratory conditions/activities to the PI/Laboratory Supervisor.
- Immediately reporting any fires or fire extinguisher discharge, even if the fire is extinguished, to the Fire Department and the PI/Laboratory Supervisor.
- Immediately reporting any new or previously unrecognized workplace hazards within their department to their PI/Laboratory Supervisor or SRM.
- Completing all required health, safety, and environmental training and providing documentation to their supervisor.
- Participating in the medical surveillance program, when required.
- Informing the PI/Laboratory Supervisor of any work modifications ordered by a physician as a result of medical surveillance, occupational injury, or exposure.
- Discussing with the PI/Laboratory Supervisor, and receiving prior approval for, any activities and procedures that are to be conducted while alone in the laboratory.
- When performing independent research or work:
    - Reviewing the written plan or scope of work for their proposed research with the PI/Laboratory Supervisor.
    - Notifying in writing and consulting with the PI/Laboratory Supervisor in advance if they intend to deviate from previously reviewed procedures (Note: changes may include, but are not limited to, change in the objectives, change in
- PI, change in the duration, quantity, frequency, temperature or location, increase or change in PPE, and reduction or elimination of engineering controls.).
- Preparing SOPs and performing literature searches relevant to safety and health appropriate for their work.
- Providing appropriate oversight, training, and safety information to laboratory or other personnel they supervise or direct.
- On termination or transfer of laboratory personnel, all their related hazardous materials (including chemicals and samples) shall be properly disposed, or transferred to the PI/Laboratory Supervisor or a designee, with the chemical inventory updated appropriately.

2.11 Chemical and Hazardous Material Purchasers

Chemical and Hazardous Material Purchasers includes any individuals that are delegated with the authority by department or operating nit management to purchase materials. Purchasers are expected to perform the following activities:

- Read and understand the Chemical Hygiene Plan as well as the Hazardous Materials Management Plan.
- Complete the applicable training associated with Chemical and Hazardous Materials Management.
- Purchase materials as outlined in the CHP, HMMP and other Cal Maritime policies and guidance. This includes completion and submission of the appropriate paperwork required for purchasing hazardous materials.
- Provide feedback and ideas regarding improvements to the CHP and HMMP based upon their implementation of its guidelines and procedures.

3.0 General Requirements

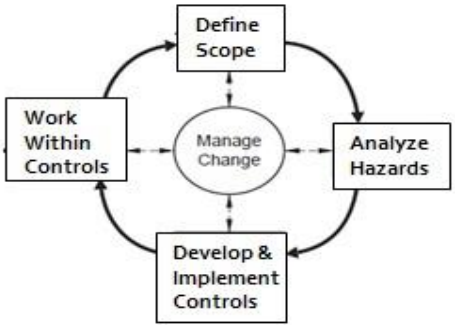
3.1 Hazard Identification, Risk Assessment & Control (HIRAC)

3.1.1 Integrated Campus Safety Management System (ICSMS)

Cal Maritime is committed to having all campus-related work performed safely and in a manner that strives for the highest degree of protection for the Campus Community. To achieve these goals, Cal Maritime implements, the principles of safety through an Integrated Campus Safety Management System (ICSMS).

Simply put, ICSMS applies a plan-do-check-act approach to campus safety management. Five core activities represent the plan-do-check-act approach, and comprise the underlying process for any construction work activity. The five core activities are:

1) Define the Scope of Work
2) Analyze the Hazards
3) Develop and Implement Hazard Controls
4) Perform Work Within Controls
5) Provide Feedback and Manage Change



The identification and analysis of workplace hazards is part of the pre-work planning process. The goal of this core activity is to ensure that the hazards associated with construction work activities are clearly understood and appropriately managed. All new campus work activities, changes to existing work or introduction of new equipment or processes (which introduce new hazards or increase the hazard level) need to be reviewed to analyze hazards, identify safety standards/requirements, and establish appropriate controls. Safety conditions and requirements need to be formally established and in place before construction work is initiated.

The campus Job Hazards Analysis (JHA) process is the principle method for achieving this.

3.1.2 Hazard Identification, Risk Assessment & Determining Control Table (HIRAC)

The environmental health and safety (EHS) Hazard Identification, Risk Assessment and Determining Control Table (HIRAC) process is used to identify, assess and risk-rank Cal Maritime campus-related activities in order to ensure that Cal Maritime Campus Safety programs, activities and work controls are appropriately addressing construction risks. The initial HIRAC assessment and risk-ranking of campus-related activities was conducted during the third quarter, AY 2016-2017. The HIRAC assessment will be reviewed annually, when new campus-related activities are introduced that create or modify assessed risks, and when worksite observations or accident/incident experience identify previously unrecognized or incorrectly categorized risks.

3.1.3 Application of Hierarchy of Controls

In developing hazard controls and preparing the Job Hazard Analysis submittal, the campus shall select means and methods to mitigate worker exposure to workplace hazards using the Hierarchy of Controls as specified in the American National Standards Institute (ANSI) Z10-2005 Occupational Health and Safety Management Systems.
The campus shall make a good faith effort to analyze each hazard and identify the appropriate control(s) using the following hierarchy:

- Elimination or substitution of the hazards where feasible and appropriate;
- Use of engineering controls where feasible and appropriate;
- Application of work practices and administrative controls that limit worker exposures; and
- Provision and use of personal protective equipment

3.1.4 Job Hazards Analysis (JHA)

For the purposes of this section Job Hazard Analysis (JHA) and Job Safety Analysis (JSA) can be used synonymously. A JHA/JSA can be incorporated into a Pre Task Plan, provided there is a section for employees to review, comment and sign. Core components of the scope of work and relative hazards can be electronically completed ahead of time, provided there is room for current site conditions are able to be readily added as applicable. When the scope or conditions change, the change in work plan should be noted in a different colored pen with employee's initially that they have been briefed on the change.
The Department of Safety and Risk Management will work with individual Departments to develop a master Campus JHA library.

- Each employee scheduled to work in the activities identified below shall receive safety training in those activities prior to working on them.

- Subcontractors shall submit a Job Hazards Analysis (JHA) for those construction activities meeting the requirements for performing JHA (see below). The JHA shall be reviewed and authorized to proceed by the Cal Maritime Department of Safety and Risk Management before work commences.
- Subcontractor shall be responsible for submitting a JHA and work procedures to Cal Maritime Department of Safety and Risk Management for review a minimum of seven days prior to the start of work for most work activities.

3.1.4.1 JHA Requirements

A JHA shall be written based on the following conditions:

- Jobs with the highest injury or illness rates
- Jobs with the potential to cause severe or disabling injuries or illness, even if there is no history of previous accidents
- Jobs in which one simple human error could lead to a severe accident or injury
- Jobs that are new to your operation or have undergone changes in processes and procedures
- Jobs complex enough to require written instructions.

If not otherwise specified in a particular project specification, the JHA shall be performed in accordance with the OSHA 3071.

JHA processes. In general the JHA will include:

- Description of work phase or activity
- Identification of potential hazards associated with the activity
- Address further hazards revealed by supplemental site information (e.g., site characterization data, as-built drawings) provided by the subcontractors construction manager.
- A list of the Subcontractor's planned controls to mitigate the identified hazards
- Identification of specialized training required
- Identification of special permits required
- Name of the Competent Person(s) responsible for inspecting the activity and ensuring that all proposed safety measures are followed.

3.2 Hazard Assessment

⚠ *Note: Each work task will have its own JHA, refer to the JHA Library for more details.*

GENERAL HAZARD IDENTIFICATION & CONTROL MEASURES FOR CHEMICAL & EQUIPMENT USE			
TASK	**HAZARD**		**HAZARD CONTROLS & PROTECTION MEASURES**
CHEMICAL & EQUIPMENT USE	**Trip or fall hazards**		Walking/working surfaces training for working around uneven, wet and slippery surfaces (includes warning to others of slippery surfaces); use cord cover and keep out of traffic areas
	Cuts, crush, pinch, etc. during operation and/or maintenance of equipment		⚠ Keep protective guards in place; disconnect from power source before servicing; use lockout-tagout; use PPE; keep away from power lines
	Periodic lifting/climbing/bending/stooping		Use proper lifting techniques; Ergonomic training; use dolly/cars.
	Exposure to hazardous and carcinogenic chemicals		Wear PPE (gloves, respirators, safety glasses, etc.) as appropriate; refer to MSDS; report spills immediately; practice universal precautions; prohibit eating & drinking in work areas; use fume hood whenever necessary; ensure fume hood is working properly; keep small quantities of keep chemicals to limits size of spills; eliminate use carcinogenic materials as much as possible; limit exposure to know substances and use protective coverings; have absorbent materials handy in case of spills; refer to materials safety data sheet
	Cuts/punctures from sharp instrument		Use caution and proper techniques; sterilize equipment; use sharps containers
	Skin burns, eye/nasal irritation, spills		Good ventilation, chemicals stored in small quantities to keep spills to minimum and to provide easy handling. Store flammables in fire- resistant cabinets. Have absorbent materials readily available in case of spills
	Potential electrical shock		Avoid working around electrical equipment or outlets; ensure insulation on electrical cord is unbroken

TRAINING REQUIREMENTS

DO NOT use this equipment unless an instructor or shop supervisor has instructed you in the safe use and operation and has authorized you to operate this equipment.

✓ IIPP	✓ Dept. Specific	✓ Operators/Owner's Manual	✓ Other:

PERSONAL PROTECTIVE EQUIPMENT

Eye Protection	Foot Protection	Hand Protection	Hearing Protection	Body Protection	Head Protection	Respiratory Protection	Fall Protection	Face Shield	OTHER
When exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation...	When working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, or will protect the affected	When hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; chemical burns	When exposed to a time weighted average noise level of 85 dBA or higher over an 8 hour work shift.	When exposure to: Intense heat, hot metals, other hot liquids Impacts from materials that can cut, burn Hazardous chemicals Or potentially infectious materials	Where there is a potential for injury to the head from falling objects and/or when there is a risk of impact to head	May be required if removal of contaminants from the air does not fall below permissible exposure level.	When there is a risk of falling from a height greater than 4ft GSO 6ft CSO 6ft MSO When working in confined space	Face shield can be used over the glasses if there is a presence of a lot of flying debris.	

3.2.1 Hazardous Materials and Reproductive Effects

Both men and women may be exposed to hazardous agents that pose a reproductive hazard such as infertility, hormonal changes, birth defects and genetic damage. These agents include ionizing radiation, alcohol, cigarette smoke, pharmaceuticals, and some of the thousands of different chemicals that are used in the home or workplace. Although many of these have been tested to determine whether they cause acute (immediate) effects on the body, few have been studied to see if they cause birth defects (teratogens) or genetic defects (mutagens). Even fewer have been studied to see if they can cause infertility, reduced sperm count, menstrual disorders, or other disorders relating to reproduction. Therefore, SRM and the CHO designate shall consider the potential reproductive effects of chemicals prior to selecting materials for use, and where feasible, preclude or limit their use.

3.2.2 Hazardous Materials and Pregnancy

The primary path for hazardous substances to reach an unborn child is through the placenta. Many chemicals and drugs that enter a pregnant woman's body (through breathing, swallowing, absorption through the skin, etc.) will eventually enter the mother's blood circulation, cross the placenta and thus affect the developing fetus. In general, the important questions of exactly how much of the toxic substance that enters the mother's body will reach the fetus, or what concentration the fetus can tolerate without harmful effects have not yet been answered.

The fetus is usually most vulnerable in the early weeks of pregnancy (first 13 weeks or trimester) but may also be at risk later in pregnancy. In light of the potential harm from workplace exposures to both the pregnant woman and her developing fetus, it is important for the woman to inform her supervisor of her pregnancy as soon as possible, so that necessary steps to avoid exposure to reproductive toxins can be taken. This recommendation is not intended to discriminate against women; rather, it is intended to provide the pregnant woman with information about the possible hazards and her options.

Workplace hazard and PPE assessments are required, see *8 CCR §3380* "Personal Protective Equipment", for all locations where: A) there is use or storage of hazardous materials, or B) where equipment may present a physical hazard. Detailed Cal Maritime policy requirements and guidance are provided in Personal Protective Equipment Program. Related requirements include:

- Written hazard assessments
- Identification of required PPE
- Training and refresher training
- Posting of area hazards and required PPE

The Laboratory Hazard Assessment Tool (LHAT) categorizes chemical and other types of hazards and specifies the appropriate PPE for each hazard. Note that the LHAT does not identify all the hazards present in a particular work environment. PIs/Laboratory Supervisors must evaluate whether there are additional hazards in their laboratories not addressed by the LHAT. Once the appropriate PPE is identified for the active worker and individuals in the adjacent area, the PI/Laboratory Supervisor must provide the required PPE to all personnel and conduct and document training on the proper use of the PPE. PIs and Laboratory Supervisors are required to provide information to SRM concerning: the laboratory location; laboratory personnel roster, identity of the Laboratory or Facility Supervisor; the Laboratory Safety Coordinator, if applicable; and certify the assessment and training was successfully completed.

Laboratory Hazard Control Measures & Equipment

Overview

- SRM will measure an employee's anticipated worse-case exposure to any regulated hazardous chemical if there is reason to believe that exposure levels for that chemical routinely exceed the action level [one-half of the Cal-OSHA Permissible Exposure Level (PEL)], or in the absence of an action level, the (PEL) or Threshold Limit Value (TLV).
- Routine monitoring of airborne concentrations is not usually justified nor practical in laboratories, but may be appropriate when testing, redesigning or introducing new fume hoods or other exhaust ventilation devices, or when a highly hazardous chemical or process is used in a manner which is likely to cause exposure.
- The CHO-designate and SRM will promptly investigate all employee-reported incidents in which there is a possibility of employee overexposure to a hazardous chemical. If you suspect that chemical exposures may exceed the PEL, contact the CHO-designate. If symptoms are present, arrange for a visit to Cal Maritime's authorized medical facility.
- Events or circumstances that might reasonably constitute overexposure include:

- A hazardous chemical leaked, spilled, or otherwise was released in an uncontrolled manner.
- Direct skin or eye contact with a hazardous chemical.
- Faculty or staff manifests symptoms, such as a headache, rash, nausea, coughing, tearing, irritation or redness of eyes, irritation of nose or throat, dizziness, loss of motor dexterity or judgment, and
- Some or all of the symptoms disappear when the person is taken away from the exposure area and breathes fresh air, and
- The symptoms reappear soon after the employee returns to work with the same hazardous chemicals.
- Two or more persons in the same laboratory work area have similar complaints.

Chemical Control Criteria Guidelines

- Exposures by inhalation of airborne contaminants (gases, vapors, fumes, dusts, and mists) must not exceed levels listed as permissible exposure limit (PEL) by Cal-OSHA in the latest edition of Threshold Limit Values of Airborne Contaminants (TLV) published by the American Conference of Governmental Industrial Hygienists (ACGIH), whichever is lowest. These TLV levels refer to airborne concentrations of substances and represent conditions under which it is believed that workers may be repeatedly exposed without adverse effect. TLVs are normally published on manufacturer's Material Safety Data Sheets (MSDS), which are available in the laboratory area or through SRM.
- In all cases of potentially harmful exposure, feasible engineering or administrative controls must first be established. In cases where respiratory protective equipment alone or with other control measures is required to protect the employee, the protective equipment must be approved by the CHO-designate for each specific use.

Hazard Control Prioritization

- No laboratory can rely on one particular type of control technology to ensure that exposures to hazardous chemical agents are kept as low as reasonably achievable. The primary and most effective approach is through the use of engineering controls. Complementing the engineering controls should be the correct combination of administrative procedures and the use of personal protective equipment.

Recirculation of Air

- Recirculation of contaminated exhaust air in laboratories using toxic, corrosive, flammable or other hazardous agents is prohibited.
- Laboratory facilities using carcinogens and acute toxins, that, if released, could pose a personal injury or environmental impact risk, shall be designed so that a negative pressure differential exists between the laboratory and the exit corridor(s) servicing the laboratory. The only exception to this is where clean room requirements mandate that the room be under positive pressure with respect to the surrounding facilities.

Laboratory Hoods General Principles

- Laboratory exhaust hoods should be considered as backup devices that can contain and exhaust toxic, offensive, or flammable materials when the material being used on the design of an experiment causes vapors, gas, or dust to escape from the apparatus being used.
- Hoods are not regarded as a means for disposing of chemicals.
- Hoods should be evaluated by operators prior to and during each use by means of simple visual indicators (such as mylar strips) for adequate airflow.
- Except when adjustments of apparatus within the hood are being made, the hood sash should be kept closed. If the hood does not have a bypass grill, then the sash should be left open at least six inches to avoid the flow from being choked off. Vertical sashes should be left down and horizontal sashes closed. Sliding sashes should not be removed from horizontal sliding-sash hoods.
- During operations, keep the face opening of a hood as small as possible to improve the performance of the hood. Reducing the opening in the laboratory hood may also provide protection from explosions due to chemical reactions, over pressure, etc.
- Performance of a hood depends upon such factors as the placement of materials and equipment in the hood, room drafts from open doors or windows, turbulence caused by persons walking by, and the presence of the user in front of the hood. Keep apparatus back from the front edge of the hood to reduce the potential for contaminant release.
- Hoods are not intended for storage of chemicals. Materials stored in hoods should be kept to a minimum. Stored chemicals should not block vents or alter airflow patterns. Chemicals not in use should be covered or capped.

- Laboratory workers should be prepared for the event of ventilation failure or other unexpected occurrences such as fire or explosion in the hood.
- Mechanical ventilation must remain in operation at all times when hoods are in use and for a sufficient time thereafter to clear hoods of airborne hazardous substances. When mechanical ventilation is not in operation, hazardous substances in the hood must be covered or capped off.
- Hoods must be inspected frequently and cleaned as necessary to ensure adequate airflow and the prevention of residue buildup. The Facilities Department shall conduct an annual ventilation survey and post flow rate and date of test on each hood.

Hood Construction

- Newly purchased laboratory hoods and installed exhaust ducting for solvent operations shall be constructed of non-combustible materials to reduce the potential of damage should a fire occur within the workstation.
- Newly purchased laboratory hoods and exhaust ducting for corrosive applications shall be constructed from or coated with, materials that are resistant to corrosive compounds.
- Provisions must be made for adequate make up air for all hoods that are used in a laboratory.
- General airflow should not be turbulent and should be relatively uniform throughout the laboratory.
- Laboratory-type hood face velocities (including wet bench enclosures) must be sufficient to maintain an inward flow of air at all openings into the hood under normal operating conditions. Air flow into hoods depends upon configuration but must be at a minimum average face velocity of at least 100 linear feet per minute (lfpm) with a minimum of 70 lfpm at any point, except where more stringent special requirements are identified. Hoods used for carcinogen control must have minimum face velocity of 150 lfpm with a minimum of 125 lfpm at any point.
- The face velocity must be obtainable with the movable sashes opened at least 18". Where the required velocity can be obtained by partly closing the sash, the sash and/or jamb must be marked to show the maximum opening at which the hood face velocity meets the requirements. Any hood failing to meet the requirements must be considered deficient in airflow and must be posted with placards, plainly visible, which prohibit use of hazardous substances within the hood.
- When sufficient quantities of flammable gases or liquids are used, or when combustible liquids are heated above their flash points, hoods that are not bypassed must have permanent stops installed which restrict closure of the sash so that sufficient airflow is maintained to prevent explosions. Concentrations in the duct must not exceed 10% of the lower explosive/flammable limit.
- Exhaust fan systems must be non-sparking where ignition sources are isolated if exhausting sufficient quantities of flammable vapors and corrosion resistant if handling corrosive fumes.
- Exhaust stacks must be located in such a manner with respect to air intakes as to preclude the recirculation of laboratory hood emissions within a building.
- Laboratory hoods must be seismically braced to prevent toppling or sliding during an earthquake.
- Perchloric acid must be used in a closed system or within a specially designated acid fume hood with wash down systems to prevent the accumulation of explosive perchlorates in the fume hood.

Other Ventilation Systems

- Other local exhaust systems used in the laboratory, should be coordinated by Facilities Department in accordance with ACGIH, American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), National Fire Protection Association (NFPA) requirements and other nationally recognized standards.
- Do not attach canopy hoods or snorkel systems to existing fume hood exhaust ducts without consulting Facilities.
- Glove boxes generally operate under negative pressure, though some operate under positive pressure, in which case, leaks could cause problems. Positive pressure glove boxes should be thoroughly tested before each use and there should be a method of monitoring the integrity of the system (such as a shutoff valve or a pressure gauge designed into the system).
- Laboratory apparatus that may discharge hazardous vapors (vacuum pumps and distillation columns) should be vented to an auxiliary local exhaust system such as direct ducting, canopy, or snorkel hoods.

3.3 General Safe Laboratory & Shop Work Practices

3.3.1 General Principles

The most important administrative controls for hazardous operations are the safe work practices that are developed and used in the Laboratory. **Safe work practices** are those practices used in a laboratory operation, which have been communicated via on-the-job training, through reading of equipment and process specifications, and through reading of general safety information.

Written safe work practices are required for "high hazard" operations and recommended for other potentially hazardous operations. Safe work practices should be developed by the faculty and maintained in appendix of this document. A list of possible "high hazard" operations requiring Safe Work Practices by classification is provided below.

The number of hazardous chemicals and the number of reactions among them is so large that previous knowledge of all potential hazards cannot be at Cal Maritime. Therefore, when the chemical properties of a material are not fully known, it should be at Cal Maritime hazardous and used in the smallest quantity possible. This will minimize exposure potential, and thus, reduce the probable magnitude of unexpected chemical events.

The following general safety principles should be observed by all personnel when working with chemicals:

- Substitute less toxic materials whenever possible (e.g., toluene may be substituted for benzene).
- Minimize all chemical exposures through the use of engineering (e.g., lab-hoods), administrative (e.g. Safe Work Practices), and personal protective (e.g. gloves) controls.
- Obtain and read the Material Safety Data Sheets (MSDS) and other hazard information on solids, liquids, and gases used to support laboratory operations.
- Confine long hair and loose clothing in the laboratory.
- Be knowledgeable in the use of laboratory emergency equipment such as eyewashes, showers, and fire extinguishers, and receive information about how to obtain additional help in an emergency.
- Carefully label or cross-reference every secondary container with the identity of its contents. Appropriate hazard warnings will be required if more than one person will be using the secondary container or if the container is to be left unattended for more than half an hour.
- Utilize equipment only for its designed purpose.
- Keep the work area clean and orderly.
- Determine compatibility of chemicals and store incompatibles separately.
- Provide a means of containing the materials if equipment or containers should break or spill their contents (secondary containment). A pre-determined spill abatement procedure should be part of the Safe Operating Procedure which covers the use of the chemical.
- Limit the volume of volatile or flammable materials to the minimum needed for short operation periods.
- Position and clamp reaction apparatus thoughtfully in order to permit manipulation without the need to move the apparatus until the entire reaction is complete. Combine reagents in appropriate order.
- All chemical storage cabinets and racks, and all laboratory equipment using hazardous materials shall be seismically braced in accordance with best structural engineering practices.
- **A**lways **A**dd **A**cids to water to avoid reactions and splattering.

Health and Hygiene

- NEVER use mouth suction to pipette chemicals or to start a siphon; a pipette bulb or an aspirator should be used to provide vacuum.
- Contamination of food, drink, and smoking materials is a potential route for exposure to toxic substances. Food shall be stored, handled, and consumed in areas free of hazardous substances.
- Food and drink shall not be permitted in areas where chemicals or chemical equipment are being used.
- Glassware or utensils that have been used for laboratory operations should never be used to prepare or consume food or beverages. Laboratory refrigerators and ice chests shall not be used for food storage.
- Thoroughly wash hands and remove contaminated lab coats etc. prior to leaving laboratory.

Example High Hazard Operations Requiring Written Safe Work Practices

- Equipment and processes which use carcinogenic, mutagenic, or teratogenic substances.

- Equipment or processes which use more than 2 pint/ 2 pound of organic solvents, acids, bases, oxidizers, heavy metals, toxic materials.
- Equipment or processes which involve accessible hazardous electricity or ionizing and non-ionizing radiation, including laser light.
- Powered machining areas and equipment.

3.3.2 Access to Cal Maritime Laboratories

Access to Cal Maritime Laboratories is controlled by Faculty and Technicians. Cal Maritime requires that every employee, visitor, contractor, or other person performing work in the lab be familiar with, and observe the applicable Cal Maritime environmental health and safety requirements for the University. New employees and, where appropriate, contractors, students and visitors are required to receive chemical safety and hazard training matched to their responsibilities and duties. The responsible Faculty ensures that this requirement is met in their areas.

3.2.1 Unattended Operations & Working Alone

Cal Maritime does not allow for students to work alone in any of the University labs or shops. A faculty, lab technician or other designated staff member must be on Campus at all times the lab or shop is accessible.

Unattended Operations

Precautions should be taken for unattended laboratory operations that are carried out continuously or overnight. Unattended operations should be designed to be safe, and plans should be made to avoid hazards in case of failure. If possible, make arrangements for routine surveillance (e.g., each hour) of the operation, leave the lights on, and leave an appropriate sign on the door to indicate that the operation is going but has been left unattended.

- Names and telephone numbers of lab operator(s) are to be posted on the entrance door for unattended operations.
- Operations requiring cooling water shall employ monitoring devices that will shut the operation down in the event of water supply failure.
- In general, it is imprudent to work in laboratories alone. Arrangements should be made between individuals working in separate laboratories to crosscheck with one another periodically.
- Laboratory work known to be hazardous must not be undertaken by faculty/staff alone in a laboratory. At least two persons must be present. Safe Work Practices shall specify this requirement.
- For hazardous operations (as determined by the faculty supervisor or regulation), students shall not be left unsupervised while working in the laboratory.

Working Alone

Cal Maritime employees shall not work alone in laboratories when involved in highly hazardous operations. Examples of highly hazardous operations follow:

- Confined space entry.
- Conditions requiring the use of Self-Contained Breathing Apparatus (SCBA), air line respirators, or Supplied Air Breathing Apparatus (SABA).
- Work on energized high voltage (600 volts or more) electrical equipment.
- Work involving the potential for atmospheres Immediately Dangerous to Life or Health (IDLH). (e.g., those operations where engineering controls are not in place to preclude IDLH atmospheres from occurring).
- Work on unguarded moving equipment or machinery.
- Work on energized high-pre systems or vessels.
- Work with high-energy materials (i.e., oxidation, polymerization, radioactive, etc.).
- Work in laboratories involving the handling and processing of bulk chemicals (e.g., greater than 1 gallon containers).
- Any other work activity identified by faculty, the Program Administrator or SRM as being too hazardous to be performed alone.

3.3.3 Glassware

The following safe work practices should be observed at all times in the laboratory:

- Careful handling and storage procedures should be used to avoid damaging glassware.
- Adequate hand protection should be used when inserting glass tubing into rubber stoppers or corks or when placing rubber tubing on glass hose connections. Glass tubing should be fire polished or rounded and lubricated, and hands should be held close together to limit movement of glass, should fracture occur. The use of plastic or metal connectors should be considered.

- Glass-blowing operations should not be attempted unless proper annealing facilities are available.
- Vacuum-jacketed glass apparatus should be handled with extreme care to prevent implosions. Equipment such as Dewar flasks should be taped or shielded. Only glassware designed for vacuum work should be used for that purpose.
- Hand protection should be used when picking up broken glass.
- Glass disposal boxes should be made available where broken glass may be generated. When glass boxes are full, the Recycling Department should be contacted for pick-up and disposal.
- Proper instruction should be provided in the use of glass equipment designed for specialized tasks, which can represent unusual risks for the first-time user. (For example, separatory funnels containing volatile solvents can develop considerable pressure during use.)

3.3.4 Housekeeping

The following housekeeping practices should be observed at all times in the laboratory:

- There is a definite relationship between safety performance and orderliness in the laboratory. Work areas should be kept as clean as possible and free from obstructions. Cleanup should be completed following any operation.
- Stairways and hallways should not be used as storage areas.
- Spilled chemicals shall be identified, isolated, safely as soon as feasible, cleaned up and disposed of properly. Only trained personnel shall perform spill clean-ups. Spills of large quantities of chemicals where there is the potential for personal injury, for environmental impact, and for property damage shall be reported to SRM for response.
- Old containers and chemical wastes should be disposed of promptly and not be allowed to accumulate in the laboratory. Wastes shall not be accumulated for more than 90 days except in designated satellite accumulation areas. Waste containers shall be labeled for contents and dated.
- Non-hazardous materials spills (e.g. water) are to be cleaned up immediately.
- Access to exits, emergency equipment, and essential equipment shut downs and controls shall never be blocked.
- Equipment and chemicals all should be stored properly; clutter should be minimized.
- Incompatible chemicals and operations need to be segregated during use.
- Chemical storage containers should be closed and stored appropriately at all times except during use.

3.3.5 Transport of Hazardous Materials On-Site or From Cal Maritime Site

Transport of hazardous materials containers on-site, within a building or back and forth to the hazardous materials storage facility must have secondary containment. The secondary containment shall involve the use of transport carts capable of containing all contents of the containers on the cart, or One-bottle secondary containment totes designed specifically for transport of hazardous materials. Except for transport to the outside hazardous materials storage facility, transportation of hazardous materials by Cal Maritime employees outside of the building is prohibited. Transportation of hazardous materials by private vehicle, or non- designated Cal Maritime vehicle is not permitted because of the possibility of spillage or breakage of the container and resulting risk of injury to personnel and damage to property.

Note: For the purpose of hazardous materials transport there are no exempt quantities that don't require secondary containment.

3.3.6 Pressurize Equipment

Standards for the use of pneumatic and high-pressure hydraulic equipment are available in American Society of Mechanical Engineering (ASME) documents however; the following are additional requirements for laboratory operations:

- Reactions should never be carried out in, nor heat applied to, an apparatus that is a closed system unless it is designed and tested to withstand pressure apparatus shall have an appropriate relief device.
- If the reaction cannot be opened directly to the air, an inert gas purge and bubbler system should be used to avoid pressure buildup.
- All pressure gas cylinders and systems shall be installed and used in accordance with Safe Operating Procedures developed by faculty or lab technicians and approved by SRM for safe equipment usage, handling, and storage.

3.4 Chemical Hazard Identification

Cal Maritime is responsible for providing information about the hazardous substances and activities in our workplaces including laboratories, the associated risks, and the measures to mitigate those risks. Proper hazard communication involves the active participation of the PI/Laboratory Supervisor, the campus Chemical Hygiene Officer, and the Department of Safety and Risk Management, who are each responsible for providing consultation and safety information to employees and students working with hazardous chemicals.

3.4.1 List of Hazardous Substances

All laboratories, technical areas, or shops are required to maintain an accurate chemical inventory using the Cal Maritime online Chemical Inventory System (*CIS*). For each hazardous substance on their inventory, specific information on any associated health or safety hazards must be made readily available to all personnel. Compressed gases must also be included in the inventory list.

3.4.2 Hazard Determination

PIs/Laboratory Supervisors are responsible for verifying if any items on their chemical inventory are subject to the requirements of the hazard communication regulation.

Note that *hazardous chemical* is formally defined in *8 CCR §5191* and *8 CCR §5194*.

The term "hazardous substance" refers to any chemical which may present an asphyxiation hazard, environmental hazard, health hazard, physical hazard, or hazard not yet classified. Hazardous substances include, but are not limited to, those chemicals listed in the following:

1. "The Hazardous Substance List", commonly known as the Directors List of Hazardous Substances, *8 CCR §339*
2. "Toxic and Hazardous Substances, Air Contaminants", *8 CCR, §5155*
3. "Threshold Limit Values for Chemical Substances in the Work Environment", ACGIH, updated annually
4. "*13th Report on Carcinogens*", NTP, 2014
5. "*Monographs*", IARC, WHO
6. Safety Data Sheets (*SDSs*) for reproductive toxins and cancer causing substances

3.4.3 Safety Data Sheets

The term Materials Safety Data Sheet or MSDS was changed to simply Safety Data Sheet (SDS) in 2015 and must be available for each hazardous substance in a laboratory's or facilities chemical inventory. Laboratory or the facilities space with a hazardous substance supervisors are responsible for keeping SDSs current and making them readily available to all students and employees throughout the work day. SDSs must be in a central location that can be accessed immediately in the event of an emergency. Electronic copies may be used, but must be accessible to all personnel.

A *SDS Quick Card* and more detailed information is available from *OSHA*.

3.4.4 Signage/Labeling

Labeling of Hazardous Materials Containers

All containers (including lab glassware, safety cans, and plastic squeeze bottles) must have labels that identify their chemical contents. Primary responsibility is held by the department using/generating such containers. Experiments that carry over or must otherwise be stored must be properly labeled and contained. Exceptions to this requirement are secondary containers (such as beakers, graduated cylinders or containers) used solely by one person within their workstation for a portion of a day. The container labels may contain an abbreviated or common chemical name, such as HCl. The complete chemical name associated with each abbreviated or common name will be posted in an accessible place in the laboratory. Materials Safety Data Sheets for each chemical will be stored in a central location readily accessible to faculty and staff. The department or operating unit designated personnel will regularly inspect labs and other pertinent areas to ensure that proper labeling occurs. SRM will also conduct routine inspections throughout the academic period.

3.4.5 Chemical Storage

The separation of chemicals (solids or liquids) during storage is necessary to reduce the possibility of unwanted chemical reactions which may result from accidental mixing. Use either distance or barriers (e.g., trays) to isolate chemicals into the following minimum classifications.

- Flammable or combustible liquids (e.g., acetone, benzene, ether, alcohol).
- Other liquids (e.g., chloroform, trichloroethane).

- Inorganic Acids (e.g., nitric, sulfuric, hydrochchloric, perchchloric)- treat acetic acid as a flammable liquid.
- Bases (e.g., sodium hydroxide, ammonium hydroxide) and oxidizers and poisons.
- Explosives or unstable reactives, such as picric acid, should be stored separately, outdoors in flammable storage facility.

In addition to the above classifications:

- Carcinogens should be stored in secondary containers that are chemically resistant and unbreakable.
- Stored chemicals (such as Peroxide Formers) should be examined semiannually for deterioration, integrity and expiration dates.
- The amount of chemicals permitted for storage should be kept as small as practical.
- Exposure of chemicals to heat or direct sunlight shall be avoided.
- Fume hoods are not intended as a primary storage area of chemicals. Chemicals stored in fume hoods should be kept to a minimum and should not block vents or alter airflow.
- Lips, strips, or bars should be installed across the width of reagent shelves to restrain the chemicals in case of earthquake.
- Chemicals must not be stored in the same refrigerator used for food storage. Refrigerators used for storing chemicals must be appropriately identified by placing the following label on the door (labels may be obtained from SRM).
- Chemical Storage areas will be labeled with a National Fire Protection Association (NFPA) diamond reflecting the hazards in the area. Reference the Hazard Communication Program for a discussion of the NFPA labeling system.

Refer to the Flammable Materials Store Plan for more details.

3.4.6 Chemical Procurement

It is the responsibility of the Faculty to follow reasonable guidelines when ordering/procuring chemicals for use in teaching and research. It is prudent to consider the following:

- Chemical purchases should consider high waste disposal costs at a later date.
- Containers shall not be accepted without an adequate identifying label (e.g., chemical identity, hazard warnings, manufacturers name and address). Unsolicited samples of hazardous materials must not be accepted by Cal Maritime personnel.

Procedures for Chemical Ordering and MSDS Procurement:

- Person wishing to order any chemical will fill out Purchase Requisition (PR).
- Technician receives PR from requester (can be in the form of an email), evaluates against allowed storage amounts for the use area, ensure is not a significant hazard, and with above restrictions met order is made.
- In cases of chemicals of significant hazard, the faculty requesting the material shall consult the CHO-designate and SRM Director for help in a Cal Maritime proper storage, handling, and to allow for the future disposal of waste products. This is the responsibility of the faculty and shall be done prior to ordering and must include written documentation.
- For chemicals deemed particularly hazardous by regulatory citation (e.g., CCR, Title 8, fire code or other) or the requesting faculty, the person ordering should provide an MSDS sheet, or equivalent information (if possible). The requesting faculty shall demonstrate compliance with all pertinent regulations, including baseline medical monitoring if required prior to ordering.
- Chemical sent to requester directly from vendor.
- Technician places MSDS at appropriate location. MSDS may also be obtained from a campus computer at **https://www.csum.edu/web/safety/home** by selecting the MSDS icon.
- Faculty and Staff must review MSDS prior to working with a material

3.5 Personal Protective Equipment (PPE)

The use of personal protective equipment (PPE) is needed to compliment the variety of engineering and administrative controls present in the laboratory environment. Operation specific PPE requirements are provided in Safe Work Practices. The following is a listing of minimum PPE use guidelines for laboratory personnel:

3.5.1 Apparel

The following practices concerning apparel should be observed at all times:

- Appropriate clothing must be worn, including a protective apron or laboratory coat to protect against chemical splashes or spills, cold, and heat. Use protective apparel, including face shields, gloves, and other special clothing or footwear, as needed.
- Skin and eyes should always be protected from possible exposure by use of appropriate laboratory clothing, gloves, safety glasses, or goggles.
- Remove jewelry from wrists and hands to prevent chemicals from collecting underneath, contacting electrical sources, catching on laboratory equipment, and/or damaging the jewelry itself.
- To prevent spreading contamination to areas outside of a laboratory, laboratory coats should not be removed from the laboratory area.
- Loose apparel should be confined.
- Open-toed shoes or sandals should not be worn in any laboratory area.
- If laboratory coats are contaminated with hazardous materials, they should be removed immediately and placed in a hazardous waste bag for decontamination.

3.5.2 Gloves

Gloves should be worn whenever working with hazardous chemicals, rough or sharp- edged objects, or very hot or very cold materials. Select gloves based on the material being handled, the particular hazard involved, and their suitability for the procedures being conducted. Gloves should be checked visually for discoloration, punctures, and tears or by other means prior to each use and should be changed often, based on their frequency of use and permeability to the chemical(s) handled. Even appropriate, high quality gloves will eventually be permeated by chemicals.

3.5.3 Eye Protection

Safety glasses are required in all laboratory areas where hazardous materials are stored and used. The safety glasses should be impact resistant eyeglasses with side shields. Goggles and/or Face Shields should be worn in addition to safety glasses when pouring or mixing bulk chemicals. **Contact lenses are prohibited** where handling of corrosive chemicals and/or particulate emissions could result in exposure to the eye.

3.5.4 Respirators

The use of respirators at Cal Maritime is governed by the requirements set forth in the Cal Maritime Respiratory Protection Plan. Respirators should not be needed in a normal laboratory setting. However, if engineering and administrative controls cannot control the concentrations of airborne hazardous materials below OSHA Permissible Exposure Limits (PELs), or when atmospheric conditions are unknown, respiratory protection will be required.

Refer to the Personal Protective Equipment Program for more details.

3.6 Safety & Emergency Equipment

3.6.1 Equipment Guarding

- All machining, test and mechanical equipment shall be adequately furnished with guards that prevent access to hazardous electrical connections, pinch points or moving parts.
- All guards should be inspected before using equipment.

- Faculty/Staff shall not turn on, use, repair, or operate any hazardous laboratory equipment unless trained and authorized by the responsible lab technician or faculty member.

3.6.2 Shields

Safety shields must be used for protection against possible explosions or uncontrolled reactions. Laboratory equipment must be shielded on all sides so that there is no line-of sight exposure to personnel. The sash on a chemical fume hood is a readily available partial shield. However, a portable shield must also be used, particularly with hoods that have vertical-rising sashes rather than horizontal-sliding sashes for operations having the potential for explosion such as:

- Whenever a reaction is attempted for the first time (small quantities of reactants should be used to minimize hazards); and
- Whenever a familiar test or reaction is carried out on a larger than usual scale.

3.6.3 Eyewash & Showers

- Eyewash fountains are required if the substance in use presents an eye hazard (e.g., any corrosive). The eyewash fountain must provide a soft stream or spray of aerated water.
- Safety showers must be provided in areas where a corrosive chemical or rapid fire hazard exists, for immediate first aid treatment of chemical splashes and for extinguishing clothing fires. The shower must be capable of drenching the victim immediately in the event of an emergency.
- Eyewash fountains and safety showers should be located close to each other so that, if necessary, the eyes can be washed while the body is showered. Access to these facilities must remain open at all times and within ten seconds of travel distance. In case of accident, flush the affected body part for at least 15 minutes. Report the accident.
- Eyewash and showers shall be tested and flushed by Facilities personnel at least monthly to ensure that they are operating properly. Inspection tags must be filled out to document testing. Faulty equipment shall be repaired by Facilities, when problem is identified or upon request.

3.6.4 Fire Extinguishers

Laboratories using hazardous chemicals should have a BC or ABC rated, dry chemical fire extinguisher in close proximity of any exit for use on ordinary combustibles, flammable liquids, and electrical fires. If additional extinguishers are needed for an area, contact SRM for information concerning recommendations and requirements.

3.6.5 Flammable Liquid Storage Cabinets

- Generally, a minimum amount of flammable liquids necessary for normal lab operations should be kept on hand and stored in a cabinet.
- Capacity should not exceed the volume capacity rating of each chemical storage cabinet.
- Cabinets must be labeled "Flammable - Keep Fire Away."
- Storage of flammable liquids in excess of ten gallons must be in an UL listed, Factory Mutual (FM) approved, flammable liquids storage cabinet.
- Flammable liquids storage cabinets should be used for the storage of flammable and combustible liquids only. Do not store corrosives, oxidizers, or reactive chemicals with flammable or combustible liquids.

(Note: A storage cabinet for flammable liquids is not fireproof, but only protects the contents from extreme temperatures for a limited time to allow evacuation of personnel and prompt entry of fire fighters.)

3.7 Preventative Maintenance

Proper equipment maintenance is important for safe and efficient operation. Equipment should be inspected and maintained on a regular basis. Preventative equipment maintenance, (e.g., vacuum pump oil change outs) and facilities-related equipment (e.g., HVAC, ventilation hoods) is maintained by Facilities.

3.7.1 Exhaust Ventilated Hood Performance Evaluations

- All hoods are checked by the Facilities Department when they are first installed and annually thereafter, for adequate ventilation performance. Performance measurements and the initials of the individual performing the test are left on the hood as record to verify performance.
- Performance of a ventilation system must be checked whenever there has been a change in a system or location.
- Laboratory ventilation equipment scheduled for maintenance or repair work must be cleaned and/or decontaminated. Facilities Department workers have the right to refuse to do work if the area or equipment is not clear of hazards.
- All ventilation systems need routine maintenance to prevent blocked or plugged air intakes and exhaust, loose belts, bearings in need of lubrication, motors in need of attention, corroded duct work, and component failure.
- Filters should be replaced periodically in certain types of ventilation systems, such as electrostatic precipitators and cyclones for dust collection.
- Ventilation system monitoring devices such as a magnehelic gauge or incline manometer should be installed in ventilation systems that control certain highly toxic operations, such as those involving carcinogens, to notify the user of malfunctions.

3.7.2 Laboratory & Equipment Decommissioning

- The Dean is ultimately responsible for all laboratory space occupied by their programs and/or activities is maintained free from undue hazards. In particular, when vacating laboratory space, the Dean must ensure that all chemicals, radioactive materials, and/or hazardous wastes are removed and properly disposed. The Lab Technician and/or CHO-designate can provide assistance in labeling, packaging and removing chemicals and waste. If laboratory premises are left in an environmentally unacceptable state, it may be necessary to obtain the services of outside contractors to identify and dispose of unidentified chemicals and waste.
- When occupying new space, Laboratory supervision is advised that said space is free from hazards. Please call the CHO-designate and/or SRM.
- Equipment which is being surpluses, readied for transport to another facility, or disposed of must be checked for hazardous material contamination as part of the decommissioning process. Equipment decommissioning and decontamination may require support from SRM, Facilities Department and/or outside contractor services. The Dean of The School of Science and Technology is responsible to ensure that the decommissioning process leaves the equipment free of hazardous contamination prior to off-site transport or shutdown in place.

3.8 Hazardous Materials Disposal and Spill Response

The information provided in this section is a practical overview of the guide to Hazardous Waste Management. The purpose is to ensure that waste is handled in a safe, legal, and cost effective manner. More detailed information can be found in Cal Maritime's Hazardous Waste Management Policy or in the Cal Maritime Spill Response Plan on file with SRM.

3.8.1 Identification of A Hazardous Waste

The general definition of hazardous waste is any substance which exhibits characteristic(s) of flammability, reactivity, corrosivity, or acute or chronic toxicity. Substances which may lack these characteristics may also be considered hazardous due to their concentration or quantity. A substance is only considered a waste after it is determined unusable.

3.8.2 Containers

Only those containers which are provided and approved by SRM will be used for the containment of hazardous materials and their waste(s). Check with SRM for the locations of empty hazardous waste containers. It is critical that each container be labeled properly. Labels shall include, though not limited to, name of waste and date of generation. It is important that hazardous waste is collected in Department of Transportation approved containers and drums to prevent unnecessary re-containerization of hazardous waste.

3.8.3 Notification

SRM shall be notified prior to the commencing of activities that may generate hazardous wastes. In the event of a spill or contamination by hazardous materials, SRM shall be notified immediately.

3.8.4 Spills of Hazardous Materials

The following actions should be taken when responding to chemical spills of less than one pint or one pound:

- Wear appropriate personal protective equipment during clean up.
- Pour appropriate sorbent and/or neutralizing agent on spill.
- Clean up; place waste in labeled plastic bag for disposal.
- Decontaminate spilled area if required.
- Complete a label/tag and attach it to spill clean-up containers for identification of contents.
- Take container to designated accumulation station.

If the spill is greater than one pint or one pound and has the potential to cause personal injury, environmental impact, or property damage, the following actions should be taken:

- If in laboratory hood close sash.
- Evacuate people from the area.
- Isolate the spilled material, if possible to do so safely.
- Identify the spilled material.
- If the material is flammable, turn off ignition and heat sources.
- **Call 1111 from an internal phone to summon Campus Police and stay on the line to answer questions.**

4.0 Training Requirements

Effective dissemination of safety information lies at the very heart of a successful Injury and Illness Prevention Program. It is essential to provide training for employees concerning general safe work practices as well as specific instruction with respect to hazards unique to each employee's job assignment.

The Department or operating unit has the option of providing **Chemical Hygiene Safety** from:

- Providing training from within the department by the designated competent person/trainer, or
- Training provided by University SRM, or
- A training provider outside the University.

⚠ Note: All outside trainer venders are to be reviewed and content approved by SRM.

Training content is determined by the Department of Safety and Risk Management, as well as Department Management which is based upon observed hazards, type of equipment, Department need, and work requirements.

Program Training is intended to help participants understand the goals and objectives of the Chemical Hygiene Safety Program and provide guidance on how to follow the policies and procedures contained in the Plan. It is the responsibility of the Hazardous Material Coordinator to ensure that Chemical Handlers, from professors to students, all obtain appropriate training and receive the guidance necessary to follow the procedures outlined in the Program. Personnel must complete the Program Training within six months of employment or assignment to a location where chemical materials are used or stored and every three years thereafter.

- Components of the hazardous materials training include:
- Roles and responsibilities.
- Understanding the definition of a hazardous material.
- Guidelines for purchasing hazardous materials.
- Hazardous materials management.
- Ways to minimize quantity and toxicity of hazardous materials.
- Ways to minimize hazardous materials usage and waste generation.
- Procedures for maintaining an inventory of hazardous materials.
- Health and safety requirements for use and storage of hazardous materials.
- Procedures for completing the Hazardous Materials Management Plan forms.

The Cal Maritime program specific training will be conducted through the Department of Safety and Risk Management in conjunction with existing training programs associated with chemical and hazardous materials management. The training will be provided in a blended format, of online modules and instructor lead, so that it is accessible for all users at their convenience.

Employees expected to utilize chemicals as part of their job duties must be adequately trained prior to using such chemicals. Employees should be trained in the following areas:

- Be able to recognize hazards associated with different types of chemicals and equipment; and the safety precautions necessary for use.
- The PPE required to be worn during the use of chemicals.
- The proper use of tools and other equipment, be able to recognize defects in tools, which may render them out of service.
- When applicable, provide access to the manufacturer specification and manual's for specific equipment to be used.
- Department-developed standard operating procedures (SOPs) outlining specific safety precautions for certain tools or activities.
- Signs and symptoms related to the exposures to hazardous chemicals used in the work area;
- Methods that may be used to detect the presence or release of a hazardous chemical.
- This could include industrial hygiene monitoring, the use of continuous monitoring devices, visual appearance, or odors of chemicals;
- Details of manufacturer labels, SDSs and workplace labeling system, and how that information can be used to assure safe handling and storage; and
- Procedure for addressing non-routine tasks involving hazardous chemicals.

Frequency

- Supervisors and Principal Investigators must provide employees information and training regarding the physical and health hazards of the chemicals in the work area before assigning employees to work with hazardous chemicals. Refresher training is required whenever a new chemical hazard is introduced into the workplace or a new or updated SDS is received.

Non-Routine Tasks

- Employees must be provided training or refresher training prior to engaging in a non- routine task. Employees must be provided hazard notification and precautionary measures to avoid or minimize the potential for risk of exposure.

Retraining may be necessary to maintain employee knowledge of working with chemicals or if a near-miss or injury has occurred.

Training is to be documented and kept in a readily accessible location by the Department designee for access reference as needed by Department Management, Department of Safety & Risk Management, or regulatory agency (e.g. CalOSHA). Submit the completed training roster of attendees to the Department of Safety & Risk Management.

Refer to Cal/OSHA Safety & Health Training and Instruction Requirements as outlined in Appendix C of the Injury Illness Prevention Program.

5.0 Document Control & Recordkeeping

Essential records, including those legally required for Workers' Compensation, insurance audits and government inspections will be maintained for as long as required. Individual Departments and/or Colleges will also keep records of steps taken to establish and maintain the Injury and Illness Prevention Program.
They must include:

- Records of scheduled and periodic inspections to identify unsafe conditions and work practices. The documentation includes the name of the person(s) conducting the inspection, the unsafe conditions and work practices identified, and the corrective action(s) taken. These records will be maintained for at least three years.
- Documentation of health and safety training for each employee. Specifically, employee name or other identifier, training dates, type(s) of training and the name of the training provider will be included. Records will be retained for at least three years. Standard forms for maintaining this information can be obtained from the Department of Safety and Risk Management.

Accurate documentation and recordkeeping of exposure monitoring, medical surveillance and health and safety training is an important component of this CHP. This section defines the recordkeeping requirements for important aspects of the Plan.

Specific Recordkeeping Responsibilities:

- Current chemical inventories and Material Safety Data Sheets for each laboratory shall be readily available for staff and faculty access and reference in the event of an emergency. Responsibility: Chemical Technician
- Exposure records for hazardous chemicals and harmful physical agents will be maintained for 30 years from end of employment per 29 CFR 1910.20. Responsibility: SRM and CHO.
- Medical records for staff or faculty exposed to hazardous chemicals and harmful physical agents will be maintained for the duration of employment plus 30 years per 20 CFR 1910.20. Responsibility: SRM.
- Additionally, the following records must be kept for a minimum of three years:
    1. Staff and Faculty Training Records-will be held by SRM, while Student Records are held by faculty. Student records must be held until class is completed, the semester ends or a student is no longer enrolled.
    2. Area Sponsored or Area Specific Classes including Training on Safe Work Practices presented to students by faculty or staff; Responsibility: Faculty.
    3. Accident Investigations. Responsibility: School Dean of Science and Technology, SRM and CHO.
    4. Lab Safety Committee Meetings; Responsibility: CHO.

Detailed recordkeeping is a vital aspect of promoting health and safety, as well as maintaining environmental compliance. The success of the program can only be measured if everyone participates and maintains the required records. Records and reporting documents are required for purchasing, storing, use, and disposal of hazardous materials. The forms are indicated throughout the Hazardous Materials Management Plan and include:

- Follow P-Card or Purchase Order procedures.
- Laboratory Check-In/Check-Out Form.
- Laboratory Decommissioning Checklist.
- Laboratory Safety Inspection Checklist.
- Up-to-date inventory in Cal Maritime CIS.
- SDS in Cal Maritime CIS.

Each Department is responsible for maintaining their own records of machine safeguarding inspections / surveys. In addition, Departments must maintain training records of personnel who have been trained on this program and/or to specific equipment as may be necessary to demonstrate training compliance to a regulatory agency. Documents such as JSAs, SOPs, operation manuals, signage, etc., may all function to demonstrate record keeping, safe-operation, warning and training activities.

Retain all training records for ten years after employees have retired or left University employment. For students, retain records for ten years after the student's projected graduation date.

Training records will be kept in each department and copies will be forwarded to the Department of Safety and Risk Management.

Departments must maintain the following records as part of the hand and portable power tool safety program.

- Employee training records
- Specialized SOPs
- Manufacturer specifications/manuals
- Maintenance/service records

Record	Timeframe/Frequency	Location of Record	Retention Period*
Chemical Hygiene & Hazardous Materials Management General Awareness	Initial, Annual Refresher for affected employees.	Document on Employee's Safety Training Checklist	3-Years
Chemical Hygiene & Hazardous Materials Management Users/Handlers	Initial, Annual Refresher for affected employees.	Document on Employee's Safety Training Checklist	3-Years
Chemical Hygiene & Hazardous Materials Management Users/Handlers	Post incident and/or process management change for affected employees.	Document on Employee's Safety Training Checklist	3-Years

**Refer to the Injury Illness Prevention Program Document Retention Table and/or California State University Systemwide for more information.*

Appendix A: Definitions

General Definitions

ANSI:	American National Standards Institute
Authorized person:	Means a person approved or assigned by the employer to perform a specific type of duty or duties or to be at a specific location or locations at the jobsite.
Competent person:	A competent person is a person who is **capable** of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees. The competent person has the **authority** to impose prompt corrective measures to eliminate these hazards. *Examples:* • **Excavation** - Inspectors 1541 • **Fall Protection** Plan implementers & supervisors 1671.1 • **Lift Slab Construction** 1522.1
Confined Space:	Is a space that (1) is large enough and so configured that an employee can enter bodily, (2) has limited or restricted means for entry or exit (e.g., tanks, vessels, vaults, shafts, pits), and (3) is not designed for continuous occupancy.
Construction Manager:	Is the Cal Maritime employee responsible for the supervision and field management of day-to-day needs of a construction project. It may be a project superintendent, a craft supervisor, or a lead person.
Construction work:	For purposes of this section, "Construction work" means work for construction, alteration, and/or repair, including painting and decorating. Construction: is any combination of engineering, procurement, erection, installation, assembly, demolition, or fabrication used to create a new facility, or to alter, add to, rehabilitate, dismantle, or remove an existing facility. It also includes the alteration and repair (including dredging, excavating, and painting) of buildings, structures, or other real property, as well as any construction and excavation activities conducted as part of environmental remediation efforts.
Controlled Access Zone (CAZ)	Means an area in which certain work (e.g., overhand bricklaying) may take place without the use of guardrail systems, personal fall arrest systems, or safety net systems and access to the zone is controlled
Imminent Danger:	Is any condition or practice that could reasonably be expected to cause death or serious physical harm (permanent or prolonged impairment of the body or temporary disablement requiring hospitalization) to employees or the public unless immediate actions are taken.
Project Manager:	Is the Cal Maritime employee representative with overall responsibility for a project. This person ensures subcontractor compliance with subcontract documents, including performance, schedule, budget, and safety.
Shall:	Means mandatory
Should:	Means recommended
Subcontractor:	Is a firm that has sole contractual responsibility for execution of the construction work related to a project, and for compliance with all safety, health, and environmental codes, standards, and regulations.
Qualified Person:	A qualified person is a person **designated** by the employer; and by reason of **training**, experience, or instruction has demonstrated the ability to perform safely all assigned duties; &, when required is properly licensed in accordance with federal, state, or local laws and regulations. Examples: • Mobile Crane & Tower **Crane** Operators 5006.1(a) • **Scaffold** Erection & Dismantling Supervisors 1637(k)(1) • **Demolition** 1736 • **Personal Fall Arrest** System supervisors 1670(b)

Definitions (cont.) **Key Hazard Materials Definitions-**

Nearly all chemicals, including many common household cleaners and paints, are considered "hazardous." A hazardous material is a material that, because of its quantity, concentration, or physical or chemical characteristics, may pose a physical, environmental, or health risk. Examples include chemicals that are toxic, corrosive, flammable, highly reactive, explosive, and/or emit ionizing radiation. Some common terms used when describing hazardous materials include:

Chemicals of Interest	A list of chemicals and their corresponding screening threshold quantities developed by the DHS (Appendix C). Institutions, including colleges and universities that possess a chemical of interest at or above a regulatory screening threshold quantity must complete and submit a consequence analysis (i.e., Top-Screen) to the DHS as part of the Federal Chemical Facility Anti-Terrorism Standards.
Hazard:	A chemical, biological, radioactive, or physical agent, which may cause an adverse effect on the human body. Hazards may be acute, toxic, or chronic.
Acutely Toxic:	A material that has the potential to produce a lethal dose or lethal concentration to living tissues under certain conditions.
Toxic:	Materials that may present an unreasonable risk of injury to the health of living things or the environment.
Toxin:	A chemical agent that adversely affects the human body. These may include hepatotoxins, nephrotoxins, neurotoxins, and reproductive toxins. Examples of chemical toxins include dibromochloropropane, halogenated hydrocarbons, mercury, lead, and carbon tetrachloride.
Carcinogen:	An agent capable of causing cancer.
Irritant:	A chemical, which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact.
P-Listed (Acute) Hazardous Waste:	The USEPA has designated certain chemical wastes as "acutely hazardous" and placed special restrictions on their accumulation and disposal. When these chemicals become a waste, both the residual chemical and the empty containers must be disposed of as an "acute" P-Listed hazardous waste. There are hundreds of P-Listed wastes and they are identified 40 CFR 261.33. Generators with acutely hazardous waste are subject to different accumulation limits for those wastes.
Sensitizer:	A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.
Shock-Sensitive:	Materials that may undergo sudden explosion with movement, friction, or heat. The label and MSDS will indicate if a chemical is shock-sensitive. Some chemicals become more shock-sensitive with age. Unless the manufacturer has added an inhibitor, most shock-sensitive materials should be disposed within a year.
Tier II Reportable Chemical:	A hazardous chemical present in quantities equal to or greater than established threshold amounts outlined Title III of the Superfund Amendments and Reauthorization Act of 1986 (Section 312, Public Law 99-499, 42.U.S.C. Section 11022). A hazardous chemical under Title III includes those substances for which an SDS must be maintained under OSHA's Hazard Communication Standard.

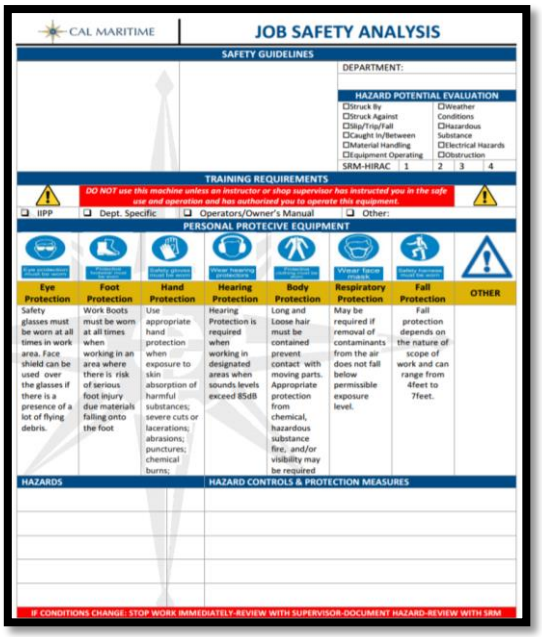
Definitions (cont.) **Chemical Definitions-**

Article	A manufactured item (1) which is formed to a specific shape or design during manufacture; (2) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (3) which does not release, or otherwise result in exposure to a hazardous substance under normal conditions of use or in a reasonably foreseeable emergency resulting from workplace operations.
Classification	To identify the relevant data regarding the hazards of a chemical; review those data to ascertain hazards associated with the chemical; and decide whether the chemical will be classified as hazardous, and the degree of hazard where appropriate, by comparing the data with the criteria for health and physical hazards. Typical classifications might be flammable, corrosive, reactive and toxic.
Hazardous chemical	Any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, a hazard not otherwise classified, or is included in the *Director's List of Hazardous Substance*.
Health hazard	A chemical for which there is statistically significant evidence based on at least one study conducted in accordance with the established scientific principles that acute or chronic health effects may occur in exposed employees. Health Hazard Criteria can be found in *29 CFR §1910.1200- Appendix A* (8 CCR §5194 Appendix A references this federal regulation). Hazards are listed as "H" codes on GHS- compliant labels and safety data sheets (SDSs).
Immediate use	The hazardous substance will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.
Label	An appropriate group of written, printed, graphic information elements concerning a hazardous chemical that is affixed to, printed on, or attached to the immediate container of a hazardous chemical, or to the outside packaging.
Near miss	As defined by *OSHA*, refers to incidents where no property was damaged and no personal injury sustained, but where, given a slight shift in time or position, damage and/or injury easily could have occurred.
Physical hazard	A chemical that is classified as posing one of the following hazardous effects: explosive; flammable (gases, aerosols, liquids, or solids); oxidizer (liquid, solid or gas); self-reactive; pyrophoric (liquid or solid); self-heating; organic peroxide; corrosive to metal; gas under pressure; combustible liquid; water reactive; or in contact with water emits flammable gas. Physical Criteria can be found in *29 CFR§1910.1200 Appendix B* (8 CCR §5194- Appendix B references this federal regulation).
Pictogram	A composition that may include a symbol plus other graphic elements, such as a border, background pattern or color that is intended to convey specific information about the hazards of a chemical.
Precautionary statement	A phrase that describes recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to hazardous chemicals, or improper storage or handling. Statements are listed as "P" codes on GHS-compliant labels and SDSs
Pyrophoric gas	A chemical that will ignite spontaneously in air at a temperature of 130 degrees F (54.4 degrees C) or below.
Safety data sheet (SDS)	Written or printed material concerning a hazardous chemical that is prepared in accordance with 8 CCR §5194(g). (See *Appendix B* for details).
Signal word	A word used to indicate the relative level of severity of hazard and alert the reader to a potential hazard on the label. The signal words used are "danger" and "warning." "Danger" is used for the more severe hazards, while "warning" is used for the less severe.
Simple asphyxiant	A substance or mixture that displaces oxygen in the ambient atmosphere, and can thus cause oxygen deprivation in those individuals who are exposed, leading to unconsciousness and death
Trade secret	Any confidential formula, pattern, process, device, information, or compilation of information which gives its user an opportunity to obtain a business advantage over competitors who do not know or use it. A trade secret shall not include chemical identify information which is readily discoverable through qualitative analysis
Use	To package, handle, react, or transfer
Workplace label	Non-original manufacturer label"- Label placed on a secondary (workplace) container. When hazardous material is removed/transferred from the original manufacturer labeled container to another container (secondary (workplace) container), the secondary (workplace) container must have a workplace label with the exception of portable containers that will contain chemicals for immediate use.

Appendix D: Hazard Assessment & Controls

Templates available for download on the Safety & Risk Management webpage, under the Hazard Assessment & Controls section.

Samples-



CAL MARITIME

JOB SAFETY ANALYSIS

SAFETY GUIDELINES

DEPARTMENT:

HAZARD POTENTIAL EVALUATION

TRAINING REQUIREMENTS

DO NOT use this machine unless an instructor or shop supervisor has instructed you in the safe use and operation and has authorized you to operate this equipment.

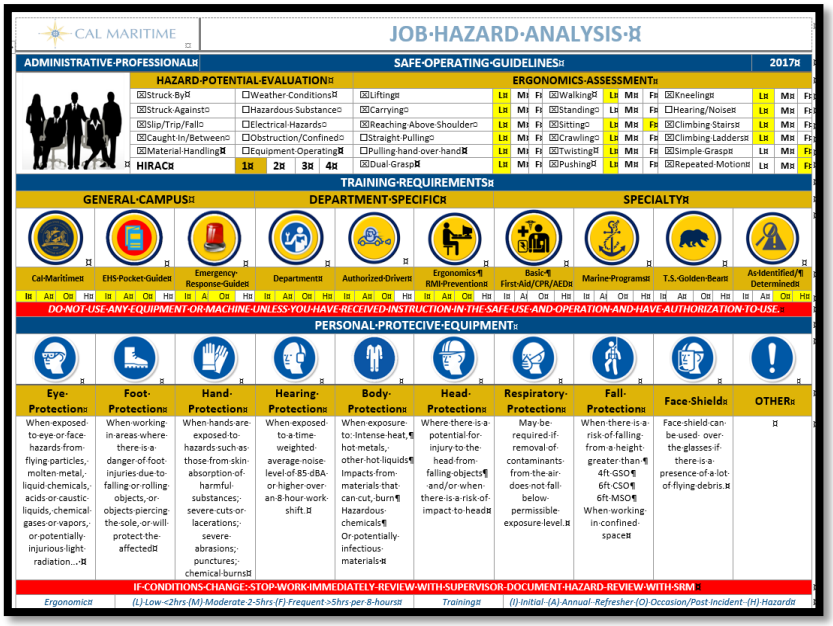
IIPP | Dept. Specific | Operators/Owner's Manual | Other:

PERSONAL PROTECIVE EQUIPMENT

Eye Protection	Foot Protection	Hand Protection	Hearing Protection	Body Protection	Respiratory Protection	Fall Protection	OTHER
Safety glasses must be worn at all times in work area. Face shield can be used over the glasses if there is a presence of a lot of flying debris.	Work Boots must be worn at all times when working in an area where there is risk of serious foot injury due materials falling onto the foot	Use appropriate hand protection when exposure to skin absorption of harmful substances; severe cuts or lacerations; abrasions; punctures; chemical burns;	Hearing Protection is required when when working in designated areas when sounds levels exceed 85dB	Long and Loose hair must be contained prevent contact with moving parts. Appropriate protection from chemical, hazardous substance fire, and/or visibility may be required	May be required if removal of contaminants from the air does not fall below permissible exposure level.	Fall protection depends on the nature of scope of work and can range from 4feet to 7feet.	

HAZARDS	HAZARD CONTROLS & PROTECTION MEASURES

IF CONDITIONS CHANGE: STOP WORK IMMEDIATELY-REVIEW WITH SUPERVISOR-DOCUMENT HAZARD-REVIEW WITH SRM



CAL MARITIME

JOB·HAZARD·ANALYSIS·¤

ADMINISTRATIVE-PROFESSIONAL¤ | SAFE·OPERATING·GUIDELINES¤ | 2017¤

HAZARD·POTENTIAL·EVALUATION¤

☒Struck-By¤	☐Weather-Conditions¤	☒Lifting¤	☒Walking¤	☒Kneeling¤
☒Struck-Against¤	☐Hazardous-Substance¤	☒Carrying¤	☒Standing¤	☐Hearing/Noise¤
☒Slip/Trip/Fall¤	☐Electrical-Hazards¤	☒Reaching-Above-Shoulder¤	☒Sitting¤	☒Climbing-Stairs¤
☒Caught-In/Between¤	☐Obstruction/Confined¤	☐Straight-Pulling¤	☒Crawling¤	☒Climbing-Ladders¤
☒Material-Handling¤	☐Equipment-Operating¤	☐Pulling-hand-over-hand¤	☒Twisting¤	☒Simple-Grasp¤
HIRAC¤ 1¤ 2¤ 3¤ 4¤		☒Dual-Grasp¤	☒Pushing¤	☒Repeated-Motion¤

ERGONOMICS-ASSESSMENT¤

TRAINING·REQUIREMENTS¤

GENERAL·CAMPUS¤ | DEPARTMENT·SPECIFIC¤ | SPECIALTY¤

Cal·Maritime¤ | EHS·Pocket·Guide¤ | Emergency·Response·Guides | Department¤ | Authorized·Driver¤ | Ergonomics·¶ RMI·Prevention¤ | Basic·¶ First·Aid/CPR/AED¤ | Marine·Programs¤ | T.S.·Golden·Bear¤ | As·Identified/¶ Determined¤

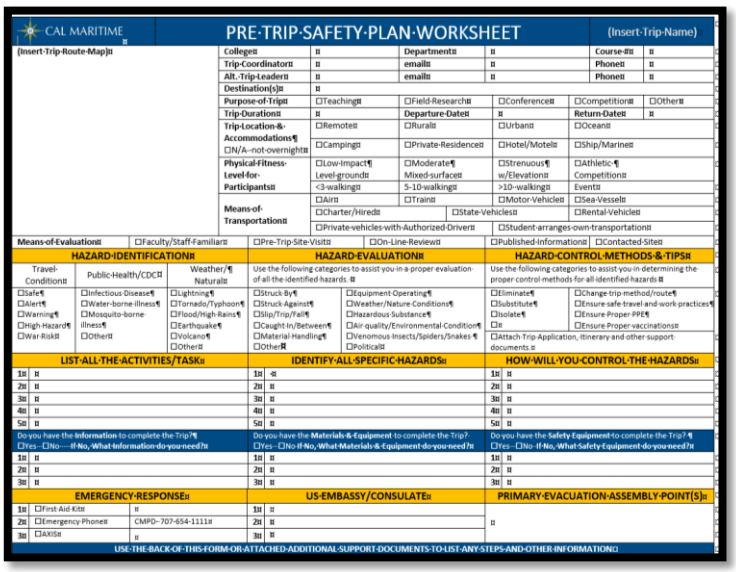
DO-NOT-USE-ANY-EQUIPMENT-OR-MACHINE-UNLESS-YOU-HAVE-RECEIVED-INSTRUCTION-IN-THE-SAFE-USE-AND-OPERATION-AND-HAVE-AUTHORIZATION-TO-USE.

PERSONAL·PROTECIVE·EQUIPMENT¤

Eye·Protection¤	Foot·Protection¤	Hand·Protection¤	Hearing·Protection¤	Body·Protection¤	Head·Protection¤	Respiratory·Protection¤	Fall·Protection¤	Face·Shield¤	OTHER¤
When·exposed·to·eye·or·face·hazards·from·flying·particles,·molten·metal,·liquid·chemicals,·acids·or·caustic·liquids,·chemical·gases·or·vapors,·or·potentially·injurious·light·radiation…¤	When·working·in·areas·where·there·is·a·danger·of·foot·injuries·due·to·falling·or·rolling·objects,·or·objects·piercing·the·sole,·or·will·protect·the·affected¤	When·hands·are·exposed·to·hazards·such·as·those·from·skin·absorption·of·harmful·substances;·severe·cuts·or·lacerations;·severe·abrasions;·punctures;·chemical·burns¤	When·exposed·to·a·time·weighted·average·noise·level·of·85·dBA·or·higher·over·an·8·hour·work·shift.¤	When·exposure·to:·Intense·heat,¶ hot·metals,·other·hot·liquids¶ Impacts·from·materials·that·can·cut,·burn¶ Hazardous·chemicals¶ Or·potentially·infectious·materials¤	Where·there·is·a·potential·for·injury·to·the·head·from·falling·objects¶ and/or·when·there·is·a·risk·of·impact·to·head¤	May·be·required·if·removal·of·contaminants·from·the·air·does·not·fall·below·permissible·exposure·level.¤	When·there·is·a·risk·of·falling·from·a·height·greater·than·¶ 4ft·GSO¶ 6ft·CSO¶ 6ft·MSO¶ When·working·in·confined·space¤	Face·shield·can·be·used·over·the·glasses·if·there·is·a·presence·of·a·lot·of·flying·debris.¤	¤

IF·CONDITIONS·CHANGE:·STOP·WORK·IMMEDIATELY·REVIEW·WITH·SUPERVISOR·DOCUMENT·HAZARD·REVIEW·WITH·SRM¤

Ergonomic¤ (L)·Low·<2hrs·(M)·Moderate·2·5hrs·(F)·Frequent·>5hrs·per·8·hours¤ Training¤ (I)·Initial·(A)·Annual·Refresher·(O)·Occasion/Post·Incident·(H)·Hazard¤



CAL MARITIME

PRE·TRIP·SAFETY·PLAN·WORKSHEET (Insert·Trip·Name)

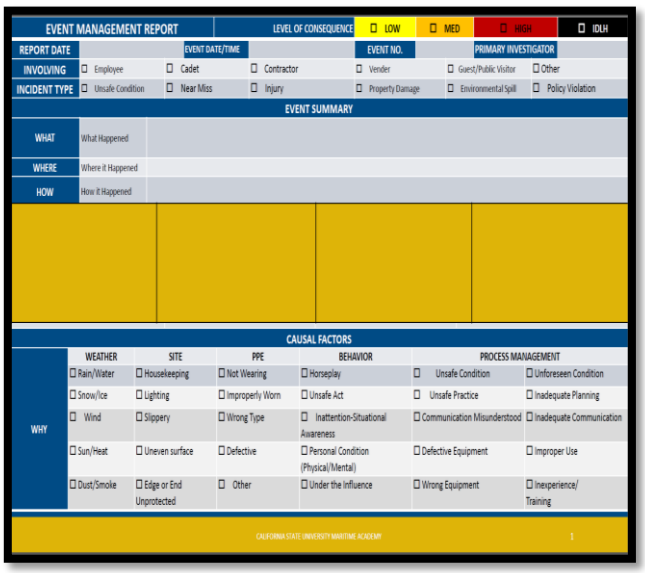
(Insert·Trip·Route·Map)¤	College¤ ¤	Department¤ ¤	Course·#¤ ¤
	Trip·Coordinator¤ ¤	email¤ ¤	Phone¤ ¤
	Alt.·Trip·Leader¤ ¤	email¤ ¤	Phone¤ ¤
	Destination(s)¤ ¤		
	Purpose·of·Trip¤	☐Teaching¤	☐Field·Research¤	☐Conference¤	☐Competition¤	☐Other¤
	Trip·Duration¤ ¤	Departure·Date¤ ¤	Return·Date¤ ¤
	Trip·Location·&·Accommodations¶ ☐N/A·-not·overnight¤	☐Remote¤	☐Rural¤	☐Urban¤	☐Ocean¤
		☐Camping¤	☐Private·Residence¤	☐Hotel/Motel¤	☐Ship/Marine¤
	Physical·Fitness·Level·for·Participants¤	☐Low·Impact¶ Level·ground¤	☐Moderate¶ Mixed·surface¤	☐Strenuous¶ w/Elevation¤	☐Athletic·¶ Competition¤
		<3·walking¤	5·10·walking¤	>10·walking¤	Event¤
	Means·of·Transportation¤	☐Air¤	☐Train¤	☐Motor·Vehicle¤	☐Sea·Vessel¤
		☐Charter/Hired¤	☐State·Vehicles¤	☐Rental·Vehicle¤
		☐Private·vehicles·with·Authorized·Driver¤	☐Student·arranges·own·transportation¤
Means·of·Evaluation¤	☐Faculty/Staff·Familiar¤	☐Pre·Trip·Site·Visit¤	☐On·Line·Review¤	☐Published·Information¤	☐Contacted·Site¤

HAZARD·IDENTIFICATION¤			HAZARD·EVALUATION¤		HAZARD·CONTROL·METHODS·&·TIPS¤	
Travel·Condition¤	Public·Health/CDC¤	Weather/¶ Natural¤	Use the following categories to assist you in a proper evaluation of all the identified hazards. ¤		Use the following categories to assist you in determining the proper control·methods for all identified hazards ¤	
☐Safe¶ ☐Alert¶ ☐Warning¶ ☐High·Hazard¶ ☐War·Risk¤	☐Infectious·Disease¶ ☐Water·borne·illness¶ ☐Mosquito·borne·illness¶ ☐Other¤	☐Lightning¶ ☐Tornado/Typhoon¶ ☐Flood/High·Rains¶ ☐Earthquake¶ ☐Volcano¶ ☐Other¤	☐Struck·By¶ ☐Struck·Against¶ ☐Slip/Trip/Fall¶ ☐Caught·In/Between¶ ☐Material·Handling¶ ☐Other¤	☐Equipment·Operating¶ ☐Weather/Nature·Conditions¶ ☐Hazardous·Substance¶ ☐Air·quality/Environmental·Condition¶ ☐Venomous·Insects/Spiders/Snakes·¶ ☐Politica¤	☐Eliminate¶ ☐Substitute¶ ☐Isolate¶ ☐¤	☐Change·trip·method/route¶ ☐Ensure·safe·travel·and·work·practices¶ ☐Ensure·Proper·PPE¶ ☐Ensure·Proper·vaccinations¤
					☐Attach·Trip·Application, itinerary and other support documents.¤	

LIST·ALL·THE·ACTIVITIES/TASK¤	IDENTIFY·ALL·SPECIFIC·HAZARDS¤	HOW·WILL·YOU·CONTROL·THE·HAZARDS¤
1¤ ¤	1¤ ¤	1¤ ¤
2¤ ¤	2¤ ¤	2¤ ¤
3¤ ¤	3¤ ¤	3¤ ¤
4¤ ¤	4¤ ¤	4¤ ¤
5¤ ¤	5¤ ¤	5¤ ¤
Do·you·have·the·Information·to·complete·the·Trip?¶ ☐Yes··☐No·····If·No,·What·Information·do·you·need?¤	Do·you·have·the·Materials·&·Equipment·to·complete·the·Trip?· ☐Yes··☐No·If·No,·What·Materials·&·Equipment·do·you·need?¤	Do·you·have·the·Safety·Equipment·to·complete·the·Trip?·¶ ☐Yes··☐No··If·No,·What·Safety·Equipment·do·you·need?¤
1¤ ¤	1¤ ¤	1¤ ¤
2¤ ¤	2¤ ¤	2¤ ¤
3¤ ¤	3¤ ¤	3¤ ¤

EMERGENCY·RESPONSE¤		US·EMBASSY/CONSULATE¤	PRIMARY·EVACUATION·ASSEMBLY·POINT(S)¤
1¤ ☐First·Aid·Kits¤	¤	1¤ ¤	
2¤ ☐Emergency·Phone¤	CMPD··707·654·1111¤	2¤ ¤	¤
3¤ ☐AXIS¤	¤	3¤ ¤	

USE·THE·BACK·OF·THIS·FORM·OR·ATTACHED·ADDITIONAL·SUPPORT·DOCUMENTS·TO·LIST·ANY·STEPS·AND·OTHER·INFORMATION☐



EVENT MANAGEMENT REPORT | LEVEL OF CONSEQUENCE ☐ LOW ☐ MED ☐ HIGH ☐ IDLH

REPORT DATE | EVENT DATE/TIME | EVENT NO. | PRIMARY INVESTIGATOR

INVOLVING ☐ Employee ☐ Cadet ☐ Contractor ☐ Vender ☐ Guest/Public Visitor ☐ Other

INCIDENT TYPE ☐ Unsafe Condition ☐ Near Miss ☐ Injury ☐ Property Damage ☐ Environmental Spill ☐ Policy Violation

EVENT SUMMARY

WHAT	What Happened
WHERE	Where it Happened
HOW	How it Happened

CAUSAL FACTORS

	WEATHER	SITE	PPE	BEHAVIOR	PROCESS MANAGEMENT	
WHY	☐ Rain/Water	☐ Housekeeping	☐ Not Wearing	☐ Horseplay	☐ Unsafe Condition	☐ Unforeseen Condition
	☐ Snow/Ice	☐ Lighting	☐ Improperly Worn	☐ Unsafe Act	☐ Unsafe Practice	☐ Inadequate Planning
	☐ Wind	☐ Slippery	☐ Wrong Type	☐ Inattention·Situational Awareness	☐ Communication Misunderstood	☐ Inadequate Communication
	☐ Sun/Heat	☐ Uneven surface	☐ Defective	☐ Personal Condition (Physical/Mental)	☐ Defective Equipment	☐ Improper Use
	☐ Dust/Smoke	☐ Edge or End Unprotected	☐ Other	☐ Under the Influence	☐ Wrong Equipment	☐ Inexperience/ Training

CALIFORNIA STATE UNIVERSITY MARITIME ACADEMY 1

Appendix E: Chemical Hazard Class SOP for Explosives

1. Purpose

This standard operating procedure (SOP) is intended to provide guidance on how to safely work with explosive chemicals in a Cal Maritime laboratory. Laboratory personnel should review this SOP, as well as the appropriate Safety Data Sheet(s) (SDSs), before using explosive chemicals.

2. Scope

This hazard class SOP only addresses safety issues specific to the explosive hazard of a chemical; several hazard class SOPs may be applicable for a specific chemical. In addition, some explosive chemicals may fall under the regulatory purview of the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF). If you are using an explosive chemical that falls under one of these categories, refer to the University Chemical Hygiene Plan for additional requirements.

3. Hazard Description

Explosives are chemicals or combinations of chemicals that may cause a sudden release of pressure, gas and heat when subjected to sudden shock, pressure or high temperature. This hazard class is not to be confused with the "explosive materials" regulated by the ATF, which are designed with the primary function to explode.

Common chemical explosives include acetylides, azides, organic nitrates, nitro compounds and organic peroxides. The explosive nature of compounds may vary widely; some are set off by the action of a metal spatula on the solid (e.g. organic azides) and others may decompose explosively when exposed to a ground glass joint (e.g. diazomethane). Organic peroxides are considered to be both explosives and highly reactive chemicals; refer to both hazard class SOPs for work with these chemicals.

4. General Control of Hazards

The following general control measures must be implemented whenever using or handling explosive chemicals:

- Limit your inventory of explosive chemicals, especially azos, peroxides and peroxidizables; use minimum amounts in experiments.
- Keep away from heat, sparks, open flames and hot surfaces.
- Consult the SDS. Do not handle explosive chemicals until all safety precautions have been read and understood.
- When planning a reaction, consider the potential for explosion and plan accordingly.
- If drying out increases the explosion hazard of a chemical, keep the chemical wetted.
- If the explosive is electrostatically sensitive, ground/bond the container and receiving equipment.
  Immediately discard any organic compounds that are prone to peroxidation (e.g. secondary alcohols) that become contaminated.
- Do not subject the chemical to grinding, shock or friction.

5. Engineering Controls

Explosive chemicals should be used in a chemical fume hood (or other ventilated enclosures) whenever possible. Safety shields (i.e. blast-protective shields) must be used when:

- a reaction is attempted for the first time (small quantities should be used to minimize hazards),
- a familiar reaction is carried out on a significantly larger scale than usual (e.g. 5-10 times more material), or
- operations are carried out at increased temperature and/or pressure.

Safety shields must be placed so all laboratory workers in the area are protected from the explosion hazard. These shields or barricades can provide protection not only against the exploding chemicals, but any flying particles that may result from the explosion. Shields should also be used when performing a reaction that will be left unattended for a period of time.

6. Personal Protective Equipment

At a minimum, all laboratory workers must wear safety glasses, long pants, closed-toed shoes, a laboratory coat and examination gloves when working with hazardous chemicals in a laboratory. Laboratory personnel working with explosive chemicals, or performing an experiment that may lead to an explosion, must also wear a full face shield over their safety glasses. Blast-protective clothing (e.g. aprons) may be required, depending on the amounts and stability of the explosives used. Heavy leather gloves may be required if it is necessary to reach behind a shielded area while the experiment is in progress.

7. Handling and Storage Requirements

Store explosive chemicals away from incompatible materials, including flammable materials and oxidizers. Ideally, this segregation would occur via separate cabinets. If space is limited, however, storing all compatible explosives in sealed secondary containment (i.e. plastic trays or Tupperware) within the same cabinet as incompatible chemicals is acceptable. Consult the SDS for more specific information on compatibility. Record the opening date and the date the chemical should be discarded on the label of chemicals that may degrade to become potentially explosive (e.g. organic peroxides).

8. Waste Disposal

Dispose of explosive chemicals as soon as possible; explosive waste should not be allowed to accumulate. Contact SRM for further information on the disposal of explosive chemicals.

9. Spill and Incident Procedures

In the case of a spill of explosive chemicals, do not attempt to clean the spill yourself. Evacuate the area and follow the procedures illustrated in the University Chemical Hygiene Plan section on major chemical spills. Inform the RLSS of all major chemical spills.

- In the case of an explosion in the laboratory, leave the area immediately and call 911 from a campus phone, or call 911 from a non-campus phone and mention the incident is on the Cal Maritime campus.
- If a laboratory worker is injured or exposed to explosive chemicals, immediately notify SRM. If a laboratory worker requires immediate medical attention, call 911. Remove contaminated clothing and immediately flush the contaminated areas with water for at least 15 minutes. For eye exposures, immediately remove contact lenses, if present, and flush the eyes with water for at least 15 minutes. Consult the chemical's SDS for more specific information on appropriate first aid.

10. Designated Area

Designated areas are not required for this hazard class. However, chemicals may belong to multiple hazard classes, and an explosive chemical may require a designated area if it belongs to a hazard class that includes particularly hazardous chemicals.

Appendix F: Chemical Hazard Class SOP for Flammables

1. Purpose

This standard operating procedure (SOP) is intended to provide guidance on how to safely work with flammable chemicals in a Cal Maritime laboratory. Laboratory personnel should review this SOP, as well as the appropriate Safety Data Sheet(s) (SDSs), before using flammable chemicals.

2. Scope

This hazard class SOP only addresses safety issues specific to the flammable hazard of a chemical; several hazard class SOPs may be applicable for a specific chemical. For the purposes of laboratory safety, both flammable and combustible liquids are considered to be in the "Flammable" hazard class, and are covered under this SOP.

3. Hazard Description

Flammable chemicals are easily ignited and are capable of burning rapidly. The following flammability hazards are included in this SOP:

- Flammable gas
- Flammable aerosol
- Flammable liquid
- Flammable solid
- Combustible liquid

Common flammable chemicals include acetone, ethanol, cyclohexane, and methanol. The flammability of a liquid chemical will depend on its flash point, or the temperature at which an organic compound gives off sufficient vapor to ignite in air. The lower the flash point, the more flammable the chemical. Flash points are commonly found on the chemical's SDS.

4. General Control of Hazards

The following general control measures should be implemented whenever using or handling flammable chemicals:

- Keep away from heat, sparks, open flames and hot surfaces.
- Never heat flammable chemicals with an open flame. If the temperature must be increased, use an oil or water bath.
- Avoid using ignition sources (e.g. Bunsen burners, hot plates, oil baths, electrical equipment with frayed or cracked wiring, etc.) in areas where highly flammable (i.e. low flash point) chemicals are used.
- Avoid creating static electricity in areas where highly flammable chemicals are used.
- Keep the containers of flammable chemicals tightly closed at all times when not in use to prevent accumulation of flammable vapors.

Ensure proper grounding. Be sure to ground metal containers when transferring flammable liquids.

- Do not pierce or burn pressurized containers of flammable aerosols, even after use.

5. Engineering Controls

Flammable and combustible chemicals should be used in a chemical fume hood (or other similarly ventilated area) whenever possible. This is especially true for highly flammable chemicals, large quantities (> 500mL) of flammable chemicals, or when using flammable chemicals at increased temperature or pressure.

Fire extinguishers should be immediately available in the laboratory when working with flammable chemicals. Ensure the fire extinguisher is appropriate for the chemicals used; the wrong fire extinguisher may not work against a fire, or worse, may make the fire larger. Type ABC fire extinguishers are appropriate for most laboratory settings, but a Class D fire extinguisher is required for fires involving combustible metals (e.g. magnesium, titanium, sodium, potassium).

6. Personal Protective Equipment

At a minimum, all laboratory workers must wear safety glasses, long pants, closed-toed shoes, a laboratory coat and examination gloves when working with hazardous chemicals in a laboratory. Laboratory personnel working with large quantities of flammable chemicals, or with any quantity of a flammable chemical near an ignition source, must wear a 100% cotton or flame-resistant laboratory coat. A

poly/cotton blend laboratory coat will not protect your skin against flammable hazards. If the splashing of flammable liquids is a possibility during your work, splash goggles must be worn instead of safety glasses.

7. Handling and Storage Requirements

Store flammable materials in a well-ventilated place and keep them cool. Segregate flammable chemicals from incompatible materials, such as oxidizers, corrosives, combustibles, etc. In laboratories or storage rooms where more than 10 gallons of flammable chemicals are stored, these chemicals must be stored in an approved flammable storage cabinet. Ensure there are no combustible materials (e.g. paper, cardboard, etc.) also stored in flammable storage cabinets that may act as fuel for a fire. A maximum of 60 gallons of flammable liquid may be stored within a single flammable storage cabinet, and no more than 3 flammable storage cabinets may be kept in a laboratory/fire area. An exception to this rule exists if the storage room qualifies as an "inside storage room" per International Fire Code. Contact the SRM for further information on inside storage rooms.

If a flammable chemical must be kept below room temperature, the refrigerator/freezer used for storage must be an approved explosion-proof or modified-domestic device. Flammable chemicals should not be stored in regular, domestic refrigerators/freezers.

Flammable chemicals must be transported in secondary containment, preferably a polyethylene or other non-reactive acid/solvent bottle carrier. Suitable fire control devices (e.g. fire extinguishers) must be available in laboratories or storage rooms where flammable or combustible chemicals are located.

8. Waste Disposal

Waste flammable chemicals should be collected in compatible waste containers (i.e. plastic 3.5 gallon buckets) and segregated from incompatible chemicals. Contact SRM for further information on the disposal of flammable chemicals.

9. Spill and Incident Procedures

- If a spill of flammable chemicals constitutes a major spill (e.g. it occurs near an ignition source), do not attempt to clean the spill yourself. Evacuate the area and follow the procedures illustrated in the University Chemical Hygiene Plan section on major chemical spills. Inform SRM of all major chemical spills.
- In the case of an explosion or fire in the laboratory, leave the area immediately and call 911 from a campus phone, or call 911 from a non-campus phone and mention the incident is on the Cal Maritime campus.
- If a laboratory worker is injured or exposed to flammable chemicals, immediately notify SRM. If a laboratory worker requires immediate medical attention, call 911. Remove contaminated clothing and immediately flush the contaminated areas with water for at least 15 minutes. For eye exposures, immediately remove contact lenses, if present, and flush the eyes with water for at least 15 minutes. Consult the chemical's SDS for more specific information on appropriate first aid.

10. Designated Area

Designated areas are not required for this hazard class. However, chemicals may belong to multiple hazard classes, and a flammable chemical may require a designated area if it belongs to a hazard class that includes particularly hazardous chemicals.

Appendix G: Chemical Hazard Class SOP for Oxidizers

1. Purpose

This standard operating procedure (SOP) is intended to provide guidance on how to safely work with oxidizing chemicals in a Cal Maritime laboratory. Laboratory personnel should review this SOP, as well as the appropriate Safety Data Sheet(s) (SDSs), before using oxidizers.

2. Scope

This hazard class SOP only addresses safety issues specific to the oxidizing hazard of a chemical; several hazard class SOPs may be applicable for a specific chemical.

3. Hazard Description

Oxidizers are chemicals that may react violently when they come into contact with reducing agents (e.g. zinc, hydrazine, formic acid), or combustible materials. They initiate or promote combustion in other materials, generally by the rapid release of oxygen.

Examples of oxidizing chemicals include halogens, chlorates, nitrates, chromates, persulfates and peroxides. Strong oxidizers (e.g. calcium chlorate, fluorine, hydrogen peroxide, potassium bromate) are capable of forming explosive mixtures with combustible, organic or reducing materials.

4. General Control of Hazards

The following general control measures should be implemented whenever using or handling oxidizers:

- Minimize the quantities of oxidizers used and stored in the laboratory.
- Keep oxidizing materials away from heat, flammables and potential fuels such as clothing and other combustible materials.
- Use caution when mixing oxidizers with flammable, combustible, or reducing materials for an experiment. Use small amounts to allow better control of the reaction and heat generation.

5. Engineering Controls

Oxidizing chemicals should be stored and used in a well-ventilated area. Perchloric acid must be used in a special chemical fume hood that is equipped with wash down facilities. Contact the SRM for more information on fume hood requirements for the use of this chemical.

Safety shielding is required any time there is a risk of an explosion, splash hazard or highly exothermic reaction. This shielding requirement may be met by performing the experiment in a chemical fume hood, with the sash at is lowest possible position. Portable blast shielding is acceptable, as long as it may be reasonably effective at protecting all laboratory workers in the area

6. Personal Protective Equipment

At a minimum, all laboratory workers must wear safety glasses, long pants, closed-toed shoes, a laboratory coat and examination gloves when working with hazardous chemicals in a laboratory. Laboratory personnel working with oxidizing chemicals when a splash hazard exists must wear splash goggles instead of safety glasses. Chemical-resistant gloves may be necessary if working with the oxidizing chemical for an extended period of time. Refer to the Personal Protective Equipment Selection Guide on the SRM website for further information on appropriate chemical-resistant gloves.

7. Handling and Storage Requirements

Store oxidizing gases in a cool, dry, well-ventilated place away from flammable and combustible materials such as solvents, wood, paper, Styrofoam, and plastics. Oxidizing agents should also be segregated from reducing agents (e.g. zinc, alkaline metals, etc.), as they can react violently with oxidizers. Since combustible materials (i.e. wood, paper, etc.) are great fuels for oxidizers, oxidizing chemicals should not be stored in wooden cabinets or on wooden shelves.

Secondary containment must be used when storing strong oxidizing acids, such as perchloric acid and chromic acid. Cylinders of oxidizing gases must be fitted with flow reduction valves and fittings free from oil and grease (these are great combustible fuels for oxidizers).

8. Waste Disposal

Waste oxidizing chemicals should be collected in compatible waste containers (i.e. plastic 3.5 gallon buckets) and segregated from incompatible chemicals. Contact SRM for further information on the disposal of flammable chemicals.

9. Spill and Incident Procedures

Laboratory personnel may clean a spill of small amounts of oxidizers only if the spill does not involve a reactive mixture and they have appropriate materials and training.

- Before beginning spill cleanup, alert all laboratory workers in the area of the spill of oxidizing chemicals.
- Do not use paper towels or other inappropriate combustible materials to clean a spill of oxidizing chemicals; consider the use of other absorbents (e.g. vermiculite).
- If the spill of oxidizing chemicals is large or contains a reactive mixture, do not attempt to clean the spill yourself. Evacuate the area and follow the procedures in the University Chemical Hygiene Plan section on major chemical spills. Inform the SRM of all major chemical spills.
- In the case of an explosion in the laboratory, evacuate the area immediately and call 911 from a campus phone, or call 911 from a non-campus phone and mention the incident is on the Cal Maritime campus (if on the main Tucson campus). If there is a fire in the laboratory containing oxidizing chemicals, either contain the fire using an approved fire extinguisher, or pull the fire alarm if the fire is not quickly extinguished by building/laboratory fire control equipment.
- If a laboratory worker is injured or exposed to oxidizing chemicals, immediately notify the SRM. If a laboratory worker requires immediate medical attention, call 911. Remove contaminated clothing and immediately flush the contaminated areas with water for at least 15 minutes. For eye exposures, immediately remove contact lenses, if present, and flush the eyes with water for at least 15 minutes. Consult the chemical's SDS for more specific information on appropriate first aid.

10. Designated Area

Designated areas are not required for this hazard class. However, chemicals may belong to multiple hazard classes, and an oxidizer may require a designated area if it belongs to a hazard class that includes particularly hazardous chemicals.

Appendix H: Chemical Hazard Class SOP for Compressed Gases

1. Purpose

This standard operating procedure (SOP) is intended to provide guidance on how to safely work with compressed gases in a Cal Maritime laboratory. Laboratory personnel should review this SOP, as well as the appropriate Safety Data Sheet(s) (SDSs), before using compressed gases.

2. Scope

This hazard class SOP only addresses safety issues specific to the high pressure hazard of a chemical. The gases within the cylinder may pose additional hazards, such as flammability, corrosivity, toxicity, etc. Consult the SDS for each compressed gas and refer to the other hazard class SOPs that may apply to the gas's hazards.

3. Hazard Description

- Compressed gases present a physical hazard due to the high pressures within the gas cylinders. Even if a compressed gas does not present a physical or health hazard beyond the high pressure (e.g. compressed nitrogen, etc.), the volume of the gas may fill the room in the case of a leak, creating an oxygen-deficient atmosphere.
- Cryogenic materials (e.g. liquid nitrogen) are also included within the scope of this SOP, as cryogenic dewars contain gases under high pressure. Cryogenic materials can cause tissue damage due to extreme cold, and can create an inhalation hazard in poorly ventilated areas due to boil off or spill.

4. General Control of Hazards

The following general control measures should be implemented whenever using or handling compressed gases:

- All compressed gas cylinders must be legibly marked with the chemical name of the contained material (cylinder color does not constitute chemical identity), manufacturer identification.
- When using a highly flammable or toxic gas, check the delivery system with an inert gas before introducing the hazardous gas.
- Corrosive gases should not be kept for longer than 1 year. The recommended shelf life of all other gases is 2 years.
- Check connections and hoses regularly for leaks using instrumentation, soapy water, etc.

5. Engineering Controls

Cylinders of hazardous gases may require additional engineering controls, such as a ventilated enclosure for use and storage, restricted flow orifices for regulators, and gas detection monitors. See the Use of Hazardous Gases SOP for further information on requirements for toxic, pyrophoric, or corrosive gases.

- Cryogenic dewars may need to be secured; the SRM will provide guidance for securing dewars on a case-by-case basis. The storage of cryogenic materials in a laboratory or storage room may require the installation and use of oxygen monitors. Examples of situations where oxygen monitors may be required include freezer bays and hypoxia chamber rooms.

6. Personal Protective Equipment

At a minimum, all laboratory workers must wear safety glasses, long pants, closed-toed shoes, a laboratory coat and examination gloves when working with hazardous chemicals in a laboratory.

- Laboratory personnel working with cryogenic materials should wear cryogenic-resistant gloves rather than examination-type gloves. Chemical resistant gloves should be considered if working with a gas that is hazardous to the skin. Refer to the Personal Protective Equipment Selection Guide on the SRM website for further information on appropriate chemical-resistant gloves.

If the compressed gas is corrosive, laboratory workers must wear splash goggles instead of safety glasses.

7. Handling and Storage Requirements

Only the gas cylinders necessary for experiments or procedures in the laboratory should be stored within the laboratory itself. All others, including empty cylinders, must be promptly returned to supply vender.

- Compressed gas cylinders must be secured to a wall or other sturdy structure by chains, or by a cylinder stand/clam shell. If a gas cylinder is not secured to a wall (i.e. with an approved stand), it must be secured so as not to be in danger of being knocked over by foot traffic. Compressed gas cylinders must remain upright, whether in storage or use. The valve protection cap must be fully screwed onto the gas cylinder when not in use.

- Protect gas cylinders from sunlight and store them in a well-ventilated place. Gas cylinders containing anything other than compressed air must not be stored in cold rooms or other unventilated areas. Ensure proper regulators and piping are being used for the gas in each cylinder.
- Segregate compressed gases by type and compatibility. Empty gas cylinders should be segregated from full, or partially full, cylinders. Gas cylinders that are empty must still be stored and secured as if they were full. Flammable gas cylinders must only be used with flame-resistant gas lines and hoses, and be stored at least 20 feet away from oxygen gas cylinders and other oxidizing gases.
- Compressed gas cylinders must be transported using hand-trucks or other appropriate means. Cylinders must be secured to the hand-truck by straps or chains. They should be transported in their upright position whenever possible.

8. Waste Disposal

- Contact supply vender for disposal. If vender unknown contact SRM.

9. Spill and Incident Procedures

Laboratory personnel must keep antidotes for hazardous gases on hand, whenever antidotes exist (e.g. calcium gluconate for HF gas).

- Immediately evacuate the area in the event of a spill or leak of a compressed gas that is an irritant, oxidizer, asphyxiant, or has other hazardous properties. Follow the procedures in the University Chemical Hygiene Plan section on major chemical spills. Inform the SRM of all major chemical spills.
- If there is a fire or explosion in the laboratory, leave the area immediately and call 911 from a campus phone, or call 911 from a non-campus phone and mention the incident is on the Cal Maritime campus.
- If a laboratory worker is injured or exposed to a hazardous gas, immediately notify the SRM. If they require immediate medical attention, call 911. Move the laboratory worker to fresh air. If the skin was exposed to corrosive or toxic gas, remove contaminated clothing and immediately flush the contaminated areas with water for at least 15 minutes. For eye exposures, immediately remove contact lenses, if present, and flush the eyes with water for at least 15 minutes. Consult the chemical's SDS for more specific information on appropriate first aid.

10. Designated Area

Designated areas are not required for this hazard class. However, chemicals may belong to multiple hazard classes, and a compressed gas may require storage and use in a designated area if it belongs to a hazard class that includes particularly hazardous chemicals (e.g. ammonia gas).

Appendix I: Chemical Hazard Class SOP for Highly Reactive Chemicals

1. Purpose

This standard operating procedure (SOP) is intended to provide guidance on how to safely work with highly reactive chemicals in a Cal Maritime laboratory. Laboratory personnel should review this SOP, as well as the appropriate Safety Data Sheet(s) (SDSs), before using highly reactive chemicals. If you have questions concerning the requirements within this SOP, contact the lab technician, chemistry department faculty and/or the department of safety and risk management.

2. Scope

This hazard class SOP only addresses safety issues specific to the high reactivity hazard of a chemical; several hazard class SOPs may be applicable for a specific chemical. Organic peroxides are considered to be both explosives and highly reactive chemicals; refer to both hazard class SOPs for work with these chemicals.

3. Hazard Description

Highly reactive chemicals are those that, under certain circumstances, are unstable and may cause a physical hazard. The following hazards are included within this hazard class:

- Self-reactive: Chemicals outside of the explosive, oxidizing, and organic peroxide classifications that undergo a highly exothermic (heat-releasing) decomposition in the presence of heat
- Ex: Arsine, Diborane, Hydroxylamine, etc.
- Pyrophoric: Chemicals that ignite, even in small quantities, when exposed to air
- Ex: Silane gas, Dichloroborane, White phosphorous, etc.
- Self-heating: May catch fire: Chemicals, other than pyrophorics, that self-heat when exposed to air, even in the absence of an energy supply such as a hot plate
- Ex: Magnesium, Sodium sulfide, etc.
- Organic peroxides: Chemicals that may be liable to explosive decomposition, burn rapidly, be sensitive to impact/friction, or react dangerously with other substances
- Ex: Hydrogen peroxide, Diethyl ether, Tetrahydrofuran, etc.
- Water-reactive: Chemicals that either react violently or release a toxic (or flammable) gas upon contact with water
- Ex: Calcium oxide, Phosphorous pentachloride, Sodium, Potassium, etc.

Peroxides are some of the most common and most shock-sensitive chemicals found in laboratories. Organic peroxides supply both the oxygen and the fuel source required to start a fire; all they need is a spark. Some chemicals are naturally occurring organic peroxides (e.g. hydrogen peroxide). However, others can form peroxides with air, moisture, impurities, or even time during regular storage (e.g. isopropyl ether, diethyl ether). Once peroxides have been formed, an explosion can occur when distilling, concentrating or evaporating these chemicals. Explosions can even be caused by twisting off a cap of a reagent bottle if peroxides formed between the threads of the cap.

4. General Control of Hazards

The Highly Reactive Chemicals hazard class includes a wide variety of hazards. Though basic control measures may be implemented for the class as a whole, the SDS of highly reactive chemicals should be consulted for specific information on hazard controls and safety measures.

The following general control measures should be implemented whenever using or handling highly reactive chemicals:

- Whenever possible, use a less hazardous alternative chemical to complete the experiment.
- Minimize the quantity and/or concentration of highly reactive chemicals used or synthesized to the smallest amount immediately needed for an experiment.
- Plan experiments involving highly reactive chemicals carefully, including consulting the SDS(s). Do not handle highly reactive chemicals until all safety precautions have been read and understood.
- Ensure an appropriate fire extinguisher is nearby before using highly reactive chemicals.
- All containers of highly reactive chemicals should be dated as soon as they are received, and never opened after their expiration date.
- Combine highly reactive chemicals to other chemicals slowly, watching for increased heat or release of gases.
- Consider the additional hazards of scaled-up reactions that may not be obvious on a smaller scale.
- Consult with SRM if you are working with a new chemical, or if you are unsure of the safety precautions required for the highly reactive chemical.

- Provide a mechanism for adequate temperature control and heat dissipation when handling these chemicals.

5. Engineering Controls

Since many highly reactive chemicals liberate a flammable and/or toxic gas when exposed to water vapor or air, they must be used in a chemical fume hood to prevent exposure to these gases. If a chemical is air-sensitive, it should be used in a glove box under an inert atmosphere. If a glove box is not available, consult with SRM on how to control the hazards involved with air-sensitive highly reactive chemicals. Utilize safety barricades or shields if there is a possibility of an explosion or violent chemical reaction. Place these barricades so that all laboratory workers in the area are protected from the explosion hazard.

6. Personal Protective Equipment

At a minimum, all laboratory workers must wear safety glasses, long pants, closed-toed shoes, a laboratory coat and examination gloves when working with hazardous chemicals in a laboratory. Laboratory personnel working with any highly reactive chemicals should wear splash goggles, instead of safety glasses, as well as a 100% cotton or flame-resistant laboratory coat. Heavy gloves and safety barricades should also be considered, depending on the amount and stability of the chemicals being used.

7. Handling and Storage Requirements

Store any highly reactive chemicals away from flammable or combustible materials where they cannot fall or be knocked over easily. Do not store these chemicals in temporary containers (e.g. vials, jars, beakers, etc.); keep them in their original containers. Label all highly reactive chemicals with the date received and the date the container was opened. Because of their high degree of reactivity, only the amount of these chemicals needed for immediate use should be brought into the laboratory. The chemicals' SDSs may be used to obtain specific storage requirements and precautions.

7.1 Self-reactive, Pyrophoric, and Self-heating chemicals:

Store self-reactive, pyrophoric and self-heating chemicals at low temperatures away from direct sunlight, heat, sparks, open flames and hot surfaces. Because pyrophoric chemicals can ignite spontaneously when in contact with air, they must be handled under an inert atmosphere and in a way that prevents exposure to air. Extra care must always be taken when using these chemicals, and laboratory workers should consult with SRM before using them in a laboratory.

Pyrophoric chemicals should be stored under an inert atmosphere or solvent to prevent exposure to air. Storage locations may include inert gas-filled desiccators or glove boxes. If a pyrophoric chemical must be stored below room temperature, the refrigerator/freezer must be an explosion-proof or modified domestic piece of equipment. Only those laboratory workers who have been trained on how to handle highly reactive chemicals should have access to storage areas containing pyrophorics.

7.2 Organic peroxides:

Store organic peroxides at low temperatures, but not at temperatures below the temperature at which they freeze. The sensitivity of most peroxides can be decreased by diluting them with an inert solvent (e.g. hexane). Do not allow contact of peroxides with metal lab ware, tools or equipment.

Peroxide-forming chemicals should be kept away from heat and sunlight and their containers should be tightly sealed after each use. Refrigeration does not prevent peroxide formation. Containers of peroxide-forming chemicals should be labeled with the date received and the date opened. Because of the high potential for fires and explosions, these chemicals must be disposed of one year after the opening of the container, or by the expiration date (whichever is sooner). Laboratory personnel can test for the presence of peroxides to extend the shelf-life by one year.

7.3 Water-reactive chemicals:

Store water-reactive chemicals in closed container in a dry place away from water, sources of water (e.g. sinks and safety showers) and water-containing chemicals (e.g. aqueous buffers, diluted acids). Containers of water-reactive chemicals should be tightly sealed and water-tight.

8. Waste Disposal

Waste highly reactive chemicals should be collected in compatible containers and segregated from incompatible chemicals. Do not dispose of pure organic peroxides; rather, dilute the peroxides before disposal with water. Dispose of peroxide-forming chemicals one year after

the open date or at the expiration date, whichever is sooner. Contact Risk Management Services for further information on the disposal of highly reactive chemicals.

9. Spill and Incident Procedures

- Do not attempt to clean up a spill of self-reactive, self-heating, pyrophoric or water-reactive chemicals yourself. Evacuate the area and follow the procedures in the University Chemical Hygiene Plan section on major chemical spills. Inform the SRM of all major chemical spills.
- In the case of an explosion or fire in the laboratory, leave the area immediately, pull the fire alarm, and call 911 from a campus phone (or call 911 from a non-campus phone and mention the incident is on a Cal Maritime campus).
- If a laboratory worker is injured or exposed to highly reactive chemicals, immediately notify the SRM. If a laboratory worker requires immediate medical attention, call 911. Remove contaminated clothing and immediately flush the contaminated areas with water for at least 15 minutes. For eye exposures, immediately remove contact lenses, if present, and flush the eyes with water for at least 15 minutes. Consult the chemical's SDS for more specific information on appropriate first aid.

10. Designated Area

Designated areas are not required for this hazard class. However, chemicals may belong to multiple hazard classes, and a highly reactive chemical may require a designated area if it belongs to a hazard class that includes particularly hazardous chemicals.

Appendix J: Chemical Hazard Class SOP for Corrosives

1. Purpose

This standard operating procedure (SOP) is intended to provide guidance on how to safely work with corrosive chemicals in a Cal Maritime laboratory. Laboratory personnel should review this SOP, as well as the appropriate Safety Data Sheet(s) (SDSs), before using corrosives.

2. Scope

This hazard class SOP only addresses safety issues specific to the corrosive hazard of a chemical; several hazard class SOPs may be applicable for a specific chemical.

3. Hazard Description

Corrosive chemicals (i.e. acids and bases) cause visible destruction or permanent damage of skin or tissue at the point of contact. They can also be corrosive to metals. Corrosives can be liquids, solids or gases, and can therefore affect the skin, eyes and respiratory tract. Three general categories of corrosive chemicals exist: acids, bases, and dehydrating agents. Common examples of highly corrosive chemicals are hydrochloric acid, sodium hydroxide, chlorine gas, and phosphorous.

4. General Control of Hazards

The following general control measures should be implemented whenever using or handling corrosive chemicals:

- Wash hands thoroughly after handling corrosive chemicals.
- Do not breathe dusts or mists if inhalable particles may be created during use.
- Do not pour water into a liquid corrosive. Slowly add the corrosive to the water and stir.

5. Engineering Controls

Corrosive chemicals should be used in a chemical fume hood when used in high concentrations, or when the chemical, or reactions with the chemical, may produce an airborne hazard such as a gas, mist or fume.

6. Personal Protective Equipment

At a minimum, all laboratory workers must wear safety glasses, long pants, closed-toed shoes, a laboratory coat and examination gloves when working with hazardous chemicals in a laboratory. Laboratory personnel working with large quantities of corrosive chemicals, or with any quantity in a way that may generate a splash hazard, must wear splash goggles instead of safety glasses. Chemical-resistant gloves may be necessary if working with corrosive chemicals in high quantities or for an extended period of time. Refer to the Personal Protective Equipment Selection Guide on the SRM website for further information on appropriate chemical-resistant gloves.

7. Handling and Storage Requirements

Liquid acids and based may react violently with one another if they come into contact, depending on their strength and concentration. Concentrated, strong liquid acids and bases must be stored in corrosion-resistant secondary containment that can hold the full amount of chemicals being stored. Secondary containment may be built into the storage location (i.e. approved corrosive cabinets) or may be added to a storage area (e.g. plastic trays or Tupperware). Segregate concentrated strong acids and bases from each other, either in separate cabinets or with secondary containment. Nitric acid should be stored in separate secondary containment from other concentrated acids, such as acetic acid and hydrochloric acid.

Corrosive materials (acids and bases) must be stored below eye level, and should not be stored in flammable storage cabinets (with the exception of organic acids such as acetic acid, lactic acid and formic acid, in which case secondary containment is required). The corrosive materials may cause serious damage to the flammable cabinet and the other chemicals inside. Corrosives should be stored in separate areas from organic chemicals and flammable/combustible materials. Large quantities of corrosive chemicals should be stored in specially designated corrosive-resistant cabinets. It is recommended to label the outside of corrosive cabinets with hazard warnings, such as “Acids,” “Bases” or “Corrosives.”

8. Waste Disposal

Dispose of corrosive chemicals as aqueous hazardous waste (unless they are contaminated with other non-aqueous chemicals), in appropriate waste containers (i.e. plastic 3.5 gallon buckets) and segregated from incompatible chemicals. Contact SRM for further information on the disposal of hazardous chemicals.

9. Spill and Incident Procedures

Laboratory personnel may clean a small spill of corrosive chemicals themselves, as long as appropriate neutralizing materials (i.e. sodium bicarbonate for acids and citric acid for bases) and personal protective equipment are on hand, and workers have appropriate training. Neutralizing materials must be added to the spill slowly; the neutralization reaction may be exothermic (heat producing), and can cause more damage than the original spill if it occurs too rapidly. Once the addition of more neutralizing material does not generate signs of a reaction (i.e. heat, bubbling, etc.), the spill may be swept up and disposed of as hazardous waste.

If the spill of corrosive chemicals is large or contains a reactive mixture, do not attempt to clean the spill yourself. Evacuate the area and follow the procedures in the University Chemical Hygiene Plan section on major chemical spills. Inform the SRM of all major chemical spills.

If a laboratory worker is injured or exposed to corrosive chemicals, immediately call 911 and notify department management as well as SRM; if the laboratory worker needs immediate medical attention. Remove contaminated clothing and immediately flush the contaminated areas with water for at least 15 minutes. For eye exposures, immediately remove contact lenses, if present, and flush the eyes with water for at least 15 minutes.

Due to the high hazards associated with certain corrosive chemicals, additional safety precautions may be required in the laboratory, including the application of antidotes (e.g. calcium gluconate for HF gas). Consult the chemical's SDS for more specific information on appropriate first aid.

10. Designated Area

Designated areas are not required for this hazard class. However, chemicals may belong to multiple hazard classes, and a corrosive chemical may require a designated area if it belongs to a hazard class that includes particularly hazardous chemicals (e.g. hydrofluoric acid).

Appendix K: Chemical Hazard Class SOP for Inhalation Hazards

1. Purpose

This standard operating procedure (SOP) is intended to provide guidance on how to safely work with chemicals that present an inhalation hazard in a Cal Maritime laboratory. Laboratory personnel should review this SOP, as well as the appropriate Safety Data Sheet(s) (SDSs), before using chemicals that present an inhalation hazard. If you have questions concerning the requirements within this SOP, contact the Department of Safety and Risk Management.

2. Scope

This hazard class SOP only addresses safety issues specific to the inhalation hazard of a chemical; several hazard class SOPs may be applicable for a specific chemical.

3. Hazard Description

This hazard class includes chemicals that may be hazardous to a laboratory worker via inhalation. While this class ranges from chemicals that are irritating, harmful, toxic and fatal to laboratory workers, the mode of entry for this class is the same: inhalation. This classification allows for the determination of hazard controls required to protect laboratory workers from inhalation hazards. This hazard class also includes chemicals that cause, or may cause, damage to organs after inhalation. Chemicals that are fatal to laboratory workers if inhaled are considered to be particularly hazardous chemicals by OSHA. However, it is important to note that not every chemical under this hazard class is a particularly hazardous chemical.

4. General Control of Hazards

The following general control measures should be implemented whenever using or handling chemicals which pose an inhalation hazard:

- Plan experiments involving inhalation hazards carefully, including consulting the SDS(s). Do not handle chemicals that present inhalation hazards until all safety precautions have been read and understood.
- Minimize the quantity and/or concentration of these chemicals used or synthesized to the smallest amount immediately needed for an experiment.
- Do not breathe dust, fumes, gas, mist, vapors or sprays when handling these chemicals.
- Use and store only in well-ventilated areas.
- Keep containers tightly closed and sealed.

5. Engineering Controls

A certified chemical fume hood must be used when handling chemicals that present an inhalation hazard, especially those that are toxic or fatal if inhaled. In some cases, other local ventilation or containment devices may be used to adequately control the inhalation hazard (i.e. glove box/glove bag, snorkel, gas cabinet, etc). The use of a chemical monitor/alarm may be required for chemicals that present an inhalation hazard (e.g. ammonia gas, carbon dioxide gas, etc.). For additional information on engineering control options, contact SRM.

6. Personal Protective Equipment

At a minimum, all laboratory workers must wear safety glasses, long pants, closed-toed shoes, a laboratory coat and examination gloves when working with hazardous chemicals in a laboratory. If chemicals that present an inhalation hazard cannot be used in a ventilated enclosure (i.e. chemical fume hood) due to experimental restrictions, laboratory workers should consider the use of a respirator. This is especially true for chemicals that are toxic or fatal if inhaled. Contact SRM to perform a hazard assessment of your experimental procedures to determine if respiratory protection should be used.

7. Handling and Storage Requirements

When working with highly toxic chemicals, or poisons, prevention of accidental release becomes even more important than usual. Chemicals that are fatal if they are inhaled should be securely stored; access to these chemicals should be restricted. Segregate chemicals that are fatal or toxic if inhaled from non-toxic materials. Ideally, this segregation would occur via separate cabinets. If space is limited, however, storing chemicals that are fatal or toxic in secondary containment (i.e. plastic trays or Tupperware) within the same cabinet as other chemicals is acceptable. Particularly hazardous chemicals (i.e. those that are fatal upon inhalation) must be stored and used within a labelled designated area. If you are unsure if a chemical constitutes a particularly hazardous chemical, be conservative and treat them as if they are. Carefully plan the transportation of chemicals that are fatal or toxic if inhaled. Handling chemicals outside of the laboratory area should be minimized, but when necessary, wear full personal protective equipment and carry the chemicals in unbreakable secondary containment.

8. Waste Disposal

Waste chemicals that present an inhalation hazard should be collected in compatible waste containers (i.e. plastic 3.5 gallon buckets) and segregated from incompatible chemicals. Some particularly hazardous chemicals may require special decontamination and disposal procedures. Contact Risk Management Services for further information on the disposal of chemicals.

9. Spill and Incident Procedures

Laboratory personnel may clean a small spill of chemicals that present an inhalation hazard themselves, as long as they wear appropriate personal protective equipment and have appropriate training. If the spill is large, occurs with a chemical that is fatal if inhaled, requires a respirator for cleanup, or occurs in a public area, do not attempt to clean the spill yourself. Evacuate the area and follow the procedures in the University Chemical Hygiene Plan section on major chemical spills. Inform SRM of all major chemical spills.

If a laboratory worker is injured or exposed to a chemical that is toxic or fatal by inhalation, immediately call 911 and department management and SRM, if the laboratory worker needs immediate medical attention. Move the laboratory worker to fresh air. If the exposed laboratory worker is experiencing extreme pain or difficulty breathing, they should get immediate medical attention. If the exposure is less severe, and the laboratory worker is feeling ill or if there is persistent respiratory burning, he/she should call the Poison & Drug Information Center at 1-800-222-1222for information to determine if further medical action is required. Inform SRM of the incident as soon as practicable.

If a fellow laboratory worker's breathing has stopped after exposure to a chemical that is toxic or fatal after inhalation, and you have been trained in cardiopulmonary resuscitation (CPR), perform artificial respiration as you wait for the emergency response team. Consult the chemical's SDS for more specific information on appropriate first aid.

10. Designated Area

Chemicals that are fatal upon inhalation are considered to be particularly hazardous chemicals. Because of this, some chemicals in this hazard class will require the designation of an area for their use and storage. All laboratory workers must know the location of these designated areas, and must use or store particularly hazardous chemicals only within them. Designated areas also require posting with the "Designated Area Label," which can be found on the SRM website.

Appendix L: Chemical Hazard Class SOP for Contact (Skin or Eye) Hazards

1. Purpose

This standard operating procedure (SOP) is intended to provide guidance on how to safely work with chemicals that present a health hazard through contact with the skin or eyes in a Cal Maritime laboratory. Laboratory personnel should review this SOP, as well as the appropriate Safety Data Sheet(s) (SDSs), before using chemicals that present a contact hazard. If you have questions concerning the requirements within this SOP, contact SRM.

2. Scope

This hazard class SOP only addresses safety issues specific to the hazards of a chemical presented by contact with the skin or eyes; several hazard class SOPs may be applicable for a specific chemical.

3. Hazard Description

This hazard class includes chemicals that may be hazardous to a laboratory worker upon contact with the skin or eyes. While this class ranges from chemicals that are irritating, harmful, toxic and fatal to laboratory workers, the mode of entry for this class is the same: skin or eye contact. This classification allows for the determination of hazard controls required to protect laboratory workers from contact hazards. This hazard class also includes chemicals that cause, or may cause, damage to organs after contact with the skin or eyes.

Chemicals that are fatal to laboratory workers upon contact are also considered particularly hazardous chemicals. However, it is important to note that not every chemical under this hazard class is a particularly hazardous chemical.

4. General Control of Hazards

The following general control measures should be implemented whenever using or handling chemicals which pose a contact (eye & skin) hazard:

- Plan experiments involving chemicals that are toxic upon contact carefully, including consulting the SDS(s). Do not handle chemicals that present contact (eye & skin) until all safety precautions have been read and understood.
- Minimize the quantity and/or concentration of these chemicals used or synthesized to the smallest amount immediately needed for an experiment.
- Do not get in eyes, on skin or clothing.
- Wash hands thoroughly after handling.
- Do not bring contaminated work clothing out of the laboratory.

5. Engineering Controls

- Chemicals that present a health hazard through contact with the skin or eyes must be used in a laboratory that is negatively pressured in relation to any public spaces. Contact the SRM or Facilities Management to determine if your laboratory is negatively pressured.
- Particularly hazardous chemicals (i.e. those that are fatal if in contact with the skin or eyes) must be used within a certified chemical fume hood or other approved ventilated enclosure.

6. Personal Protective Equipment

At a minimum, all laboratory workers must wear safety glasses, long pants, closed-toed shoes, a laboratory coat and examination gloves when working with hazardous chemicals in a laboratory. Laboratory personnel working with chemicals that present a contact hazard through the skin or eyes should wear splash goggles instead of safety glasses. Double gloving with examination-type gloves, or the use of chemical resistant gloves, should also be used. Liquid-resistant chemical aprons should be considered when working with liquid chemicals that present a hazard via skin absorption, especially if there is a high probability of splashing. Refer to the Personal Protective Equipment Selection Guide on the SRM website for further information on appropriate chemical-resistant gloves and liquid-resistant aprons.

7. Handling and Storage Requirements

When working with highly toxic chemicals, or poisons, prevention of accidental release becomes even more important than usual. Chemicals that are fatal if they come in contact with the skin or eyes should be securely stored; access to these chemicals should be restricted.

Segregate chemicals that are fatal or toxic upon contact with the skin or eyes from non-toxic materials. Ideally, this segregation would occur via separate cabinets. If space is limited, however, storing chemicals that are fatal or toxic in secondary containment (i.e. plastic trays or Tupperware) within the same cabinet as other chemicals is acceptable.

Particularly hazardous chemicals (i.e. those that are fatal upon contact with the skin or eyes) must be stored and used within a labelled designated area. If you are unsure if a chemical constitutes a particularly hazardous chemical, be conservative and treat them as if they were.

Carefully plan the transportation of chemicals that are fatal or toxic upon contact. Handling chemicals outside of the laboratory area should be minimized, but when necessary, wear full personal protective equipment and carry the chemicals in unbreakable secondary containment.

8. Waste Disposal

Waste chemicals that present a contact (eyes & skin) hazard should be collected in compatible waste containers (i.e. plastic 3.5 gallon buckets) and segregated from incompatible chemicals. Some particularly hazardous chemicals may require special decontamination and disposal procedures. Contact SRM for further information on the disposal of chemicals.

Spill and Incident Procedures

Laboratory personnel may clean a small spill of chemicals that present a contact (eyes & skin) hazard themselves, as long as they wear appropriate personal protective equipment and have appropriate training. If the spill is large, requires a respirator for cleanup, or occurs in a public area, do not attempt to clean the spill yourself. Evacuate the area and follow the procedures in the University Chemical Hygiene Plan section on major chemical spills. Inform the SRM of all major chemical spills.

If a laboratory worker is injured or exposed to a chemical that is toxic or fatal by inhalation, immediately call 911 and notify department management and SRM; if the laboratory worker needs immediate medical attention. Remove contaminated clothing and immediately flush the contaminated areas with water for at least 15 minutes. For eye exposures, immediately remove contact lenses, if present, and flush the eyes with water for at least 15 minutes. Consult the chemical's SDS for more specific information on appropriate first aid.

10. Designated Area

Chemicals that are fatal upon contact with the skin are considered to be particularly hazardous chemicals. Because of this, some chemicals in this hazard class will require the designation of an area for their use and storage. All laboratory workers must know the location of these designated areas, and must use or store particularly hazardous chemicals only within them. Designated areas also require posting with the "Designated Area Label," which can be found on the SRM website.

Appendix M: Chemical Hazard Class SOP for Ingestion Hazards

1. Purpose

This standard operating procedure (SOP) is intended to provide guidance on how to safely work with chemicals that present an ingestion hazard in a Cal Maritime laboratory. Laboratory personnel should review this SOP, as well as the appropriate Safety Data Sheet(s) (SDSs), before using chemicals that present an ingestion hazard. If you have questions concerning the requirements within this SOP, contact SRM.

2. Scope

This hazard class SOP only addresses safety issues specific to the ingestion hazard of a chemical; several hazard class SOPs may be applicable for a specific chemical.

3. Hazard Description

This hazard class includes chemicals that may be hazardous to a laboratory worker upon ingestion of the chemical. Direct ingestion of a hazardous chemical in a laboratory setting is highly unlikely. However, touching the mouth with contaminated hands can also cause ingestion of hazardous chemicals. Chemical vapors and particles can also settle on food and drink in the laboratory, and become ingested.

While this class ranges from chemicals that are irritating, harmful, toxic and fatal to laboratory workers, the mode of entry for this class is the same: ingestion. This classification allows for the determination of hazard controls required to protect laboratory workers from ingestion hazards. This hazard class also includes chemicals that cause, or may cause, damage to organs after ingestion, as well as chemicals that act as an aspiration hazard (may be fatal if swallowed and the chemical enters the airways).

Chemicals that are fatal to laboratory workers upon ingestion are classified as particularly hazardous chemicals by OSHA. However, it is important to note that not every chemical under this hazard class is a particularly hazardous chemical.

4. General Control of Hazards

The following general control measures should be implemented whenever using or handling chemicals which pose an ingestion hazard:

- Plan experiments involving chemicals that present an ingestion hazard carefully, including consulting the SDS(s). Do not handle chemicals that present ingestion hazards until all safety precautions have been read and understood.
- Minimize the quantity and/or concentration of these chemicals used or synthesized to the smallest amount immediately needed for an experiment.
- Wash hands thoroughly after handling.

5. Engineering Controls

Chemicals that present an ingestion hazard must be used in a laboratory that is negatively pressured in relation to any public spaces. Contact the SRM or Facilities Management to determine if your laboratory is negatively pressured. Particularly hazardous chemicals (i.e. those that are fatal if ingested) must be used within a certified chemical fume hood or other approved ventilated enclosure.

6. Personal Protective Equipment

At a minimum, all laboratory workers must wear safety glasses, long pants, closed-toed shoes, a laboratory coat and examination gloves when working with hazardous chemicals in a laboratory.

Laboratory personnel working with chemicals that present an ingestion hazard should wear double examination gloves or use chemical-resistant gloves. Refer to the Personal Protective Equipment Selection Guide on the SRM website for further information on appropriate chemical-resistant gloves. If the experimental protocols generate a splash hazard, use of higher levels of eye protection (e.g. splash goggles, face shield, etc.) should be considered.

7. Handling and Storage Requirements

When working with highly toxic chemicals, or poisons, prevention of accidental release becomes even more important than usual. Chemicals that are fatal if ingested should be securely stored; access to these chemicals should be restricted.

Segregate chemicals that are fatal or toxic if ingested from non-toxic materials. Ideally, this segregation would occur via separate cabinets. If space is limited, however, storing chemicals that are fatal or toxic in secondary containment (i.e. plastic trays or Tupperware) within the same cabinet as other chemicals is acceptable.

Particularly hazardous chemicals (i.e. those that are fatal upon ingestion) must be stored and used within a labelled designated area. If you are unsure if a chemical constitutes a particularly hazardous chemical, be conservative and treat them as if they were.

Carefully plan the transportation of chemicals that are fatal or toxic upon ingestion. Handling chemicals outside of the laboratory area should be minimized, but when necessary, wear full personal protective equipment and carry the chemicals in unbreakable secondary containment.

8. Waste Disposal

Waste chemicals that present a contact (eyes & skin) hazard should be collected in compatible waste containers (i.e. plastic 3.5 gallon buckets) and segregated from incompatible chemicals. Some particularly hazardous chemicals may require special decontamination and disposal procedures. Contact SRM for further information on the disposal of chemicals.

Spill and Incident Procedures

Laboratory personnel may clean a small spill of chemicals that present a contact (eyes & skin) hazard themselves, as long as they wear appropriate personal protective equipment and have appropriate training. If the spill is large, requires a respirator for cleanup, or occurs in a public area, do not attempt to clean the spill yourself. Evacuate the area and follow the procedures in the University Chemical Hygiene Plan section on major chemical spills. Inform the SRM of all major chemical spills.

If a laboratory worker is injured or exposed to a chemical that is toxic or fatal by inhalation, immediately call 911 and notify department management and SRM; if the laboratory worker needs immediate medical attention. Remove contaminated clothing and immediately flush the contaminated areas with water for at least 15 minutes. For eye exposures, immediately remove contact lenses, if present, and flush the eyes with water for at least 15 minutes. Consult the chemical's SDS for more specific information on appropriate first aid.

10. Designated Area

Chemicals that are fatal upon ingestion are considered to be particularly hazardous chemicals. Because of this, some chemicals in this hazard class will require the designation of an area for their use and storage. All laboratory workers must know the location of these designated areas, and must use or store particularly hazardous chemicals only within them. Designated areas also require posting with the "Designated Area Label," which can be found on the SRM website.

Appendix N: Chemical Hazard Class SOP for Delayed Health Hazards

1. Purpose

This standard operating procedure (SOP) is intended to provide guidance on how to safely work with chemicals that present a delayed health hazard in a Cal Maritime laboratory. Laboratory personnel should review this SOP, as well as the appropriate Safety Data Sheet(s) (SDSs), before using chemicals that present a delayed health hazard. If you have questions concerning the requirements within this SOP, contact SRM.

2. Scope

This hazard class SOP only addresses safety issues specific to the delayed health hazards of a chemical; several hazard class SOPs may be applicable for a specific chemical.

3. Hazard Description

This hazard class includes health hazards that may appear over a prolonged or repeated exposure to a chemical. Some of the chemicals within this hazard class are classified as particularly hazardous chemicals by OSHA (i.e. select carcinogens), but not every chemical under this hazard class is a particularly hazardous chemical. The following hazard types are included in this SOP:

- Skin sensitizer: Chemicals that cause people to develop an allergic reaction in normal tissue after exposure to the substance through skin contact
- Ex: Latex, Formaldehyde, etc.
- Respiratory sensitizer: Chemicals that induce hypersensitivity of the airways following inhalation
- Ex: Acrylonitrile, Nickel(II) chloride, Sodium dichromate, etc.
- Carcinogen: Chemicals that can initiate or speed the development of cancer in normal tissue
- Ex: 2-Mercaptoethanol, Benzene, Ethylene oxide, etc.
- Target organ toxin from prolonged or repeated exposure: Chemicals whose toxicity targets specific organs after repeated or prolonged exposure after inhalation, ingestion or skin/eye contact
- Ex: Asbestos, Cadmium, Nitrobenzene, etc.

4. General Control of Hazards

The “Delayed Health Hazard” hazard class includes a wide variety of hazard types. Though basic control measures may be implemented for the class as a whole, the SDS of chemicals presenting a delayed health hazard should be consulted for specific information on hazard controls and safety measures.

The following general control measures should be implemented whenever using or handling chemicals which pose a delayed health hazard:
Plan experiments involving delayed health hazards carefully, including consulting the SDS(s). Do not handle chemicals that present delayed health hazards until all safety precautions have been read and understood.

- Minimize the quantity and/or concentration of these chemicals used or synthesized to the smallest amount immediately needed for an experiment.
- Design experimental procedures to minimize the potential for splash, splatter or other likely scenarios of accidental contact.
- Do not breathe dust, fumes, gas, mist, vapors or sprays when handling these chemicals.
- Wash hands thoroughly after handling.
- Do not bring contaminated work clothing out of the laboratory.

5. Engineering Controls

A certified chemical fume hood must be used when handling select carcinogens, respiratory sensitizers and target organ toxins (from prolonged or repeated exposure) through inhalation. Other containment devices may be used to control exposure to these chemicals, such as glove boxes. This is especially useful when manipulating the carcinogen in such a way that it volatilizes, generates aerosols, or may result in uncontrolled release of the chemical.

6. Personal Protective Equipment

At a minimum, all laboratory workers must wear safety glasses, long pants, closed-toed shoes, a laboratory coat and examination gloves when working with hazardous chemicals in a laboratory.

Laboratory personnel working with carcinogens, skin sensitizers or target organ toxins (from prolonged or repeated exposure) should wear splash goggles instead of safety glasses. Double gloving with examination-type gloves, or the use of chemical resistant gloves, should be used if the compound can be readily absorbed through the skin. Refer to the Personal Protective Equipment Selection Guide on the SRM website for further information on appropriate chemical-resistant gloves. Other personal protective equipment that should be considered include a face shield (for high splash hazards) and a chemical-resistant apron.

If respiratory sensitizers, carcinogens with an inhalation hazard, or target organ toxins (from prolonged or repeated exposure) cannot be used in a ventilated enclosure (i.e. chemical fume hood) or containment device (i.e. glove box) due to experimental restrictions, laboratory workers should consider the use of a respirator. Contact the SRM to perform a hazard assessment of your experimental procedures to determine if respiratory protection should be used.

7. Handling and Storage Requirements

Segregate carcinogens from other hazardous chemicals and store within a labeled designated area. Ideally, this segregation would occur via separate cabinets. If space is limited, however, storing select carcinogens in secondary containment (i.e. plastic trays or Tupperware) within the same cabinet as other chemicals is acceptable. Carcinogens should be securely stored, and access to these chemicals should be restricted.

Some chemicals within this hazard class may require exposure monitoring and routine medical surveillance for any laboratory personnel who may be exposed. SRM will inform if any chemicals used in the laboratory require such monitoring/medical surveillance.

Carefully plan the transportation of select carcinogens and target organ toxins. Handling chemicals outside of the laboratory area should be minimized, but when necessary, wear full personal protective equipment and carry the chemicals in unbreakable secondary containment.

8. Waste Disposal

Waste chemicals that present a delayed health hazard should be collected in compatible waste containers (i.e. plastic 3.5 gallon buckets) and segregated from incompatible chemicals. Some carcinogens may require special decontamination and disposal procedures. Contact Risk Management Services for further information on the disposal of chemicals.

9. Spill and Incident Procedures

Laboratory personnel may clean a small spill of chemicals that present a delayed health hazard themselves, as long as they wear appropriate personal protective equipment and have appropriate training. If the spill is large, requires a respirator for cleanup, or occurs in a public area, do not attempt to clean the spill yourself. Evacuate the area and follow the procedures in the University Chemical Hygiene Plan section on major chemical spills. Inform SRM of all major chemical spills.

If a laboratory worker is injured or exposed to chemicals that present a delayed health hazard, immediately call 911 and notify department management and SRM; if the laboratory worker needs immediate medical attention. Remove contaminated clothing and immediately flush the contaminated areas with water for at least 15 minutes. For eye exposures, immediately remove contact lenses, if present, and flush the eyes with water for at least 15 minutes.

If the exposure is less severe, and the laboratory worker is left feeling ill or if there is persistent discomfort, call the Poison & Drug Information Center at 1-800-222-1222 for information to determine if further medical action is required. Consult the chemical's SDS for more specific information on appropriate first aid.

10. Designated Area

Carcinogens are considered to be particularly hazardous chemicals. Because of this, some chemicals in this hazard class will require the designation of an area for their use and storage. All laboratory workers must know the location of these designated areas, and must use or store particularly hazardous chemicals only within them. Designated areas also require posting with the "Designated Area Label," which can be found on the SRM website.

Appendix O: Chemical Hazard Class SOP for Developmental & Reproductive Toxins

1. Purpose

This standard operating procedure (SOP) is intended to provide guidance on how to safely work with developmental and reproductive toxins in a Cal Maritime laboratory. Laboratory personnel should review this SOP, as well as the appropriate Safety Data Sheet(s) (SDSs), before using developmental and reproductive toxins. If you have questions concerning the requirements within this SOP, contact SRM.

2. Scope

This hazard class SOP only addresses safety issues specific to the developmental and reproductive toxicity of a chemical; several hazard class SOPs may be applicable for a specific chemical.

3. Hazard Description

This hazard class includes chemicals that affect the reproductive capabilities of a person, including mutations and effects on the fetus. The following hazard types are included in this SOP:

- Causes genetic defects
- May damage fertility or the unborn child
- May cause harm to breast-fed children

The first two hazard types listed above are split into two categories based on the severity of the hazard. Chemicals with the higher categories of developmental and reproductive toxicity are considered to be particularly hazardous chemicals, as defined by OSHA. However, it is important to note that not every chemical under this hazard class is a particularly hazardous chemical.

4. General Control of Hazards

The following general control measures should be implemented whenever using or handling chemicals which act as a developmental or reproductive toxin:

- Plan experiments involving developmental and reproductive toxins carefully, including consulting the SDS(s). Do not handle chemicals that present developmental and reproductive toxicity until all safety precautions have been read and understood.
- Minimize the quantity and/or concentration of these chemicals used or synthesized to the smallest amount immediately needed for an experiment.
- Design experimental procedures to minimize the potential for splash, splatter or other likely scenarios of accidental contact.
- Do not breathe dust, fumes, gas, mist, vapors or sprays when handling these chemicals.
- Wash hands thoroughly after handling.
- Do not bring contaminated work clothing out of the laboratory.
- Keep exposure to these chemicals as low as reasonably achievable while pregnant or nursing. For additional information on pregnancy and working with hazardous chemicals while pregnant, contact the Poison & Drug Information Center at 1-800-222-1222.

5. Engineering Controls

A certified chemical fume hood must be used when handling developmental and reproductive toxins. Other approved ventilated enclosures (e.g. glove box) may be used to control exposure to developmental and reproductive toxins. For additional information on engineering control options, contact SRM.

6. Personal Protective Equipment

At a minimum, all laboratory workers must wear safety glasses, long pants, closed-toed shoes, a laboratory coat and examination gloves when working with hazardous chemicals in a laboratory.

Laboratory personnel working with developmental or reproductive toxins should wear splash goggles instead of safety glasses. Double gloving with examination-type gloves, or the use of chemical resistant gloves, should be used if the compound can be readily absorbed through the skin. Refer to the Personal Protective Equipment Selection Guide on the SRM website for further information on appropriate chemical-resistant gloves.

If developmental and reproductive toxins cannot be used in a ventilated enclosure (i.e. chemical fume hood) due to experimental restrictions, laboratory workers should consider the use of a respirator. Contact SRM to perform a hazard assessment of your experimental procedures to determine if respiratory protection should be used.

7. Handling and Storage Requirements

Segregate developmental and reproductive toxins from other hazardous chemicals. Ideally, this segregation would occur via separate cabinets. If space is limited, however, storing developmental and reproductive toxins in secondary containment (i.e. plastic trays or Tupperware) within the same cabinet as other chemicals is acceptable. Developmental and reproductive toxins must be securely stored, and access to these chemicals should be restricted. Those that are classified as particularly hazardous chemicals must be stored and used within a labelled designated area. If you are unsure if a developmental or reproductive toxin constitutes a particularly hazardous chemical, be conservative and treat them as if they are.

Some chemicals within this hazard class may require exposure monitoring and routine medical surveillance for any laboratory personnel who may be exposed. SRM will inform if any chemicals used in the laboratory require such monitoring/medical surveillance.

Carefully plan the transportation of developmental and reproductive toxins. Handling chemicals outside of the laboratory area should be minimized, but when necessary, wear full personal protective equipment and transport the chemicals in unbreakable secondary containment.

8. Waste Disposal

Waste chemicals containing developmental and reproductive toxins should be collected in compatible waste containers (i.e. plastic 3.5 gallon buckets) and segregated from incompatible wastes. Some particularly hazardous chemicals may require special decontamination and disposal procedures. Contact SRM for further information on the disposal of chemicals.

9. Spill and Incident Procedures

Laboratory personnel may clean a small spill of developmental and reproductive toxins themselves, as long as they wear appropriate personal protective equipment and have appropriate training. If the spill is large, requires a respirator for cleanup, or occurs in a public area, do not attempt to clean the spill yourself. Evacuate the area and follow the procedures in the University Chemical Hygiene Plan section on major chemical spills. Inform the RLSS of all major chemical spills.

If a laboratory worker is injured or exposed to developmental and reproductive toxins, immediately call 911 and notify the department management and SRM, if the laboratory worker needs immediate medical attention. Remove contaminated clothing and immediately flush the contaminated areas with water for at least 15 minutes. For eye exposures, immediately remove contact lenses, if present, and flush the eyes with water for at least 15 minutes.

If the exposure is less severe, and the laboratory worker is left feeling ill, persistent discomfort, or has concerns about potential developmental effects, they should call the Poison & Drug Information Center at 1-800-222-1222 to determine if further medical action is required. Consult the chemical's SDS for more specific information on appropriate first aid.

10. Designated Area

Chemicals that cause genetic defects or damage fertility or the unborn child are considered to be particularly hazardous chemicals. Because of this, some chemicals in this hazard class will require the designation of an area for their use and storage. All laboratory workers must know the location of these designated areas, and must use or store particularly hazardous chemicals only within them. Designated areas also require posting with the "Designated Area Label," which can be found on the SRM website.

Appendix P: Proper Use of a Chemical Fume Hood Standard Operating Procedure

1. Purpose

This Standard Operating Procedure (SOP) defines proper work practices when using a chemical fume hood. When used correctly, a chemical fume hood can help prevent exposure to hazardous chemicals; when it is not used within its manufacturer specifications and parameters, it may not provide adequate protection against exposure. If you have any questions concerning the applicability of any item listed in this procedure, contact SRM.

2. Scope

Ideally, chemical fume hoods should be used when working with any hazardous chemicals in the laboratory. A chemical fume hood must, however, be used whenever particularly hazardous chemicals (i.e. select carcinogens, developmental and reproductive toxins and chemicals with a high degree of acute toxicity) are being manipulated or when hazardous vapors, mists, aerosols or gases are being used or created during a procedure. A chemical fume hood may also be used for the storage of lecture bottle-sized cylinders of hazardous gases (e.g. gases with a National Fire Protection Agency [NFPA] health rating of 3 or 4).

3. Chemical Fume Hood Requirements

Chemical fume hoods must be used according to manufacturer specifications. Some hazardous chemicals may require the use of a specialized or modified chemical fume hood (e.g. perchloric acid). Do not modify the chemical fume hood from its manufactured settings (i.e. drilling holes into the cabinet, resetting blast gates, etc.) unless your specific modification has been assessed and approved by SRM. Though manufacturer specifications may change slightly from hood to hood, some basic principles are the same and must be used in University laboratories.

- The fume hood must be certified annually by University Facilities Management (FM) or a contracted vendor (i.e. for some satellite locations). A certification label must be present on the front of the fume hood, including the date of the last certification.
- The majority of chemical fume hoods should be functioning at a minimum of 100 linear feet per minute (fpm), though some high performance low-flow fume hoods also exist. Often, the certification label will include a mark for the fume hood sash height at which this minimum face velocity is reached. If you are unsure if a fume hood is functioning at an adequate face velocity, contact the RLSS to perform face velocity measurements.
- When a highly toxic or corrosive gas is being stored in the chemical fume hood, the face velocity should be maintained at 200 fpm.
- The fume hood light, alarm and sash should be fully functional at all times.
- Chemical fume hoods should not be plumbed into publically owned treatment works; those with sinks should be disconnected from the drain or guarded against accidental spills.
- There are two main types of chemical fume hoods: those with a vertical sliding sash and those with a horizontal sliding sash, as illustrated in Figure 1. Different certification and use procedures are necessary for each type of fume hood.

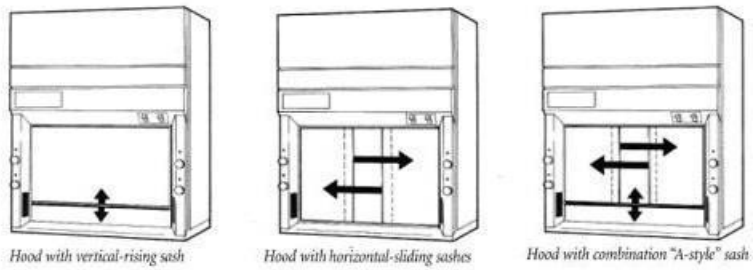


Figure 1: Illustration of the types of chemical fume hood sashes.

4. Proper Fume Hood Practices

Work must be performed with the sash at or below the mark at which the fume hood was certified. This level is typically identified by an arrow on the certification label or a line drawn in permanent marker. When working with a chemical fume hood with a vertical sliding sash, you should work with the sash at its lowest possible position, while still allowing for comfortable working conditions. When working with chemical fume hoods with horizontal sliding sashes, workers should work with their arms around a panel of the horizontal sash. If this is not possible or causes difficulties in performing experimental actions, modifications may be made by the manufacturer (e.g. narrowing the width of each horizontal sash panel) or other shielding methods may be used to allow for adequate protection. Contact SRM for further information.

To allow adequate airflow and protection against hazardous fumes, mists, vapors, dusts, etc., all work must be performed at least 6 inches inside of the hood. Some chemical fume hoods have a stainless steel bar installed on the outside of the fume hood, which forces workers to stand 6 inches from the hazardous chemical work. Contact SRM to obtain prior written approval for the removal of this bar if it prevents practical/safe work practices. The importance of working six inches within a chemical fume hood is illustrated in Figure 2.

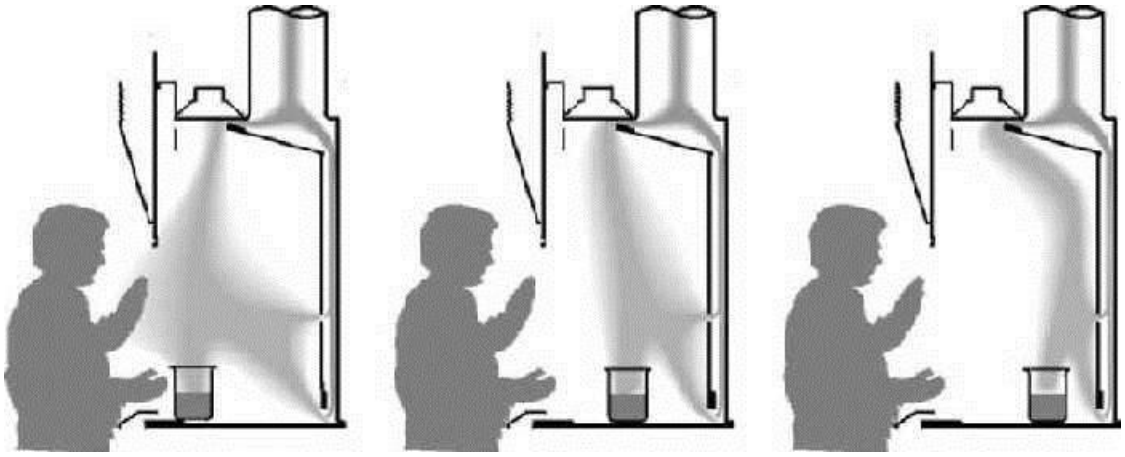


Figure 2: Containment of vapors in a chemical fume hood as a function of working distance.

The fume hood sash should be lowered completely when it is not in use, especially during unattended reactions.

Do not store hazardous chemicals or other items inside of a chemical fume hood, unless they require ventilated storage. The more objects present in a chemical fume hood, the less effective the air flow is in protecting workers against hazardous chemicals. If items, such as hot plates, shaker tables or other equipment required for the reaction, must be placed in a chemical fume hood, place them on a stand to allow airflow underneath, as shown in Figure 3. Contact the SRM to verify the fume hood's performance after adding large objects or shielding into a hood, or if a degradation of normal airflow is suspected.

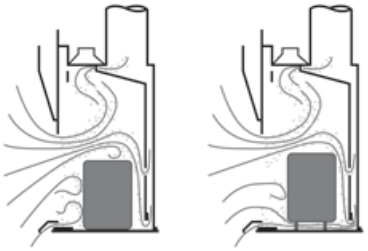


Figure 3: Obstruction of air flow by objects in a chemical fume hood.

5. Malfunctioning/Uncertified Chemical Fume Hood

If the chemical fume hood alarm sounds, immediately discontinue work, close the fume hood sash and reset the alarm. Verify the alarm settings; if the fume hood alarm system is functioning properly (e.g. it is not set to a low face velocity such as 10 fpm), contact the Facilities Management HVAC group at 707-654-1120 to inform them of the alarm if you are on the main campus. If the fume hood is on the TSGB, inform your Chief Mate or as outlined in VOM and SAM.

If the chemical fume hood is not functioning properly (e.g. lighting malfunction, strange noises coming from the fume hood, face velocity is below 100 fpm, the sash will not move properly, etc.) or is overdue for recertification, contact the FM HVAC group (main campus) or your facility coordinator and facility ventilation contractor (satellite locations) to schedule maintenance of the chemical fume hood.

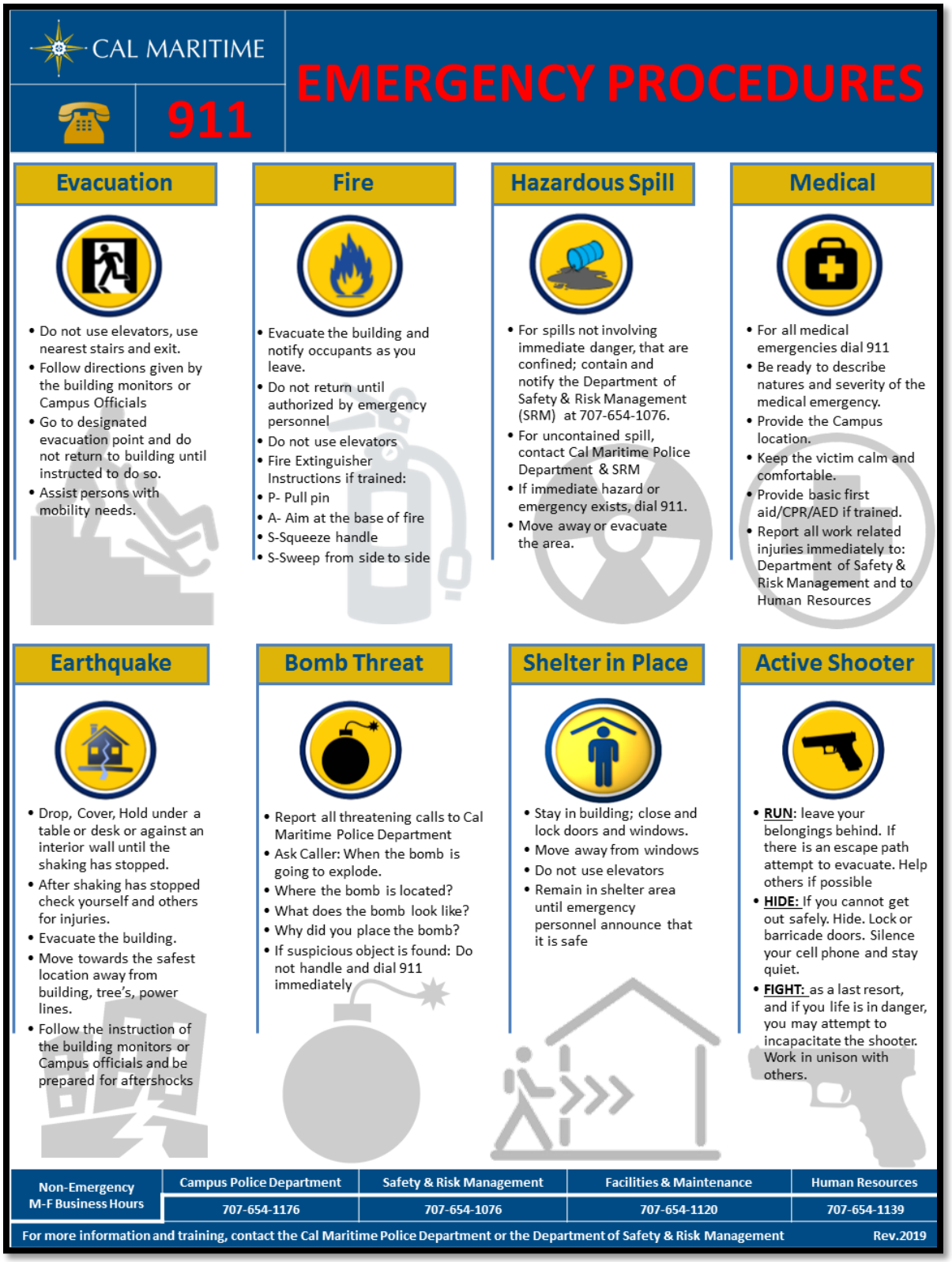
Appendix S: List of Acronym

Acronym	Definition
ACGIH	American Conference of Governmental Industrial Hygienists
ACS	American Chemical Society
AL	Action Level
APLU	Association of Public & Land-Grant Institutions
BSC	Biological Safety Cabinet
BUA	Biological Use Authorization
Cal/EPA	California Environmental Protection Agency
Cal/OSHA	California Occupational Safety & Health Administration
CCR	California Code of Regulations
CFR	Code of Federal Regulations
CHO	Chemical Hygiene Officer
CHP	Chemical Hygiene Plan
CIS	Chemical Inventory System
CLSC	Chemical and Laboratory Safety Committee
DOT	Department of Transportation
DSC	Department Safety Coordinator
DTSC	Department of Toxic Substances Control
EFR	Employer's First Report
SRM	Environmental Health and Safety
EPA	Environmental Protection Agency
FM	Facilities Management
FR	Flame-resistant
GHS	Globally Harmonized System
IACUC	Institutional Animal Care and Use Committee
IARC	International Agency for Research on Cancer
IATA	International Air Transportation Association
IBC	Institutional Biosafety Committee
IDLH	Immediately Dangerous to Life or Health
IIPP	Injury and Illness Prevention Program
IUPAC	International Union of Pure and Applied Chemistry
JSA	Job Safety Analysis
LHAT	Laboratory Hazard Assessment Tool
LMS	Learning Management System
LSP	Laboratory Safety Plan
NIOSH	National Institute of Occupational Safety & Health
NFPA	National Fire Protection Association
NTP	National Toxicology Program
OSHA	Occupational Safety & Health Administration

PEL	Permissible Exposure Limit
PFC	Peroxide-forming Chemical
PHS	Particularly Hazardous Substance
PI	Principal Investigator
PPE	Personal Protective Equipment
PPM	Policy and Procedure Manual
RCRA	Resource Conservation and Recovery Act
QAC	Qualified Applicator Certificate
QAL	Qualified Applicator License
REL	Recommended Exposure Limit
RSC	Radiation Safety Committee
SAA	Satellite Accumulation Area
SDS	Safety Data Sheet
SIT	Safety Inspection Tool
SOP	Standard Operating Procedure
STEL	Short-term Exposure Limit
STOT	Specific Target Organ Toxicity
TLV	Threshold Limit Value
TWA	Time-Weighted Average
UC	University of California
UCDHS	Cal Maritime Health System
UCDMC	Cal Maritime Medical Center
WHO	World Health Organization

Appendix T: Emergency Response

To download and/or print this poster refer to SRM website: Campus Emergency Poster , Campus Emergency Response Guide



CAL MARITIME

911

EMERGENCY PROCEDURES

Evacuation

- Do not use elevators, use nearest stairs and exit.
- Follow directions given by the building monitors or Campus Officials
- Go to designated evacuation point and do not return to building until instructed to do so.
- Assist persons with mobility needs.

Fire

- Evacuate the building and notify occupants as you leave.
- Do not return until authorized by emergency personnel
- Do not use elevators
- Fire Extinguisher Instructions if trained:
- P- Pull pin
- A- Aim at the base of fire
- S-Squeeze handle
- S-Sweep from side to side

Hazardous Spill

- For spills not involving immediate danger, that are confined; contain and notify the Department of Safety & Risk Management (SRM) at 707-654-1076.
- For uncontained spill, contact Cal Maritime Police Department & SRM
- If immediate hazard or emergency exists, dial 911.
- Move away or evacuate the area.

Medical

- For all medical emergencies dial 911
- Be ready to describe natures and severity of the medical emergency.
- Provide the Campus location.
- Keep the victim calm and comfortable.
- Provide basic first aid/CPR/AED if trained.
- Report all work related injuries immediately to: Department of Safety & Risk Management and to Human Resources

Earthquake

- Drop, Cover, Hold under a table or desk or against an interior wall until the shaking has stopped.
- After shaking has stopped check yourself and others for injuries.
- Evacuate the building.
- Move towards the safest location away from building, tree's, power lines.
- Follow the instruction of the building monitors or Campus officials and be prepared for aftershocks

Bomb Threat

- Report all threatening calls to Cal Maritime Police Department
- Ask Caller: When the bomb is going to explode.
- Where the bomb is located?
- What does the bomb look like?
- Why did you place the bomb?
- If suspicious object is found: Do not handle and dial 911 immediately

Shelter in Place

- Stay in building; close and lock doors and windows.
- Move away from windows
- Do not use elevators
- Remain in shelter area until emergency personnel announce that it is safe

Active Shooter

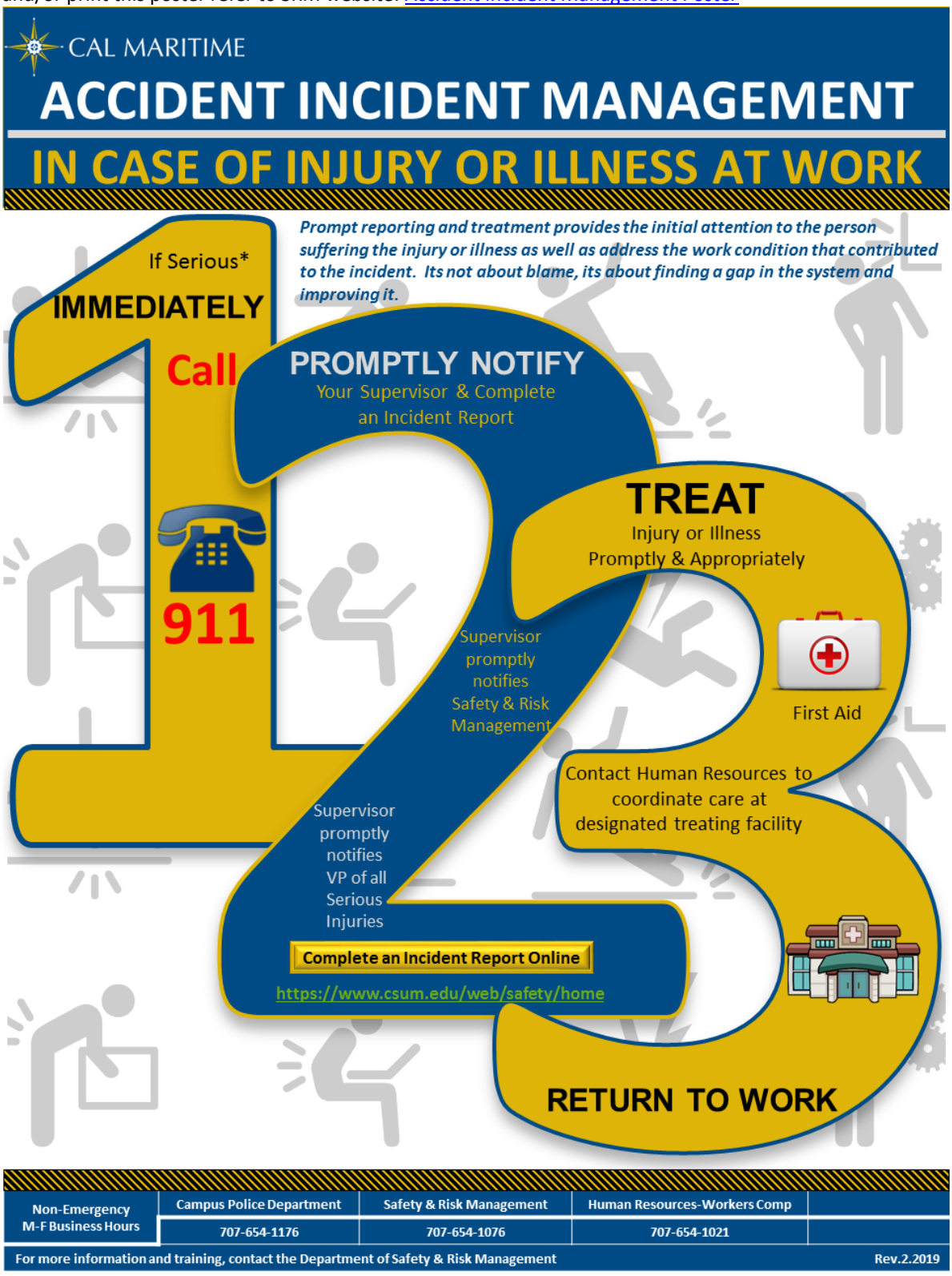
- **RUN**: leave your belongings behind. If there is an escape path attempt to evacuate. Help others if possible
- **HIDE:** If you cannot get out safely. Hide. Lock or barricade doors. Silence your cell phone and stay quiet.
- **FIGHT:** as a last resort, and if you life is in danger, you may attempt to incapacitate the shooter. Work in unison with others.

Non-Emergency M-F Business Hours	Campus Police Department	Safety & Risk Management	Facilities & Maintenance	Human Resources
	707-654-1176	707-654-1076	707-654-1120	707-654-1139

For more information and training, contact the Cal Maritime Police Department or the Department of Safety & Risk Management Rev.2019

Appendix U: Accident Incident Management

To download and/or print this poster refer to SRM website: Accident Incident Management Poster



Appendix V: Training Log

TRAINING SIGN IN SHEET

Subject			**Date**	
Instructor Name				
Department				
Course Level	❑ Awareness	❑ Competent Person	❑ Certified Person	❑ Other
Frequency	❑ Initial	❑ Annual-Refresher	❑ Process Change	❑ Post Incident

The attendees listed have satisfactorily participated and been tested per Regulation/University training requirements.

	PRINT NAME	STATUS (Staff, Faculty, Student)	SIGNATURE
1			
2			
3			
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Retain Original at Department Level & Submit Copy to Risk Management